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Developing culturally responsive mathematics teachers: secondary teachers' evolving conceptions of knowing students

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Abstract Research advances in teaching, learning, curriculum, and assessment have not changed the continued underperformance of marginalized students in mathematics education. Culturally responsive teaching is a means of addressing the needs of these students. It is sometimes challenging, however, to convince secondary mathematics teachers about the importance of culture in mathematics education. To contribute to what is known about supporting secondary mathematics teachers in developing a culturally responsive teaching practice, we studied the impacts of a graduate course called Culture in the Mathematics Classroom on 13 teachers enrolled in the course. The course was designed to guide secondary mathematics teachers in understanding and growing their capacity to enact culturally responsive teaching in their classrooms. The purpose of our research was to explore how teachers' perceptions changed as a result of their engagement in the class with respect to understanding the role of culture in knowing and being responsive to their students. Specifically, we examined how each of the four course projects seemed to individually and collectively influence teachers' thinking. Overall, teachers appeared to expand their cultural awareness and dispositions for cultural responsiveness that would support them in knowing and supporting their students in the manner of a culturally responsive teacher. Teachers did not, however, develop some more "advanced" understandings related to power and privilege in society. This study provides researchers and mathematics teacher educators with a potential analytic framework for understanding teacher change with respect to culturally responsive teaching.

Keywords Secondary mathematics · Culturally responsive teaching · Cultural awareness · Teacher professional development · Knowing students

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Introduction

The National Council of Teachers of Mathematics (NCTM) has long-held the importance of equity in mathematics education, arguing that "the mathematics education of every child [is] its most compelling goal" (NCTM 1989, p. 4) as "excellence in mathematics education rests on equity—high expectations, respect, understanding, and strong support for all students" (NCTM 2000, p. 11). Yet, research advances in teaching, learning, curriculum, and assessment have not changed the continued underperformance of African-American, Native American, and Latino students in the USA, signaling that the needs of many students are not being addressed (Martin et al. 2010).

Ladson-Billings (1995b) calls for culturally responsive teaching as a means of addressing the needs of traditionally marginalized students. Culturally responsive teaching "can be defined as using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them" (Gay 2010, p. 31). A key assumption of culturally responsive teaching is that the academic achievement of students improves when "they are taught through their own cultural and experiential filters" (Gay 2002, p. 106). Culturally responsive teachers need to understand the culture and background of their students.

It is sometimes challenging, however, to convince secondary mathematics teachers about the importance of culture in mathematics education (Leonard 2008). One reason for this is that few examples of culturally responsive teaching in secondary mathematics classrooms exist (Leonard et al. 2009). Another reason is that "the enactment of [culturally relevant pedagogy] in the mathematics classroom is complex and may contradict teachers' beliefs and assumptions about the nature of mathematics, how it is taught, and the teacher's role and identity as these relate to teaching underserved students" (Leonard et al. 2009, p. 3). One teacher belief that can be problematic in understanding the role of culture in mathematics education is that mathematics is culture-free and therefore the teaching and learning of mathematics exists outside cultural influences (Bishop 1988).

To contribute to what is known about supporting secondary mathematics teachers in developing a culturally responsive teaching practice, we studied the impacts on teachers of a graduate course called Culture in the Mathematics Classroom, which was designed to guide secondary mathematics teachers in understanding and growing their capacity to enact culturally responsive teaching in their classrooms. The purpose of our research was to explore how teachers' perceptions about the role of culture in knowing and being responsive to their students changed as a result of their engagement in the class. Specifically, we examined the influence of four course projects, individually and collectively, using the teachers' written project reflections.

Culturally responsive teaching and mathematics teaching

Culturally responsive teaching is predicated on the idea that teaching and learning are influenced by the culture of teachers, students, classrooms, schools, communities, and society (Gay 2010; Nieto 2010). Nasir et al. (2008) see "math knowledge as inherently tied to cultural practices" (p. 194) at three levels, all of which are enacted in the mathematics classroom:

(a) mathematics knowing as a cultural activity (the structures and discourse of everyday vs. school math), (b) mathematics learning as a cultural enterprise (the structures and discourse of the classroom vs. students' home and local community), and (c) the system of mathematics education as a cultural system (access to and positioning in the field of mathematics) (p. 192)

As a result, "mathematics classrooms are inherently cultural spaces where different forms of knowing and being are validated" (Nasir et al. 2008, p. 206) based on culture, language, identity, and power.

