

“I Just Wouldn’t Want to Get as Deep Into It”: **Preservice Teachers’ Beliefs about the Role of Controversial Topics in Mathematics Education**

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In this article, the authors report on the initial results of a mixed methods study that examined the beliefs that preservice teachers have about teaching real-world contexts, including those related to injustices, controversial issues, and children’s home and cultural backgrounds. Data collection included a survey with 92 preservice Pre-K–8 teachers and follow-up interviews with nine survey participants. Analysis of the data suggested that preservice teachers were open to the idea of teaching mathematics through real-world contexts, but were ambivalent regarding the use of controversial issues, and often unable to provide concrete or non-trivial examples of what these different types of real-world contexts would look like in a mathematics classroom. Based on the survey and interview findings, the authors make recommendations for future research and for the use of controversial issues in teacher education programs.

KEYWORDS: preservice teacher beliefs, real-world contexts, social justice, teacher education

A range of arguments have been advanced for why it is important to connect mathematics to real-world contexts. One argument, frequently seen in policy documents, is that connecting mathematics to real-world contexts will better prepare students for their future careers and everyday lives (Common Core State Standards Initiative [CCSSI], 2010; National Council of Teachers of Mathematics, 2014). Approaches based on this argument typically draw on examples that are likely to be viewed as largely uncontroversial or “neutral” in nature, such as shop-

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ping, counting or calculating with collections of objects, sharing food, or making connections to science and engineering. Such “neutral” topics rarely result in or emphasize a critical perspective.

A second argument is that connecting mathematics to students’ out-of-school practices—and in particular making connections to students’ homes, communities, and cultural backgrounds—can illustrate how *all* students’ backgrounds and knowledge are valued in the classroom (Civil & Andrade, 2002; de Abreu & Cline, 2007; González, Andrade, Civil, & Moll, 2001; Mukhopadhyay, Powell, & Frankenstein, 2009; Nasir, 2002; Powell & Frankenstein, 1997; Tate, 1995). For example, educators have built on students’ backgrounds by creating projects about mathematics and gardening (Civil & Khan, 2001) or about mathematics practices of small businesses in the students’ neighborhoods (Simic-Muller, Varley Gutiérrez, & Turner, 2009).

Finally, a number of scholars focus on the role of mathematics in preparing active and engaged citizens in a democratic society. This line of work is often referred to as teaching mathematics for social justice or critical mathematics, and while there are varying meanings for both of these terms (Gates & Jorgensen [Zevenbergen], 2009; Stinson & Wager, 2012), for our purposes we highlight the common focus in this line of work on the importance of using mathematics to understand, question, and effect change in our world (Frankenstein, 2009; Gutstein, 2006, 2007; Skovsmose, 1985, 1994; Skovsmose & Valero, 2001; Tate, 1994, 1995; Turner, Varley Gutiérrez, Simic-Muller, & Diéz-Palomar, 2009). Some examples include using mathematics to analyze overcrowding in a school (Turner, 2012) or to investigate the density of liquor stores in a neighborhood (Tate, 1995). In both cases, students applied their mathematical knowledge to take action on an issue, but change can also be in the form of changed perceptions of the world. These topics can be engaging for students either because they are of immediate interest to them or because they have a broader importance that students can recognize. This engagement, in turn, often leads to students developing a greater sense of *agency*—a belief that they can take both an active role in shaping the mathematics they are learning and in improving the world around them (Turner et al., 2009; Gutstein, 2006, 2007; Tate, 1995; Turner, 2012).

Each of the three approaches to connecting mathematics to real-world contexts discussed—career and everyday preparedness, valuing students’ backgrounds, and engaging in social justice—involves different forms of real-world connections. We used these classifications of mathematical tasks, which were derived from existing literature and our own ongoing research (e.g., Felton-Koestler, 2015), as our starting point to design survey items that could be used to measure the preservice teachers’ (PSTs’) beliefs about using real-world connections in their future classrooms. In this article, we focus on PSTs’ beliefs about using controversial issues, which arise when teaching mathematics for social justice.

Literature Review

Teaching Mathematics with Controversial Issues

There is a growing body of work focusing on teaching mathematics for social justice and on critical mathematics (see, e.g., Gutstein & Peterson, 2013; Wager & Stinson, 2012). However, mathematics educators have a range of perspectives on what these terms mean (Bartell, 2012, 2013; Gates & Jorgensen [Zevenbergen], 2009; Stinson & Wager, 2012). The vision of social justice mathematics that informs our work is one that involves using mathematics to support students in developing an awareness of injustices and ways in which they can critique and challenge injustices (Frankenstein, 1995, 2009; Gutstein, 2006; Skovsmose, 1994). Examples of this work include analyzing racial profiling and discrimination (Gutstein, 2006); considering how government benefits should be distributed (Skovsmose, 1994); and questioning the ways governments count and report data, such as unemployment rates (Frankenstein, 2009).

Many of the examples of teaching social justice mathematics in the literature are with urban, minoritized, and/or underserved populations (Brantlinger, 2013). In many cases, these issues can serve to make mathematics more engaging and accessible while also highlighting issues that are often of personal interest or concern to the students involved and supporting students to develop a sense of agency, especially when the students select the social justice issues to explore (Gutstein, 2006, 2007; Tate, 1995; Turner, 2012; Turner et al., 2009). However, in light of potential trade-offs between learning social justice mathematics and academic mathematics (Brantlinger, 2013), we consider it critical that social justice mathematics is practiced with *all* students, not just underserved populations.

Based on our experiences and research (Felton & Koestler, 2012, 2015; Koestler, 2010), most PSTs have little to no familiarity with “social justice” in the context of teaching mathematics. Therefore, in our survey we do not explicitly mention social justice, but instead refer to “controversial issues,” which we define for the PSTs as follows:

CONTROVERSIAL ISSUES are topics that will likely be viewed as contentious or debatable. Not everyone agrees on what topics are controversial, but some examples might include the costs of the war on drugs, government spending, funding for schools, or climate change.

We chose to focus on controversial issues because, in our experiences, most PSTs view social justice topics—such as racial profiling, analyzing government benefits, and questioning data reporting—as overtly political or controversial in nature.

Preservice Teacher Beliefs

In recent years, PSTs' beliefs have been the focus of an increasing number of research studies. There is no agreed-upon definition of beliefs in the field (Philipp, 2007), but we found Speer's (2005) explanation most relevant for our purposes: "Beliefs appear to be, in essence, factors shaping teachers' decisions about what knowledge is relevant, what teaching routines are appropriate, what goals should be accomplished, and what the important features are of the social context of the classroom" (p. 365). This explanation is relevant as we consider the factors that shape teachers' decisions about what mathematical knowledge related to real-world mathematics contexts is relevant and what goals it accomplishes, and whether creating a space for discussing controversial issues is an appropriate form of mathematics teaching.

Having spent years as students observing their own teachers before entering teacher education programs, PSTs already hold firm beliefs about what teaching should look like (Ambrose, 2004; Pajares, 1992). According to Pajares (1992), beliefs that form early are more difficult to alter, and research often discusses how resistant PSTs' beliefs are to change (Cooney, 2001; Grootenboer, 2008). Pajares also claims that PSTs identify positively with the teaching profession, and are therefore interested in preserving the status quo. In particular, they do not see themselves as enacting societal change, because they support the system in its current form. For that reason, they may not see the need for engaging students in conversations about issues of social justice. There is still not enough research to support this claim, and we do not know much about whether teachers believe they "ought to bring about social justice... in their classrooms" (Silverman, 2010, p. 294).