To illustrate the influence of culture on mathematics teaching and learning, Martin et al. (2010) describe a hypothetical Black child deemed to have low cognitive abilities based on his performance on problems in a clinical setting. Martin et al. offer a different view of the child's mathematical knowledge by describing his arithmetic competence while shopping with his grandmother, which was masked by his teacher's inability to recognize the child's existing knowledge, and her assumptions about the capabilities of Black children. Thus, because of the role of culture in students' learning, a content-focused perspective is insufficient for understanding students' mathematical identity and development. Culturally responsive mathematics teachers are able "to move beyond a narrow focus on measurable performance as dictated by the pressures of standardization and mathematics testing to attend to students' interests, cultural backgrounds, and concerns" (Bartell 2011, p. 50). A cultural perspective also includes recognizing that mathematics classrooms are situated in broader educational and cultural contexts that shape students' opportunity to learn (Diversity in Mathematics Education [DiME] 2007).

As Martin et al.'s (2010) vignette demonstrates, knowing and understanding students' cultures is foundational to culturally responsive teaching (Gay 2010; Villegas and Lucas 2002). Many mathematics teachers, though, do not know students in this way (Leonard et al. 2009). This is illustrated by the dominance of traditional teaching practices in mathematics (Stigler and Hiebert 1999), which suggests that many mathematics teachers are similar to the hypothetical teacher in Martin et al.'s (2010) vignette in that they do not recognize the role of Culture in the Mathematics Classroom. In fact, only about 50 % of middle school teachers (Fulkerson 2013) and 40 % of high school teachers (Smith 2013) feel well prepared to encourage participation in mathematics of minority or poor students. Teachers may feel this way because they are uncomfortable understanding, relating to, and supporting these students.

A particular challenge for mathematics teachers in understanding the role of culture in mathematics education is that mathematics is often perceived to be culture-free (Bishop 1988; Greer and Mukhopadhyay 2012). One aspect of this view is that mathematics is not recognized as a product of human activity, but is seen as a universal truth, which is sometimes justified with statements like, "2 plus 2 is always 4." The belief that mathematics is culture-free has been normalized within mathematics education. Prospective mathematics teachers are exposed to this belief in their primary and secondary schooling, and especially for secondary teachers, this is further enforced in college by mathematicians who maintain "that mathematics is abstract, objective, and independent of social, cultural and political conditions" (Burton 1994, p. 73). A consequence of teachers believing that mathematics is a universal truth is that mathematics becomes the same for everyone and teaching mathematics becomes apolitical and uncontroversial (Greer and Mukhopadhyay 2012). These perspectives lead teachers to ignore students' cultural and linguistic backgrounds (Gutierrez 2002).

Culturally responsive teaching and knowing students

Culturally responsive teachers have particular attitudes, beliefs, and practices that inform how they know students. Foundational in the work of culturally responsive teachers is their application of sociocultural consciousness to understanding students' cultures (Banks et al. 2005; Villegas and Lucas 2002). Sociocultural consciousness is an "awareness that one's worldview is not universal but is profoundly shaped by one's life experiences, as mediated by a variety of factors, chief among them race/ethnicity, social class, and gender" (Villegas and Lucas 2002, p. 27). It is grounded in understanding that status differentiation exists in society, especially with respect to race, ethnicity, gender, and class, and is echoed in institutions, including schools (Villegas and Lucas 2002). Sociocultural consciousness has a profound influence on knowing and teaching students:

> Sociocultural consciousness…becomes a vehicle for the development of a more affirming and positive attitude towards students. Teachers begin to understand how their interactions with their students and the world in general are influenced by their social and cultural location and that of the students…By building on the experiences and knowledge of their students, teachers can create more personalized and motivating social contexts for teaching (Banks et al. 2005, p. 253).

Culturally responsive teachers develop "caring teacher–student relationships that explicitly attend to issues of race, culture, and power" (Bartell 2011, p. 69). Hackenberg (2005) suggests that developing students' mathematical knowledge is conjoined with developing students as people, and caring relations are essential for both. Culturally responsive teachers look for the possibilities in their students with a perspective of "informed empathy" that "requires the teacher to feel with the students [which] builds a sense of solidarity between the teacher and students" (Ladson-Billings 2011, p. 35). An understanding of students' cultural backgrounds can help teachers develop positive, supportive relationships with students (Nieto 2010) characterized by humanity and equity (Banks et al. 2005).

Culturally responsive caring means believing in students' academic potential and taking responsibility for students' learning (Gay 2002). Thus, culturally responsive teachers hold high expectations for students' learning and draw on students' experiences, knowledge, and backgrounds to support their learning (Ladson-Billings 1995b). These teachers "give reason" (Duckworth 1996), by looking for ways students make sense of what they are learning based on their experiences and knowledge. To do this, teachers must *decenter*, or set aside their own ways of knowing mathematics to focus on students' ways of knowing (Hackenberg 2005). Teachers then use this understanding to address each student's learning needs (Bartell 2011).

In addition to supporting students' learning and academic success, culturally responsive teachers help students develop and/or maintain cultural competence (Ladson-Billings 1995a). That is, students should not have to push aside, hide, or ignore their cultural identity for the sake of academic excellence. To address this, teachers must work to respect and utilize students' home and community cultures in the learning process.

Some beliefs and practices are antithetical to knowing students in a culturally responsive way. One such practice is to make quick or unfounded assumptions about students, particularly with respect to students' abilities or motivation (Banks et al. 2005; Ladson-Billings 2011). This practice is often accompanied with "deficit thinking" (Valencia 2010), which is the belief that a student fails at school because of internal deficits caused by

genetics, culture, class, and/or familial socialization. Deficit thinking is consistent with a "socioculturally dysconscious orientation" and leads to lowered expectations for students (Villegas and Lucas 2002). Another way teachers sometimes expect less of students is in an attempt to be nice. Being nice can result from wanting to be sympathetic and kind toward students. But when teachers do not believe in their students' capability and do not hold high expectations for them, they are not being nice, but quite the opposite (Nieto 2010).

Another way teachers eschew the cultural identity of students is to adopt a color-blind perspective, characterized by the stance of treating all students the same (Pennington et al. 2012). Color blindness is often a product of teachers' notions of fairness and nondiscrimination which include the belief that to recognize students' race and/or ethnicity might lead to being labeled as insensitive or even racist (Irvine 2003). However, a color-blind perspective ignores the existence of racial and ethnic power differentials in society (Pennington et al. 2012). Lastly, some teachers attempt to understand the culture of their students by ostensibly learning "the characteristics" of particular races or ethnicities (Cochran-Smith 1995). Such "essentialism" (May 1999) incorrectly assumes that the cultural characteristics of a group are fixed and homogeneous for each group member, thus ignoring the variability and mutability within cultures (Gutierrez 2002; Leonard et al. 2010).

Course perspectives and analytic framework

The foundational perspectives we adopted for the Culture in the Mathematics Classroom course inform interpreting the teachers' learning as well as our analytic framework.

Course perspectives

The definition of culture we used for the course was: a dynamic social system, containing the values, beliefs, behaviors, and norms of a specific group, organization, society or other collectivity that are learned, shared, internalized, and changeable by all members of society (Hammer 2012; Watson 2010). We took the stance that cultural markers such as race, ethnicity, class, gender, and language are "multifaceted, situated, and socially constructed processes" (Orellana and Bowman 2003, p. 26) that are linked to varying degrees of power and privilege (Adams et al. 1997; Bonilla-Silva 2010). Furthermore, we viewed people's identities to be a function of their participation in multiple cultural groups, thus making identity complex and possibly situational (DiME 2007).

In operationalizing our perspectives, we made two key didactical decisions. First, we did not focus the course on any particular cultural group or groups of students (e.g., Hispanic students) because most of the teachers had students from a variety of backgrounds and we did not want to reify any essentialist conceptions the teachers might have had or developed. Second, we did not privilege or emphasize particular cultural markers, such as race, even though we realized this choice might support color-blind perspectives on the part of the teachers (Martin 2009). We chose instead to structure course instruction around supporting teachers to develop an awareness of the ways that students' experiences and learning in mathematics classrooms are influenced by the varied cultural participation of the students and teacher and cultural characteristics of the school and community.

Analytic framework

Our study aimed to understand how teachers' perceptions changed regarding the role of culture in knowing and being responsive to students. Drawing on the foundational perspectives for the course and the literature about culturally responsive ways of knowing and working with students, we developed an analytic framework for classifying statements in the teachers' reflections. The framework consists of two categories: (a) cultural awareness and (b) cultural responsiveness.