According to Ambrose (2004), one of the ways beliefs are formed is through cultural transmission. Cultural transmission creates beliefs "that may be held at a subconscious level and can be thought of as resulting from the 'hidden curricula' of our everyday lives" (p. 93). Culturally transmitted beliefs are often embodied in the form of stereotypes, for example about what mathematics is, how to teach it, or who is good at it.

One of the most persistent beliefs that PSTs hold is that of teaching as caring, they have the tendency to shelter students rather than expose them to difficult experiences (Ambrose, 2004). This belief can get in the way of difficult conversations and is prominent in PSTs' stated reasons for avoiding difficult topics in the classroom. Bartell (2011) proposes an alternative notion of caring, that of *caring with awareness*, which embraces difficult conversations, standing in solidarity with one's students, and supporting students' academic success by building on their cultural backgrounds and knowledge.

While there is well-documented evidence of PSTs' resistance to teaching focused on equity, diversity, or social justice in general, and in mathematics specifically (Aguirre, 2009; Castro, 2010; Gay, 2009; Rodriguez, 2005; Villegas, 2007),

there is also evidence that providing PSTs with opportunities to reflect, consider new perspectives, and engage in equity-oriented tasks can provide a powerful basis for shifting teachers' and PSTs' beliefs about integrating issues of equity, diversity, or social justice into mathematics teaching (Bartell, 2012; Ensign, 2005; Felton, 2012; Felton & Koestler, 2012, 2015; Felton, Simic-Muller, & Menéndez, 2012; Koestler, 2012; Mistele & Spielman, 2009; Spielman, 2009).

Surveys About Preservice Teacher Beliefs

In our search of the literature, we found only a few surveys that related to our interest in PSTs' beliefs about the use of real-world contexts. Two surveys most relevant to us were concerned with issues of social justice, diversity, or equity in teacher education in general: Enterline, Cochran-Smith, Ludlow, and Mitescu (2008) and Silverman (2010), and one focused more specifically on mathematics: Turner and colleagues (2012).

At Boston College, where strong emphasis is placed on preparing teachers to teach for diversity and social justice, Enterline and colleagues (2008) designed the Learning to Teach for Social Justice-Beliefs scale to measure teacher candidates' and new teachers' general beliefs about teaching for social justice. Over one thousand participants completed five surveys from entrance to exit of Boston College's teacher education program, and for three additional years after exiting the program. This multi-year surveying allowed Enterline and colleagues to follow the PSTs' beliefs and self-reported practices over time. In their analyses, they found that the scores of existing teacher candidates were much higher (indicating beliefs more strongly aligned with teaching for social justice) than of those who were entering the program; these increases persisted after one year of teaching. Perhaps most notably for our work, they argue that teaching for social justice is a measurable outcome that can be assessed using mixed methods. We have, therefore, created our survey with this idea of measurability in mind, but with a specific focus on teaching *mathematics* for social justice.

Silverman (2010) created the Teachers' Sense of Responsibility for Multiculturalism and Diversity scale to measure how PSTs understood commonly used terms like multiculturalism and diversity. She conducted her study as an outside researcher in an education psychology class ($N = 88$). Silverman found that PSTs were more likely to endorse general statements about multiculturalism or diversity than terms such as gender or faith. The PSTs also believed that larger organizations, such as schools and communities, bear a greater responsibility for addressing multiculturalism and diversity than individual teachers. These findings suggest that PSTs may not be inclined to take action to address these issues. The items on our survey address the PSTs' willingness to address similar issues in the context of mathematics teaching.

Turner and colleagues (2012) focused specifically on PSTs' knowledge, dispositions, and practices around building on children's multiple mathematical knowledge bases, including their cultural, home, and community-based knowledge. They conducted two surveys (one at the beginning and one at the end of the semester) with over 200 PSTs at six universities during their methods courses, which explicitly focused on the practices the surveys measured. The surveys consisted of items related to children's mathematical thinking, students' home language, and adapting curriculum materials to meet the needs of diverse students. They also conducted interviews with those PSTs who volunteered to be interviewed ($n = 24$). Turner and colleagues used the survey, interviews, and samples of PST work to hypothesize a learning trajectory for how teachers learn to build on students' multiple mathematical knowledge bases, including their family and community knowledge bases. Our study also seeks to hypothesize trajectories, but, in our case, for preparing teachers to teach mathematics using real-world contexts, controversial issues, injustices, and family backgrounds and community practices.

Our survey was informed by the surveys and methods discussed as well as our own research and practice as mathematics teacher educators. While our study is similar to others in design and interest in issues of social justice, we note that no other survey specifically investigates PSTs' beliefs about social justice in mathematics teaching. We provide the development of the survey, along with a description of the data collection and analysis in the next section.

Methods

Here, we used an explanatory design, a type of mixed study approach (Creswell & Plano Clark, 2011). This method consists of two phases: a quantitative data collection phase, followed by qualitative data collection. Our quantitative phase consisted of administering the survey, subsequently described in detail, to measure the PSTs' beliefs about using real-world issues in their future teaching. The qualitative phase examined specific quantitative results that required further explanation. Given the small number of studies in the area, using the explanatory design was particularly suited for our purposes of understanding and interpreting PSTs' beliefs related to the use of real-world issues in the mathematics classroom.

Survey Design and Testing

The survey design was primarily informed by existing research discussed previously and, as this literature thus far is limited, our combined 32 years of experience working with pre- and in-service teachers. In particular, our work was informed by Felton-Koestler's (2015) framework for understanding PSTs' beliefs about the sociopolitical nature of mathematics. One aspect of Felton-Koestler's

framework identifies a range of views PSTs may have about using mathematics to analyze the world, which include valuing connections between mathematics and real-world topics that are viewed or positioned as (a) neutral or apolitical in nature, (b) overtly political or controversial in nature, and (c) dealing explicitly with issues of perceived injustices.

Based on our experience, few PSTs have been exposed to issues of social justice, especially in mathematics (Felton & Koestler, 2012, 2015; Koestler, 2010). Therefore, to make the items comprehensible to PSTs, we relied on the research which claims that beliefs can be inferred from the potential actions someone would take (Pajares, 1992), and tied these issues to the PSTs' future teaching moves. For example, one survey item is "When I teach mathematics I will focus on mathematical concepts (for example, addition and subtraction, geometric shapes, etc.), and not worry about using controversial issues" (note that our definition of controversial issues was provided to the PSTs). This and other related questions aim to understand what PSTs think about controversial issues in relation to the usual mathematics that they might envision teaching.

We initially designed a large pool of items and discussed these among the three of us. In these discussions, our goal was to ensure that the wording would be clear to the PSTs. Through these discussions we created the four subscales of our survey (the definitions provided to the PSTs are in Table 1). The first three of these subscales correspond to Felton-Koestler's (2015) framework. In developing the survey we conceptualized the first three subscales—real-world situations, controversial issues, and issues of injustice—as interrelated, such that each new type of real-world context was a subset of the previous one. For instance, we would view an investigation of racial disparities in school funding as an issue of injustice and, likewise, as a controversial issue and a real-world situation.

We chose the specific examples for the definitions of the four subscales provided to the PSTs (Table 1) based on our experiences having used a variety of topics with PSTs. However, because not all PSTs take up all topics in the same way (Felton-Koestler, 2015), we were careful to emphasize that "not everyone agrees on what topics are controversial" and to ask the PSTs to "imagine topics that *you* consider controversial" when filling out the survey.