Cultural awareness encompasses perspectives related to recognizing the existence and role of culture in teaching and learning. Culturally aware teachers recognize the existence of culture, power, and privilege in society and related influences on students' engagement with and learning in school. Moreover, these teachers recognize the role of culture, power, and privilege in school content, classrooms, teaching and learning.

Cultural responsiveness encompasses dispositions grounded in cultural awareness to work to know, understand, and support the engagement and learning of all students. Culturally responsive teachers work to understand students' cultures and backgrounds, using such knowledge of students to support students' learning and cultural competence. Additionally, these teachers develop supportive student–teacher relationships based on culturally responsive care, have positive attitudes toward students' knowledge and experiences (i.e., reject deficit perspectives), and hold high expectations for student learning and achievement.

Drawing on Villegas's (2007) definition of dispositions as "tendencies for individuals to act in a particular manner under particular circumstances, based on their beliefs" (p. 373), we identified *cultural responsiveness* as consisting of dispositions, rather than perspectives, because we believed it encompassed behavior as well as beliefs. However, because we did not observe teachers' behaviors, we used what teachers suggested about their behavior in their reflections as evidence for their dispositions related to cultural responsiveness.

We use this framework of *cultural awareness* and *cultural responsiveness* to organize the reporting of our findings.

Methods

The course that served as the context for this study was conducted online with weekly synchronous classes. Readings were required before each class, and for most classes, the teachers engaged in an asynchronous discussion board on class topics. The beginning of the course delved into theoretical foundations by asking: What is culture? How can students' home culture influence their experiences at school? Is mathematics culture-free? What are the central tenets of culturally relevant pedagogy? The remainder of the course explored issues involving culture and student learning including student motivation, status and small group work, language in the classroom, the purpose of mathematics education, and teaching mathematics for social justice. Four projects formed the core of the teacher work for the course. Descriptions of these projects are included in the findings.

The instructor for the course was a White, middle-class woman who lived in the Northeastern USA. She previously taught secondary mathematics for 6 years and had been engaged in teacher professional development and research on equitable mathematics practices, explicitly considering culture, race, and power, for over a decade (Bartell 2012, 2013; Bartell and Meyer 2008; Gau 2005). Unfamiliar with teachers' teaching contexts,

she worked to learn from the teachers and reflected regularly, alone and with the co-authors, about how her limited knowledge might hinder her ability to support the teachers in the course. The other two researchers also identify as White, middle-class women. All three researchers participated in designing the course.

Of the 13 participants, 6 were men and 7 were women. All identified as White and all lived in the Rocky Mountain region. Their teaching experience ranged from 2 to 22 years, with an average of 10 years. The teachers taught in suburban or rural schools that typically had 20–25 % minority students. Hispanic students were the largest minority group in most schools. Most of the schools had about 10 % of students classified as English language learners and on average, 25 % as low-socioeconomic status (SES).

Data collection

Data from this course included video recordings of the online synchronous classes, text from the asynchronous discussions, and teacher work from the four course projects. The video recordings were excluded from the data analysis because they only included whole-class interactions (not breakout group discussions) that contained little data relevant to our study. The project write-ups constituted the majority of the data. The content of the project write-ups differed across the projects, although each contained a reflection component. The reflection prompts also varied, although they typically included prompts for the teachers to describe what they learned and how doing the project might affect their teaching. Within the project write-up data, the reflection section contributed the most relevant data.

Data analysis

The data were analyzed using the projects, rather than individual teachers, as the over-arching organizational structure in order to explore how the course might have afforded shifts in perspectives across all the teachers. Data analysis methods were based on Wolcott's (1994) protocol of description, analysis, and interpretation for transforming qualitative data. In the description phase, text was identified that related to teachers' perspectives on the existence and role of culture in school, how to know students, what constitutes knowing students, and how to use knowledge of students in practice. These text excerpts were categorized as relating to attitudes at the beginning of the course or to one of the four projects.

In the first part of the analysis phase, themes were identified in the teachers' comments within each of the projects. The first pass of coding involved the development of short descriptions of the themes in the data. Subsequently, codes were developed for the themes and then relationships identified among the codes that resulted in categories and subcategories. For example, in the data from the Does Culture Matter project (described below in the Findings section), a category of Culture was created that represented teacher comments indicating they had a new understanding of how culture influences students. Four subcategories were created. Table 1 contains the descriptions and an example for each of these subcategories.