In the next phase of our survey development, we sent the initial pool of items to seven experts in the area to ensure content validity. Based on the feedback, we made further changes to the items and together we agreed upon a final list of 35 items that make up the *Connecting Mathematics to the Real World Scale* (CMRWS); each item was scored a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Table 1 shows the directions that are given to the PSTs at the beginning of each section (subscale) of the survey; in each case, the subscale is designed to measure the degree of openness the PST

display towards using or learning about these types of real-world contexts in their future teaching. The full text of the survey is provided in Appendix A.

In this reporting, we chose to focus primarily on PSTs’ responses to questions about controversial issues for two reasons: (a) the scores on this scale were lower than those on the other three and (b) the responses in this part of the survey were difficult to interpret.

Table 1
Definitions of the Four Subscales

Subscale^a	Definition
Real-world situations (6)	REAL-WORLD SITUATIONS are everyday or career related topics. Examples include choosing a cell phone plan, designing buildings, using mathematics for a job, connecting mathematics to artistic designs, or solving scientific problems.
Controversial issues (8)	CONTROVERSIAL ISSUES are topics that will likely be viewed as contentious or debatable. Not everyone agrees on what topics are controversial, but some examples might include the costs of the war on drugs, government spending, funding for schools, or climate change. When responding to questions on the survey about CONTROVERSIAL ISSUES, imagine topics that <i>you</i> consider controversial.
Issues of injustice (11)	ISSUES OF INJUSTICE are topics that are likely to be seen as a form of injustice or wrongdoing. Not everyone agrees on what topics represent injustices, but some examples might include animal cruelty, amount of living space in refugee camps, or deaths from preventable diseases. When responding to questions on the survey about ISSUES OF INJUSTICE, imagine topics that <i>you</i> consider injustices.
Family backgrounds or community practices (10)	FAMILY BACKGROUNDS OR COMMUNITY PRACTICES are things that people are involved in because of a connection to their family or community. For example, for some people activities like quilting, farming, cooking certain foods, or celebrating special holidays may be an important part of their family or community heritage.

^aThe number of items for each subscale is given in parentheses.

Data Collection

We recruited our students and the students of colleagues around the United States to participate in CMRWS. In the initial round we obtained a sample of 92 PSTs. Approximately 40% of the survey participants were students in the first author’s mathematics content courses for preservice Pre-K–8 teachers. The follow-up interviews were also conducted with PSTs enrolled in the first author’s courses, at the end of the spring semester. These PSTs were taking the first or second part of the university’s two-course sequence and had not yet been accepted to the educa-

tion program. The university is a middle-sized private liberal arts institution with a stated commitment to social justice, which is visible in the curriculum, though typically not in the sciences. The content courses, when taught by the first author, include some content related to social and political issues and to student backgrounds. In particular, when these PSTs took the survey, they had already had some exposure to the types of topics it addresses. The impact that these contexts had on the PSTs is difficult to gauge. While one PST (Ann; all names are pseudonyms) shared that she thought social justice was a central tenet of the course she took, another (Kayla) thought that social justice was mentioned “a little,” while a third PST (Linda) thought that her exposure to these topics was so minimal that it made it difficult for her to respond to interview questions. Based on these responses and the research that describes PSTs’ beliefs as resistant to change (e.g., Ambrose, 2004), we believe that the course could not have had a large impact on the PSTs’ beliefs. Furthermore, at this stage of survey design and administration, we were not as concerned with what could have caused PSTs’ beliefs as with what the CMRWS was able to capture about them.

Data Analysis

Survey. We collected demographic information from the 92 PSTs who participated in the survey and started the analysis for their responses by first reverse-coding the responses to eight of the 35 items. For example in the case of the item “When teaching mathematics, REAL-WORLD SITUATIONS can distract students from learning the important mathematical concepts,” a value of 1 (strongly disagree) would represent more openness to incorporating real-world situations and hence we recoded the 1 to 5, 2 to 4 and 3 to 3. The recoding ensures that the higher values correspond to more openness to the issues under discussion. Next, we worked with the missing values in the data. We did not want to force the PSTs to respond to every item and so their response was optional. In our data, we found that there were at most 2 missing values for any one of the 35 items. Based on the recommendations of Tabachnick and Fidell (2012) for a small percentage of missing values (< 5%), we used the group mean to replace the missing data. Using Mahalanobis distance ($p < 0.001$) we did not find any outliers. Cronbach’s alpha for each of the subscales and the entire scale of 35 items is shown in Table 2.

Note that an exploratory factor analysis was not supported given that we only had 92 respondents. According to Nunnally (1978), a sample of at least 350 would be required to reduce sample error. Despite this constraint, we think that responses to the items within the scales, which demonstrate high reliabilities, along with qualitative interviews, can provide us with useful insight into PSTs’ beliefs about these issues. We describe our approach in the next section.

Table 2
Cronbach's Alpha for the Four Subscales and the Entire CMRWS

Subscale	Cronbach's Alpha
Real world situations	0.79
Controversial issues	0.86
Issues of injustice	0.91
Family backgrounds or community practices	0.90
CMRWS	0.95

There were at most two PSTs who skipped any given demographic item and there were three PSTs who skipped the item that related to the educational level of their secondary parent or guardian. The majority of the survey participants were from four states—Arizona (18%), North Carolina (15%), Texas (21%) and Washington (41%). The PSTs mostly identified as White (64%), non-Hispanic (80%), female (85%), and most were from 18–23 years old (76%). The vast majority of the PSTs (97%) had at least one parent with the equivalent of a high school degree or higher, and a majority (59%) had at least one parent with a bachelor's degree or higher. This sample is fairly representative, in terms of gender and ethnicity, of the U.S. teaching population (e.g., Zumwalt & Craig, 2005). Finally, 61% of the PSTs were interested in teaching grades pre-K–5, 28% in teaching grades 6–8, and 5% in teaching grades 9–12.

Interviews. Based on the preliminary analysis of the survey results, we conducted semi-structured qualitative interviews with PSTs to help interpret our quantitative results. Interviews were conducted with nine PSTs who had participated in CMRWS and volunteered to be interviewed. All nine were women, eight of whom were identified as White and came from a wide range of socioeconomic backgrounds. Two planned on obtaining a middle-level mathematics endorsement, while others represented a range of feelings towards mathematics, from frustration to acceptance. The interviewees also represented a wide range of interest in and openness to the ideas measured in the survey. Only one PST had taken a prior course with the first author, and their exposure to the types of contexts investigated in the survey consisted of a single semester.

The interview questions were tied to the constructs and items in CMRWS as we sought to further understand the PSTs' thinking about the use of real-world contexts in their future classrooms. The interviews were semi-structured, meaning that there was a fixed list of questions that all PSTs were asked (see Table 3). Depending on the responses, we asked some PSTs follow-up questions. All participants answered questions about their understanding of real-world issues, controversial issues, and injustices: what these terms mean, how important they are in mathematics teaching, and what real-world topics would fit into teach category. Additional follow-up questions arose from the specific information the PSTs gave, and were usually based on the personal experiences they shared during the interviews. For

example, one question asked how one PST's educational experiences in both a low-income and high-income school district would impact her teaching of real-world topics; another, posed to a PST with a stronger mathematical background, probed the types of mathematical knowledge needed to be successful in teaching real-world mathematical contexts.

The interviews were 10–45 minutes each, depending on each PST's interest, prior knowledge, and openness to the topic. If PSTs gave brief responses, 10 minutes were sufficient to respond to all the questions. If a PST was reluctant to talk or was unable to come up with examples for the contexts, we asked fewer follow-up questions. The two shortest interviews were with PSTs, who had difficulties creating examples of real-world issues, and who were not often vocal in the classroom; one of the two was also particularly ambivalent about using controversial issues in the classroom.

Table 3
Interview Prompts

1.	Some people think it is important to teach mathematics by making connections to real-world situations . What does that mean to you? [Can you give me some specific examples? Can you give me more specifics? How would you teach it? Which mathematics would you use? What issues are relevant to you?]
2.	Some people think it is important to teach mathematics by making connections to controversial issues . What does that mean to you? [Can you give me some specific examples? Can you give me more specifics? How would you teach it? Which mathematics would you use? What issues are relevant to you?]
3.	Some people think it is important to teach mathematics by making connections to injustice . What does that mean to you? [Can you give me some specific examples? Can you give me more specifics? How would you teach it? Which mathematics would you use? What issues are relevant to you?]
4.	How do you perceive the terms <i>real-world situations</i> , <i>controversial issues</i> , and <i>injustice</i> ? Are they separate, or is there an overlap? Please give examples.
5.	Would these topics/activities be appropriate to use in pre-K–8 classrooms? Please explain. Give examples of topics that would and would not be appropriate to use.
6.	If you had conditions in your school and districts that were ideal, would you use activities like these in the classroom?

The analysis of the interviews was focused on developing a more robust understanding of the survey results. We independently examined summaries of the interviews to isolate common themes that related to the quantitative results. We paid special attention to how PSTs responded to items that had a high percentage of neutral responses. After the individual analysis, we discussed the themes and reached an agreement on significant beliefs that seemed to impact the PSTs re-

sponses on the survey, with additional multiple readings of the interviews in order to ensure that our claims about the beliefs were backed by PST responses.

Limitations. The sample size for the CMRWS is not yet large enough to make generalizations about PST beliefs with confidence. We cannot perform a factor analysis based on a sample of 92. Also, as may be the case with every survey, although it is anonymous, we are unable to ascertain if PSTs were responding truthfully to the questions or were agreeing with ideas that they knew their instructors or education programs would approve of, most notably the merit of teaching mathematics through real-world topics.

Even though the interviews were conducted at the end of the semester, and PSTs knew they would not be taking another course with the researcher, there is still a possibility that the inherently unequal teacher–student relationship impacted interview responses. Also, because the interview was semi-structured, it means that not every PST answered exactly the same questions, which also may have had an impact on the results of the analysis.

Results and Discussion

Survey

The data from the 92 respondents were entered into IBM SPSS (IBM Corp., 2012) for analysis. Eight items were reverse-scored. We based the scoring on the degree of openness the PSTs displayed towards using real-world issues and grappling with the associated controversial aspects in their future teaching, and their interest in learning about these issues. Thus a score of one would indicate a PST who was not at all open toward real-world issues and a five would indicate that the PST was quite open to these ideas. The means and standard deviations of the four subscales are listed in Table 4. In addition, Table 5 shows the percent of disagreement (D, combined Disagree and Strongly Disagree), neutral (N), and agreement (A, combined Agree and Strongly Agree), for the four items that asked about the PSTs’ willingness to use the four types of real-world connections emphasized in the four subscales.

Table 4
Means and Standard Deviations for the Four Subscales

	Real World	Controversial	Injustice	Backgrounds
Mean	4.29 (.53)	3.50 (.59)	3.62 (.64)	3.94 (.65)

Table 5
PSTs' Willingness to Use Different Types of Real-World Connections

Item #	Item	Disagree	Neutral	Agree
1	When I teach mathematics I will make connections to REAL-WORLD SITUATIONS.	1%	2%	97%
7	When I teach mathematics I will make connections to CONTROVERSIAL ISSUES.	11%	61%	27%
16	When I teach mathematics I will make connections to ISSUES OF INJUSTICE.	13%	47%	40%
28	When I teach mathematics I will make connections to the FAMILY BACKGROUNDS OR COMMUNITY PRACTICES of different peoples from all over the world.	4%	5%	90%

Note. Percentages may not add to 100 due to rounding.

Tables 4 and 5 show that there is a much higher level of support for making real-world connections in the classroom than there is for making connections to controversial or social justice issues and to a lesser extent to family backgrounds or community practices. Using a paired samples *t*-test, the mean differences between the scales show that there is a significant difference between Real World and Controversial ($p < 0.05$) and Backgrounds and Controversial ($p < 0.05$), and that the difference between Injustice and Controversial is not statistically significant. The high support for real-world connections is not particularly surprising, and it may be due to a variety of reasons: the PSTs may genuinely support the use of authentic real-world contexts in mathematics teaching; they may think they support the use of authentic real-world contexts without a deep understanding of what that means; they may have a broad understanding of what constitutes a real-world connection, thus including virtually any “contextualized” problem, such as simple word problems; or they may be repeating what they heard in their education programs.

Of all the subscales, the lowest scores were on the controversial issues (CI) subscale, which we chose to investigate for this reporting, not only because of the low scores but also because the responses in this section were difficult to interpret. We were also interested in the CI scale because of our own interests in developing future teachers who are committed to using mathematics as a tool for understanding our social and political world, which requires investigating controversial issues.

The eight items of the CI subscale along with the percent of disagreement (D, combined Disagree and Strongly Disagree), neutral (N), agreement (A, combined Agree and Strongly Agree), and means are listed in Table 6. Note that the items are ordered by increasing mean scores and the “r” after the item number indicates that the scores were reverse-coded when calculating the means.

Table 6
Items on the Controversial Issues Subscale (N = 92)

# ^a	Item	Disagree	Neutral	Agree	Mean
10r	When I teach mathematics I will focus on mathematical concepts (for example, addition and subtraction, geometric shapes, etc.) and not worry about using CONTROVERSIAL ISSUES.	32%	47%	22%	3.10
11r	When teaching mathematics, CONTROVERSIAL ISSUES can distract students from learning the important mathematical concepts.	42%	32%	26%	3.16
7	When I teach mathematics I will make connections to CONTROVERSIAL ISSUES.	11%	61%	28%	3.16
13	Teaching mathematics with CONTROVERSIAL ISSUES helps students learn the mathematical concepts better.	10%	52%	38%	3.28
9	When I teach mathematics I will make sure my students have opportunities to take action to address CONTROVERSIAL ISSUES. For example, writing a letter to a government representative.	12%	30%	57%	3.45
8	I am interested in learning how to make connections to CONTROVERSIAL ISSUES when teaching mathematics.	12%	21%	67%	3.55
12	An advantage to teaching mathematics with CONTROVERSIAL ISSUES is that they help students learn about these issues in the world around them.	3%	15%	82%	3.78
14	An advantage to teaching mathematics with CONTROVERSIAL ISSUES is that some students identify these issues as important to them.	3%	13%	84%	3.80

Note. Percentages may not add to 100 due to rounding. There were two missing values in item 7 and one in item 9 since it was not possible to recode the serial mean that was used at the initial stages of the analysis.

^a Items that were reverse scored are indicated by an “r.”

Looking across the items, we see that many of the PSTs are uncertain about whether they will use controversial issues or whether use of these issues supports student learning of mathematical concepts (see items 7 and 13, over half of the responses were neutral). In addition, responses are roughly split over whether integrating controversial issues can distract learners from learning mathematical concepts (item 11). It is interesting to note that, with the exception of item 13, the items below the mean (CI = 3.50), namely 10r, 11r, 7, 13, and 9, relate to the PSTs antici-

pated teaching practice and to potential disadvantages of integrating controversial issues. Items 8, 12, and 14, which are above the mean, relate to the PSTs desire to learn more about controversial issues and their potential benefits in the classroom. The willingness to learn about controversial issues from others that is not necessarily accompanied with the desire to personally take action is consistent with Silverman's (2010) findings that PSTs often identify larger organizations as bearing the primary responsibility for addressing multiculturalism and therefore they may not be personally inclined to take action to address these issues in their own practice.