Next, the categories were grouped based on whether they related to *cultural awareness* or *cultural responsiveness* to align with our analytic framework. The Culture category was classified as relating to *cultural awareness* because this category represented teachers' statements about the existence of culture and its role in teaching and learning.

In the second part of the analysis phase, patterns were identified in teachers' statements related to *cultural awareness* and *cultural responsiveness* across the projects. Finally, these

Table 1 Subcategories, definitions, and examples for the culture category

Subcategory	Description	Example
Blind	Realization of having been blind to the existence or relevance of culture in mathematics education	Through this particular vignette assignment, I learned that I am often "blind" to the culture of my students. I see them all as my own kids and forget that they all bring something different to the classroom
Mathematics	New understanding that mathematics and the presentation of school mathematics is not culture-free	Every culture interprets fundamental mathematics concepts even though it may be taught differently. Papa New Guinea teaches counting through body parts. Other cultures see lines as a continuum, progress. Some cultures perceive circles as unity and power
Dissonance	New awareness of the existence of cultural dissonance in school	The issue of dissonance was very interesting to me. It made me wonder how often this happens to students. How often are students of different cultures made to feel uncomfortable in school situations?
None	Indication of having learned something about the role of culture, but specifics not given	The presentations and the vignettes provided for this project have given me a better basis to say that mathematics education is in no way culture-free

patterns were compared against what the literature suggests about knowing students with respect to culturally responsive teaching. Again, this interpretation was framed using the categories of cultural awareness and cultural responsiveness. The three processes (description, analysis, and interpretation) can be executed sequentially, but they also relate to and inform each other. Thus, processes were revisited, at times in nonsequential order, to verify and solidify findings.

Findings

We present our findings by first describing how the teachers discussed knowing students at the beginning of the course. Next, we present the ways teachers' comments changed across the course projects, with respect to culture and knowing students. Each project discussion begins with an explanation of the project's purpose and structure, which is followed with an analysis of the teachers' reflections for that project. Finally, we provide a cross-project summary that discusses how the four projects appeared to work collectively to influence teachers' perspectives.

We use the two themes of our analytic framework—cultural awareness and cultural responsiveness—to organize our analysis in each section. To review, we define cultural awareness as encompassing the perspectives related to recognizing the existence and role of culture in teaching and learning and cultural responsiveness as encompassing the dispositions grounded in cultural awareness to work to know, understand, and support the engagement and learning of all students.

Initial attitudes

We examined the data for evidence of how the teachers wrote about knowing students prior to the course. The teachers were not explicitly asked for this information, but most[1] of the teachers mentioned something indicative of their initial cultural awareness or responsiveness in the asynchronous discussions or their project work.

Cultural awareness

The teachers seemed to begin the course with an awareness of race, ethnicity, and home language as cultural markers, but used them as a way of indicating diversity among students rather than as deterministic of who individual students were. For example, one teacher wrote, "I believe that personal experiences and perspectives have a greater influence on students than a culture 'assigned' to a particular ethnic group." As this example illustrates, teachers rarely mentioned specific cultural groups, which might have been due to their reluctance to appear "racist," something White teachers sometimes fear in discussions related to culture and diversity (Bonilla-Silva 2010).

While teachers recognized the existence of students' home culture, a couple of teachers downplayed the influence of students' backgrounds in the classroom. One teacher admitted struggling with the idea that purposefully integrating meaningful contexts into mathematical instruction would make students more comfortable with the mathematics. Another teacher wrote, "It is true that mathematics seems to be a place where the native language of a student is less important than their ability to problem solve." Most teachers, however, did not discuss any connection between students' backgrounds and classroom learning, and no teachers discussed the school or community as cultural spaces that interact with students' learning.

Cultural responsiveness

In terms of cultural responsiveness, the teachers appeared to have a strong propensity to know and care for their students and they seemed confident in their ability to learn about their students. Most teachers were interested in finding out students' interests and hobbies, their social identities, and whether something in particular was troubling a student. What seemed most important to the teachers was using their strategies for knowing students as a means of developing good relationships with them. As one teacher wrote, "If I can't work their interests into my lessons, then knowing tidbits about my students gives me something to ask them about so that they know I care." The teachers were not specific about what constituted a good relationship other than they felt it was important that students felt valued and cared for. A couple of teachers wrote that caring for students helped support a positive classroom culture. A couple of other teachers commented that when students knew that their teacher cared for them, students were more likely to be motivated and participate in class.