We interpreted the high percentages of "neutral" responses in the "controversial issues" category, as well as similar percentages between the "agree" and "disagree" responses in many items, as PST ambivalence about these topics; and sought possible reasons for it. It is possible that, despite our definition, PSTs were still unsure about what counts as a controversial issue or could have been using a different definition; given that we allowed them to choose topics they viewed as controversial when responding to the questions. We also acknowledge that not all controversial issues are equally controversial to all people, which might also have an impact on survey responses. Further, we also conjectured that the large number of neutral responses could be due to the fact that PSTs frequently have limited knowledge about how to integrate controversial issues into mathematics teaching (Felton & Koestler, 2012, 2015; Koestler, 2010). This conjecture would seem to be supported by the results asserting that while only 27% of the PSTs indicated they would make connections to controversial issues (item 7), 67% were interested in learning how to do so. It may also be the case that, without clear evidence or experience to draw on, some PSTs could have been unsure whether implementing these issues would be worth the time and effort. Finally, it was possible that the PSTs were not interested in implementing these issues, but did not want to show disagreement, even though the participants were told that the survey was anonymous. The fact that 67% of the PSTs indicated an interest in learning more about making connections to controversial issues is an encouraging result and can provide a foundation upon which teacher educators can build.

Interviews

Recall that to further investigate PSTs' beliefs, the first author conducted interviews with nine of the PSTs enrolled in her mathematics course for preservice pre-K–8 teachers. In analyzing the interviews, two important themes were identified that shed light on the survey results. First, many of the PSTs considered a fairly narrow range of real-world contexts that could be used in the mathematics classroom, which might explain why PSTs so readily agreed with using real-world contexts in the survey. Second, many of the PSTs thought that controversial issues were only appropriate to explore with some students, which might contribute to

ambivalence toward controversial topics expressed in the survey. We explore these two themes below.

A limited range of real-world situations. On CMRWS, virtually all PSTs (97%) agreed with using real-world topics in their teaching, but, as discussed, a much lower percentage expressed interest in teaching using injustices or controversial topics. In the interviews, PSTs also emphasized the importance of learning mathematics through real-world situations. For example, Monica, who strongly disliked mathematics, insisted on contexts that students could relate to, because “if they are not going to see how it’s relevant, then they are not going to care.”

When asked for specific examples that they would consider using in their teaching, the PSTs provided contexts that are commonly seen in mathematics classrooms and curricula and that are not framed as controversial in nature. Problems about food or money were mentioned in six of the nine interviews, though two of those PSTs noted that food was the easiest but not the ideal real-world context to use. Other contexts included sports, telling time, changes in temperature, animals, and word problems about everyday objects. In response to the question about the kinds of context she would use with her students, Kate said, “Of course I am going to do the Johnny has two apples kind [of problem], that’s technically a real world [problem],” implying that any story problem can be understood as a real-world context. Food is one of the most common contexts for story problems, and the prevalence of food as a topic for PSTs to create story problems is noted in literature (e.g., Lee, 2012). Consider the following exchange from an interview:

Linda: You know, basically, if you are teaching fractions, I think it would be if you are talking to kids and they know what half of a pizza is, generally. You could cut a pizza in half and it’s like it’s a half of a pizza and that’s something they can relate to because they have seen that been cut up before and they know how that would work. So they are able to visualize it better than if you are maybe just took a circle and said this is like this. So just a little bit of context helps I think. And the addition you know there is always you give candy to your friends, how much candy do you have now?

Interviewer: Do you consider those real, real-world contexts?

Linda: I think real world as to their world. Hopefully they eat.

It is true, as Linda notes, that cutting pizza is an experience most students have had before. However, this example does not highlight how to use mathematics to solve or to investigate a genuine problem, but simply uses a familiar context to illustrate a mathematical concept (one half).

When pressed, all but two PSTs (Linda was one of the two) came up with examples of real-world contexts that were more overtly controversial in nature. It was

a difficult question for them, and some needed additional prompts, but they eventually mentioned a range of topics, including environmental issues, homelessness and hunger, and racial and language diversity. Apart from the two PSTs who were unable or unwilling to engage with controversial topics, PSTs were open to discussing these issues, and in some cases shared their personal interests, such as climate change or declining animal populations. They also readily agreed, consistent with survey results, that they would be interested in learning more about using controversial topics in their mathematics teaching. However, as is discussed below, the PSTs also frequently raised concerns about if or with whom these contexts could be used.

The interviews suggest that the PSTs in our study genuinely value real-world contexts and believe that it is important for students to relate to the contexts used for mathematics problems. This conclusion is consistent with findings in research studies conducted with inservice teachers (Chapman, 2009; Gainsburg, 2008). However, PSTs' current understanding of what kinds of real-world connections are possible in the mathematics classroom seems to have been shaped by their past educational experiences. The fact that two thirds of the interviewed PSTs gave examples related to food and money is not surprising, as it mirrors the extent of real-world mathematics that students often encounter in school. Our conjecture that some PSTs equate real-world contexts with any contextualized or story problems was partially confirmed through Kate's observation that the "Johnny has two apples" types of problems are a type of real-world problem, and the examples that other PSTs gave, which included sharing candy, counting bicycles around the school, or cutting pizza. There is certainly a place for these types of problems in the curriculum, but we would also like to see PSTs add mathematical complexity and meaning to them. For example, in addition to sharing candy, children could also discuss the fair sharing of resources; or in addition to counting bicycles around the school, children could engage in a neighborhood mapping project.

Controversial issues are only for certain populations. The PSTs generally believed that addressing controversial issues is only appropriate with certain groups of students. This occurred in three ways: (a) not exploring topics that directly affect students in negative ways because it might make them feel uncomfortable, (b) deciding whether or not to discuss topics based on how "diverse" the classroom is, and (c) avoiding controversial issues with young children.

First, seven PSTs were concerned about discussing certain topics because they could "discourage students" or "offend people." The other two were generally uninterested in talking about controversial topics. One of the seven, Laura, whose responses were overall different than those of her peers, thought teachers should still address those topics, but with care; however, others were more willing to avoid them. For example, Kate stated:

I think maybe we could talk about poverty and homelessness, I just wouldn't want to get as deep into it, ... I feel like at that age ... they haven't realized yet oh, my family is poor when they are in kindergarten, because that's not something you think about when you are that young, so I don't want to be like, oh, this is how much your parents make, that means you are in poverty, you know. I guess that was my thought process, which is why I don't want to teach about poverty in a low income school district, because I don't want to be like oh, that sucks for you, you live in poverty, I don't want to be the one to piece it together for them.

This quote corresponds to research findings that many PSTs and teachers see teaching as caring and would rather shelter their students than expose them to difficult issues (Ambrose, 2004; Bartell, 2011). We find Kate's statement problematic because it assumes that children are not aware of the circumstances they live in. Unlike Kate, Laura exhibited caring with awareness suggested by Bartell (2011), in which she would

have a conversation with this student, like, you know I really want to bring this up because I think it's great for people to be aware and I don't know if all students in our school are aware of all these things going on people's lives and kind of explaining that.

As we will discuss in more detail below, Laura has had more opportunities to discuss controversial topics with others, and this experience translated into greater comfort with the idea of introducing them to young students. We are interested in developing similar tendencies in all PSTs.