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[1] To provide a sense of scale, yet preserve the linguistic flow, we use descriptors to represent the number of teachers as follows: *a couple* means 2 teachers, *a few* means 3–5 teachers, *about half* means 6–7 teachers, *many* means 8–10 teachers, *most* means 11–12 teachers, and *all* means all 13 teachers.

Does culture matter project

The Does Culture Matter (DCM) project was designed to introduce the teachers to different perspectives on the role of culture in mathematics education. Teachers were divided into groups with each group assigned to read a different set of vignettes. The vignette categories were (a) ways students experience discord with the norms of schooling that can interfere with learning (dissonance) (Sheets 2005); (b) the role and purpose of mathematics education [e.g., mathematics for social justice (Gutstein and Petersen 2005)]; (c) cultural values and ways of understanding [e.g., the line and the circle (Ascher 1991)]; and (d) out-of-school mathematical practices [e.g., street mathematics (Nunes 1995) and candy selling (Saxe 1998)]. In the fourth class meeting, each group presented the nature of their vignettes, what they discussed and learned with respect to how culture and mathematics teaching and learning intersect, whether they believed mathematics is culture-free, and any implications of their conclusions. Each teacher then wrote a reflection based on their sense of all four vignettes, which served as the data source for this project.

Cultural awareness

All the teachers mentioned something in their project reflections related to building cultural awareness. While a couple of teachers expressed this new understanding without providing details, other teachers gave specific examples of how their awareness had been limited prior to the project. For example, a few teachers described how they felt they had been "blind" to students' cultures. One teacher reflected, "It is easy for me to see in retrospect that I don't acknowledge cultural differences very often. I like to think that I just look at each child as a student but ignoring culture is tantamount to denying it." Another wrote,

> I have been blind to culture, as an influence on student and teacher perception and behavior… Now, I recognize that a student's culture extends beyond the language he speaks. Culture in the classroom permeates every aspect of atmosphere, behavior and interaction between teachers and students.

This teacher had not only been blind to the culture of her students, but to the role of culture in the classroom.

Several teachers also discussed recognizing that the contexts of mathematics problems are cultural. For example, one vignette included a mathematics problem that involved buying candy with an explanation of how this context could be interpreted as supporting consumerism and unhealthy eating habits (Gutstein and Petersen 2005). Referencing this problem, one teacher wrote:

> The very nature of approaching mathematics education in a contextual manner, rather than as just a set of procedures, inevitably makes culture relevant as a learning tool because no contextual problem can be culture-free. I was surprised initially that even questions that seem completely benign of culture, like the candy example, have cultural implications. I guess I have never viewed questions like this through a cultural lens, most likely because the context is "my" culture.

This teacher's reflection touches on another cultural issue related to context: the degree to which problem contexts are accessible or relevant to students. Another vignette described cases in which students experienced sweet potato pie as opposed to pumpkin pie as a Thanksgiving dessert or had bus riding experiences that included more than two bus rides per day as opposed to exactly twice a day (Tate 2005). In response to these examples, a teacher wrote,

I also learned to be careful when incorporating concepts into the classroom and how those concepts intersect with students' culture. As in the vignettes about using pumpkin pie and assuming that a work week is five days long, students may be less engaged or get the wrong answer when answering math questions.

Here, the teacher's statements demonstrate cultural awareness in the form of recognizing that concepts in the classroom intersect with students' cultural experiences in ways that might have implications for students' opportunities to learn mathematics.

Another way teachers discussed the role of students' culture in learning was how it influenced students' feelings about and engagement in school and, specifically, in mathematics class. This realization, made by many teachers, seems to have been triggered by the vignettes related to dissonance. One teacher reflected, "The reason for dissonance to exist may go unnoticed by a teacher, which can cause undue stress for a student. After putting our presentation together, it really made me think about the impact of things outside of our control as educators that may affect a student's success or failure." Another teacher wrote,

The vignettes and presentation dealing with dissonance are probably the most concerning. In hindsight, I am sure that I have had students in similar situations where they did not feel like they fit into a particular group socially but academically they did, but I sure was not aware of it at the time. This is of particular concern because my lack of insight meant that maybe these students' needs were not being met as effectively as they might have been had I been more aware.