Second, two of the PSTs directly stated and two others implied that the diversity of the students in their classroom would influence which controversial issues to explore. For example, Monica talked about the need to talk about race, but only in a diverse classroom:

It doesn't apply to every classroom but I think that a really big deal is being different color than someone else. I think it would depend on the classroom because there aren't always diverse classrooms. ... But if you had a more diverse setting then you could talk about it, it'd be like you know this is okay we are not all the same, we are all different, and at the same time how many of use come from these backgrounds and data like that could be plotted or bar graphed.

She also noted that she had gone to an all-White school where race was not discussed because "it was not an issue," which is a perspective we have seen elsewhere (Felton-Koestler, 2015) that reflects the notion that "whiteness" is not a race (McIntosh, 1990). In contrast, Ann talked about a classroom with only White students being a safer environment to investigate these issues:

I feel like if you were in an all-White classroom, you could do stuff with injustice because you are not going to be likely risk, there is less controversy there, versus hurting

someone's feelings and in some ways it may be easier there than in a class with one kid that isn't White.

Ann also talked about not wanting children to feel marginalized, thus again showing that caring can get in the way of critical conversations. Both quotes highlight the perspective that whether or not a topic can be broached depends greatly on the makeup of the student body. While we believe it is important to be cognizant of and responsive to one's students, we also see this perspective as problematic if it results in important topics, such as race, only being discussed with minoritized groups of students.

In addition, PSTs mentioned concerns over parent and administrator disapproval of these topics. Two stated that they did not want to offend anyone, and even Laura said that she would check with an administrator before discussing a topic that could be deemed as controversial. If, as suggested by these data, PSTs are ready to discuss controversial topics only in certain contexts with certain students, then their ambivalence toward teaching controversial topics is understandable: they may be neutral because their final decision about whether to include controversial issues in the mathematics curriculum will depend on their school setting and the support they receive. This is an important notion for teacher educators to consider, as school administrators may not be aware of, informed about, or supportive of discussing controversial issues in mathematics.

Finally, the most prevalent version of the idea that controversial issues are only for certain groups centered on the age of the students. All PSTs interviewed were interested in teaching early elementary grades, with five of the nine choosing a grade level between kindergarten to third grade as their preferred grade to teach, and the other four undecided between early elementary and either middle school or special education. In their interviews, two thirds of the PSTs stated that controversial issues would be inappropriate for younger children (three explicitly mentioned first- and second-grade students as being too young) because they would have difficulty comprehending or caring about the issues that were being discussed or because they had not considered them before. Kate's previous quote about homelessness and poverty provides one example of this perspective. Another can be seen in the following exchange:

Interviewer: Can you give examples of making connections to real-world situations? How would you do it if you thought it was important?

Monica: That was hard for me to answer on the survey. I want to teach really young children and I feel like that's going to be really hard. Because a lot of the stuff I want to make connections to I feel like are more middle school high school level things like when I talked about the child soldiers [a project she did in high school]. Kindergarteners are not even going to know what that means or will not care. So I feel like the

things that I feel like are important are going to be out of the range of knowledge of the kids I want to teach. So like on the survey most of the questions I was like I would love to teach about them but I have no idea how I would do that. So I feel like it would have to be a lot lesser real-world situation like ice cream, which is still, like money. Money is like for first graders especially I feel like it would be a really easy real-world connection to make but it's not really an issue.

In this quote, young children are viewed as incapable of understanding contexts beyond money or ice cream. Though literature mostly documents work with slightly older students (e.g., Turner et al., 2009), first-graders have also shown to be capable of discussing complex topics, such as power and inequality, through mathematics (Murphy, 2009). Interestingly, Monica later stated that first-graders know a lot and have opinions about everything, which contradicted everything else she said in the interview, and which led us to conjecture that, at least in her case, the belief that children are not capable of understanding these issues was not firm. Research points to the importance of field placements of PSTs in diverse schools and communities (e.g., Villegas & Lucas, 2002; Zeichner, 2010), and we believe that it would be beneficial for the PSTs to interact with young students who live in marginalized or underprivileged communities and learn from them about their understanding of the issues they face.

An illuminating case. Amidst uncertainty about the meaning of and openness to teaching controversial topics, one PST's interview responses were pointedly different from those of her peers. We include her case because we think that her different responses and background offer insight into possible paths for preparing PSTs to teach mathematics through real-world contexts, and, in particular, controversial issues. This PST, Laura, had a strong mathematical background, grew up in the low-income area surrounding the university, and was a residence assistant (RA) on campus. We think that these three factors played an important part in shaping her interview responses, but we will only discuss the second and third here.

Unlike her peers, Laura had ready examples for both real-world and controversial issues that could be used when teaching mathematics. For example, she talked about a problem that would involve finding the number of school lunches that a celebrity's income could purchase, and noted that this problem would be fun while also relating to students' lives. Drawing on her experience volunteering in an elementary school in her community, she gave examples of story problems that students were likely to relate to about students who speak multiple languages, who have parents living out of state, or who live in very large households. In all three examples she emphasized that the goal would be for students to relate to the context and to see that they are not the only ones dealing with difficult situations such as living away from a parent. We think that her familiarity with the community and with the students' circumstances helped her to see these circumstances as assets and

potential contexts for mathematics problems rather than as issues to avoid because they are too controversial or too difficult for students to grasp. Laura commented on this when she contrasted her own perspective with those of her peers, noting, “I feel like being from around here makes my perspective a little different.”

Also unlike her peers, Laura did not think that controversial issues were only for some student populations. Although she also thought that fifth grade was the right age for having in-depth conversations about real-world mathematical contexts, her concerns were more of a mathematical nature. For example, she worried about using school demographics with younger students because of percentages, but was still willing to create simpler problems for younger students (e.g., missing addend problems) using school data. Laura was comfortable discussing social justice issues, due, it appears, to the social justice programming that she is responsible for as an RA. For instance, when initially asked about her interest in integrating real-world issues in the classroom she brought up social justice issues in connection with her work as an RA:

Just like with my RA position, I have learned about so much more about mostly social justice issues, how it's more than just skin color obviously, your gender, so I think that I've learned a lot from that and I am excited to be able to incorporate what I have learned.

She easily related some of her duties with teaching, in particular discussing the awareness of the lack of resources that many low-income students experience. When she later stated that discussing some issues, such as “abuse or jail rates... might hit [students] really hard if their family has been involved in that,” she again made connections back to her experience as an RA. She reflected on how she has to find ways to have conversations with residents who have been affected by particular issues, such as suicide, before making announcements or posting fliers for programming related to that topic. She maintained that, analogously, she would still incorporate controversial topics in the classroom, after checking in with students first. Although she noted that checking in with students about discussing controversial issues that may affect them would be “something I would learn over time how to [do],” Laura’s experiences as RA seem to have provided her with both a greater knowledge of social justice issues in general and a higher comfort level with discussing these issues.

Laura ended her interview with a question, “Do people not want to include them in their teaching? I am thinking why would someone not want to include real-world issues in their teaching? Maybe it’s just me being very naïve.” We found that almost all the survey respondents and all the interviewees said that they did want to include real-world issues in their teaching, and in the next section discuss our recommendations for helping PSTs learn how to do so effectively.

Recommendations and Implications for Research

As mentioned, we are yet unable to make generalizations about PSTs' beliefs based on our survey and interviews. However, based on our results we have several recommendations for research and practice in mathematics teacher education, with the goal of preparing PSTs to become more open, willing, and able to integrate controversial and social justice issues into their future mathematics teaching. In particular, we discuss the value of broadening PSTs' understandings of what real-world contexts can be integrated with mathematics, challenging their assumptions about who can benefit from exploring controversial issues, thinking carefully about the sequencing of real-world topics, and exposing PSTs to social justice issues in a variety of contexts. We also identify directions for future work in each area.

Understanding of real-world issues. The PSTs we surveyed readily agreed with the use of real-world contexts in their future teaching, but further probing suggests that their understanding of what this looks like largely corresponds to familiar textbook scenarios and word problems as opposed to more authentic uses of mathematics outside the classroom in a variety of contexts. Moreover, a significant number of the interviewed PSTs thought that many controversial issues were inappropriate for particular groups of students, and especially for young children. Therefore, we suggest providing PSTs with a broad range of examples of real-world contexts and controversial issues that can be integrated with mathematics at a variety of grade levels. Developing a rich set of examples of how to integrate mathematics and controversial issues, especially in the younger grades, remains an important task for educators committed to equity-oriented mathematics teaching. In addition, we suggest providing opportunities for PSTs to identify topics that they see as relevant or appropriate for students to explore and then support them in finding ways to explore these topics mathematically. Such an approach would have the added benefit of supporting PSTs in developing their understandings of mathematical modeling by supporting them in seeing how to mathematize real-world phenomena (CCSSI, 2010; Felton, Anhalt, & Cortez, 2015; Koestler, Felton, Bieda, & Otten, 2013).

Challenging assumptions about who can benefit from exploring controversial issues. One of our possible explanations for why PSTs were ambivalent about controversial topics in the survey was that they did not consider them appropriate for everyone, but only some of the students, most notably older students, but also those belonging (or not belonging) to particular racial and/or ethnic groups. As discussed, we take the position that young children are capable of having difficult conversations about their lives and communities; researchers and educators have documented examples of rich and meaningful work with students of all ages, and in particular pre-K–8 students (e.g., Turner et al., 2009; Denny, 2013; Gutstein, 2006; Peterson, 2013; Varley Gutiérrez, 2013; Turner, 2012), showing that children are not only

aware of the issues that affect them and others, but are also capable of having complex conversations around these issues and engaging in complex mathematics to explore them in more depth.

In response to the dismissal of young children's ability to comprehend controversial issues, we have begun to respond to our own PSTs by arguing that children learn about many things in school that they will not *fully* comprehend, either immediately or over the course of their formal education. However, we *start* the conversation about these topics with students, and it grows over time. This growth in comprehension is true both with controversial real-world issues and with typical school content. For example, a young child will not "fully understand" everything about addition but can begin learning about it. We argue that, in principle, real-world, controversial, and social justice issues should be no different. However, as with other school content, we also acknowledge that topics must be introduced in ways that are attentive to children's current understandings as well as their local contexts.

Therefore, as discussed, the development of a range of examples—not only of how to integrate mathematics and controversial issues but also of the kinds of conversations children are capable of having around these issues—can inform both the PSTs' views about what is possible in the classroom and the field's understanding of how to introduce these issues in age appropriate ways.

It is also important to challenge the belief that social justice should only be discussed in classrooms with a particular racial and/or ethnic makeup. We find especially useful the notion that the (mathematics) curriculum should function both as a window into other perspectives or issues that students may not be familiar with and as a mirror reflecting back students' interests and concerns (Gutiérrez, 2007; Tate, 1994). However, much of the work done focusing on social justice mathematics has been focused on "urban youth of color" or their teachers (Brantlinger, 2013) and on the "mirror" portion of the above metaphor. Thus, as has been emphasized in discussions of social justice more broadly (see, for example, Swalwell, 2013), we again call for incorporating into mathematics teacher education programs a broader range of examples of the nuances of integrating social justice issues into mathematics across a diverse range of classrooms, in which mathematics serves both as a mirror and as a window into people's lives.

Sequencing with care. According to Enterline and colleagues (2008), PSTs differ in the degree "to which they understand, accept, believe and are prepared to teach in ways consistent with social justice principles" (p. 273). The goal of CMRWS is to measure this degree of agreement, which should provide valuable information to teacher educators. In particular, the survey can help us identify social justice content that is easiest for PSTs to agree with and accept. Because PSTs are especially resistant to ideas that clash with their beliefs (Ambrose, 2004; Pajares, 1992), one possible strategy is to introduce PSTs to ideas of social justice through

contexts they find more acceptable. As CMRWS results show, PSTs readily agree with the use of real-world contexts but have a more difficult time with controversial issues. While we did not focus on injustices here, we found that PSTs were somewhat more likely to agree with using injustices in their teaching than controversial issues (40.9% vs. 22.7%). We consequently conjecture that controversial issues that can be perceived as injustices (for example, past appropriation of indigenous lands, the gender wage gap, or unequal access to water around the world) may be easier for PSTs to engage with and can be more influential in changing their perceptions about controversial issues in general.

More work is needed to examine (a) how PSTs respond to particular topics, (b) how the sequencing of topics affects PSTs reactions, and (c) how PSTs' responses relate to their background and existing beliefs. It may be that there is large agreement among PSTs from a variety of backgrounds about which real-world topics they view as largely neutral and which they see as controversial or as dealing with injustice. Or it may be that how they take up a topic depends greatly on their background and how the topic is framed. Local context also plays a part in determining which topics are controversial. For example, while it is acceptable to discuss the cost of war in some parts of the country, in the area where the first author's university is located (next to a military base), this topic is extremely controversial. One PST, Briana, discussed this in her interview, noting, "you could talk about the war, but talk about supporting the troops" and "with all the military families, that's where all the controversy comes in." A better understanding of how PSTs interpret real-world contexts and which contexts they are initially most open to considering in their own teaching can inform mathematics teacher educators' practice.

Exposing PSTs to social justice contexts in and out of the classroom. Of the nine PSTs interviewed, Linda stood out in her comfort with and willingness to discuss and explore issues of social justice. As discussed, this was due, in part, to her work as a residence assistant in the dormitories, which included training that required her to attend and organize social justice programming. The other PSTs interviewed did not have similar experiences; although through other courses they may have experienced similar topics, they had not participated in similar experiences outside of their academic coursework. We have to be realistic about what we as teacher educators can accomplish in a three- or four-credit semester-long course. For example, even though the interviewed students were exposed to some controversial issues in their mathematics methods course, they did not understand what these issues were or how to use them in mathematics teaching. Despite evidence that mathematics content and methods courses can be powerful sites for beginning a conversation with PSTs about these issues (Bartell, 2012; Ensign, 2005; Felton, 2012; Felton & Koestler, 2012, 2015; Felton, Simic-Muller, & Menéndez, 2012; Koestler, 2012; Mistele & Spielman, 2009; Spielman, 2009), there is little evidence that a single course will have a large or lasting effect on PSTs beliefs or their prac-

tices. Teacher education programs committed to issues of equity and social justice must look for ways to provide opportunities for ongoing interaction with social justice issues both throughout their course work (McDonald, 2005; Nieto, 2000; Villegas & Lucas, 2002; Zeichner, 2010) and outside of the classroom. We also suggest that teacher educators consider assignments within their own courses that will encourage PSTs to interact with or learn about social justice issues in their local context, such as observing a protest or interviewing students, parents, or community members about their concerns.

Conclusion

In this article, we introduced the *Connecting Mathematics to the Real World Scale* (CMRWS) for measuring PSTs' beliefs about connecting mathematics to four kinds of real-world topics: (a) everyday or career related topics, (b) controversial issues, (c) issues of injustice, and (d) family backgrounds or community practices. The CMRWS is unique in its focus on a range of types of real-world contexts and their use in the *mathematics* classroom. Reflecting our interest in supporting PSTs in engaging in teaching mathematics for social justice, we focused our analysis on PSTs' beliefs about using controversial issues in the mathematics classroom. PSTs' showed the least willingness to use controversial issues. Interviews with PSTs suggest that their concerns with controversial issues stem primarily from concerns about the types of students they believe are ready to have these conversations in terms of age and race and/or ethnicity. Moreover, many of the PSTs seem to have limited experience with how to use mathematics to explore controversial issues.

By developing a tool to triangulate PSTs' beliefs with other qualitative forms of data we can better understand how teacher education programs affect PSTs' beliefs and can ultimately lead to identifying learning trajectories based on different incoming past experiences. We believe this, coupled with a greater range of examples of teaching mathematics with controversial issues, may better prepare PSTs to engage in teaching mathematics for social justice.

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APPENDIX A

Connecting Mathematics to the Real World Scale (CMRWS)*

We are interested in learning your views about connecting mathematics to real-world situations and to people’s lives. Each section of the survey defines a specific kind of mathematical connection for you to consider. We appreciate your time in completing this questionnaire.

Using the scale below, please indicate how much you agree or disagree with each statement by circling a response.

1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree
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REAL-WORLD SITUATIONS are everyday or career related topics. Examples include choosing a cell phone plan, designing buildings, using math for a job, connecting math to artistic designs, or solving scientific problems.

1.	When I teach mathematics, I will make connections to REAL-WORLD SITUATIONS.	1	2	3	4	5
2.	I am interested in learning how to make connections to REAL-WORLD SITUATIONS when teaching mathematics.	1	2	3	4	5
3.	When I teach mathematics, I will focus on mathematical concepts (e.g., addition and subtraction, geometric shapes, etc.), and not worry about using REAL-WORLD SITUATIONS.	1	2	3	4	5
4.	When teaching mathematics, REAL-WORLD SITUATIONS can distract students from learning the important mathematical concepts.	1	2	3	4	5
5.	An advantage to teaching mathematics with REAL-WORLD SITUATIONS is that they help students learn about the world around them.	1	2	3	4	5
6.	Teaching mathematics with REAL-WORLD SITUATIONS helps students learn the mathematical concepts better.	1	2	3	4	5

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Using the scale below, please indicate how much you agree or disagree with each statement by circling a response.

1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree
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CONTROVERSIAL ISSUES are topics that will likely be viewed as contentious or debatable. Not everyone agrees on what topics are controversial, but some examples might include the costs of the war on drugs, government spending, funding for schools, or climate change. When responding to questions on the survey about **CONTROVERSIAL ISSUES**, imagine topics that you consider controversial.

7.	When I teach mathematics, I will make connections to CONTROVERSIAL ISSUES .	1	2	3	4	5
8.	I am interested in learning how to make connections to CONTROVERSIAL ISSUES when teaching mathematics.	1	2	3	4	5
9.	When I teach mathematics, I will focus on mathematical concepts (e.g., addition and subtraction, geometric shapes, etc.), and not worry about using CONTROVERSIAL ISSUES .	1	2	3	4	5
10.	When teaching mathematics, CONTROVERSIAL ISSUES can distract students from learning the important mathematical concepts.	1	2	3	4	5
11.	An advantage to teaching mathematics with CONTROVERSIAL ISSUES is that they help students learn about the world around them.	1	2	3	4	5
12.	Teaching mathematics with CONTROVERSIAL ISSUES helps students learn the mathematical concepts better.	1	2	3	4	5
13.	An advantage to teaching mathematics with CONTROVERSIAL ISSUES is that some students identify these issues as important to them.					

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Using the scale below, please indicate how much you agree or disagree with each statement by circling a response.

1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree
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ISSUES OF INJUSTICE are topics that are likely to be seen as a form of injustice or wrongdoing. Not everyone agrees on what topics represent injustices, but some examples might include animal cruelty, amount of living space in refugee camps, or deaths from preventable diseases. When responding to questions on the survey about **ISSUES OF INJUSTICE**, imagine topics that you consider injustices.

14.	ISSUES OF INJUSTICE are also CONTROVERSIAL ISSUES.	1	2	3	4	5
15.	When I teach mathematics I will make connections to ISSUES OF INJUSTICE.	1	2	3	4	5
16.	I am interested in learning how to make connections to ISSUES OF INJUSTICE when teaching mathematics.	1	2	3	4	5
17.	When I teach mathematics I will make connections to ISSUES OF INJUSTICE related to gender. For example, comparing women's and men's pay or looking at differences in the number of women and men in different professions.	1	2	3	4	5
18.	When I teach mathematics I will make connections to ISSUES OF INJUSTICE related to people's income or wealth levels. For example, showing the difficulty of making ends meet on a minimum wage job.	1	2	3	4	5
19.	When I teach mathematics I will make connections to ISSUES OF INJUSTICE related to people's race or ethnicity. For example, comparing differences in funding for schools in predominantly Black, Latino/a, and White neighborhoods.	1	2	3	4	5
20.	When I teach mathematics I will make sure my students have opportunities to take action to address ISSUES OF INJUSTICE. For example, writing a letter to a government representative.	1	2	3	4	5
21.	When I teach mathematics I will focus on mathematical concepts (e.g., addition and subtraction, geometric shapes, etc.), and not worry about using ISSUES OF INJUSTICE.	1	2	3	4	5
22.	When teaching mathematics, ISSUES OF INJUSTICE can distract students from learning the important mathematical concepts.	1	2	3	4	5
23.	An advantage to teaching mathematics with ISSUES OF INJUSTICE is that they help students learn about these issues in the world around them.	1	2	3	4	5
24.	Teaching mathematics with ISSUES OF INJUSTICE helps students learn the mathematical concepts better.	1	2	3	4	5
25.	An advantage to teaching mathematics with ISSUES OF INJUSTICE is that some students identify these issues as important to them.	1	2	3	4	5

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DEMOGRAPHICS

Gender

- 1 = Male
- 2 = Female
- 3 = Other

State

Race

How do you identify your race? (Choose all that apply)

- 1 = White or Caucasian
- 2 = Black or African American
- 3 = American Indian or Alaska Native
- 4 = Asian
- 5 = Native Hawaiian or other Pacific Islander
- 6 = Other

Are you of Hispanic, Latino/a, or Spanish origin?

- 1=No
- 2=Yes

What is your age?

- 1 = 18–23
- 2 = 23–30
- 3 = 30–40
- 4 = 40–50
- 5 = 50–60
- 6 = 60+

What is the highest level of school that your primary parent(s) or guardian(s) have completed? There is room to answer for up to two primary parents or guardians.

Parent or guardian 1

- 1 = Less than a high school degree
- 2 = High school degree or equivalent (e.g., GED)
- 3 = Some college but no degree
- 4 = Associate degree
- 5 = Bachelor's degree
- 6 = Master's degree
- 7 = Professional school degree (e.g., M.D., J.D.)
- 8 = Doctorate degree

Parent or guardian 2

- 1 = Less than a high school degree

- 2 = High school degree or equivalent (e.g., GED)
- 3 = Some college but no degree
- 4 = Associate degree
- 5 = Bachelor's degree
- 6 = Master's degree
- 7 = Professional school degree (e.g., M.D., J.D.)
- 8 = Doctorate degree

Teaching interest after graduation (Choose the one that best applies)

- 1 = Preschool–2
- 2 = 3–5
- 3 = 6–8
- 4 = 9–12
- 5 = Other

Classroom teaching experience (Do not include experiences working in classrooms that were part of your teacher preparation program. Include only the years you were a teacher.)

- 1 = None
- 2 = 0–4 years
- 3 = 5–10 years
- 4 = 11–20 years
- 5 = 20+ years