Cultural responsiveness

Since cultural responsiveness is grounded in cultural awareness and teachers' reflections indicated that their cultural awareness evolved from working on this project, it is not a surprise that teachers also wrote about being culturally responsive with respect to knowing students and responding to students' needs. Knowing students differently was the predominant theme in teachers' DCM reflections related to cultural responsiveness.

Most of the teachers mentioned that as a result of the project, they believed they needed to know and understand their students differently. Often they used the word "personal" to describe the change in how they wanted to know their students. One teacher described what information she typically deemed appropriate to know about her students and then reflected, "Despite all of this knowledge about my students, none of it strikes me as incredibly personal." Another teacher wrote, "I need to work hard to know all of my students on a personal level." Specific aspects of "personal" knowledge that a few teachers mentioned included the nature of the mathematical experiences students have outside school and the different perspectives on mathematics that students might have. One of these teachers wrote, "I have never thought to ask students to share their personal experiences with mathematics even though it would be an easy thing to do and would provide insightful information to some of the beliefs my students have about mathematics." This teacher's reflection may indicate an understanding of mathematical activity occurring and interacting in different cultural milieus and that students may not only bring their knowledge of school mathematics to everyday endeavors, but also bring their knowledge of everyday or home mathematics to school (Nasir et al. 2008).

At the same time, half of the teachers were careful to clarify that it was not appropriate to essentialize students; it was important to know students individually as each student had a unique set of experiences and perspectives. One teacher wrote, "The topics discussed

during this assignment have reminded me to look at each of my students as unique cases and to value what they have experienced and be understanding of what they bring with them to class each day." Another teacher expressed this idea by saying, "Treating every student as an individual with their own culture, their own 504 plans, will hopefully help to minimize the level of discomfort that my students have in my classroom." In practice, 504 plans are developed so students with disabilities have adequate access to education. Teachers seemed to reference 504 plans because they are developed to meet the needs of individual students.

Additionally, half of the teachers began to think about how to use knowledge of students to help them teach more effectively—an important component of cultural responsiveness. One teacher reflected, "I will continue to search out ways to honestly incorporate students' culture into my classroom." Similarly, another wrote, "Perhaps I can figure out some mathematics problems that use some of the concepts that these students deal with daily." As a group, these teachers had a dim view of creating mathematics problems with only surface cultural features, such as using ethnic names.

Community engagement project

The second project of the course, the Community Engagement project (CEP; adapted from Bartell et al. 2010), was designed to have teachers gain culturally grounded knowledge of their students by engaging with their students' communities. This assignment is premised on the belief that students' home and community-based knowledge form a critical part of the knowledge base for teaching. Teachers were provided with suggestions about how to learn more about a particular student's lived experiences or her/his community including doing a home visit, interviewing community members, touring communities with an "expert" (e.g., student or parent), and visiting community centers.

Cultural awareness

None of the teachers mentioned anything related to building cultural awareness in their CEP reports. This may have been because the premise of the project was that students have lived experiences grounded in the culture of their communities, so the project was about exploring the nature of community cultures rather than ascertaining the existence of culture.

Cultural responsiveness

Many teachers mentioned something related to cultural responsiveness in their reflections on the CEP. About half of these teachers' reflections seemed to express a positive attitude toward the knowledge and experiences students have. One teacher commented, "I think kids are really in tune with their community and their family." Similarly, another teacher wrote, "I learned that most students are knowledgeable of their community and willing to discuss it openly. Many students were able to recognize photo subjects, describe its location and identify nearby landmarks."

Some teachers discussed realizing they had made assumptions about students that were invalid. For example, one teacher wrote,

> This experience has reminded me that I should never judge a book by its cover. Just
> because students appear to be friends in class does not mean they have the same

home life, values, or work ethic. If a student appears sleepy, then they probably are tired and not just lazy.

Her realization came as a result of a home visit with a student. Another teacher had made assumptions about where his students lived in the process of developing his CEP. To test his assumptions, he used school technology to access pictures of a few of his students' residences. He found that

> My 'townie' doesn't live in an older, in need of maintenance, single story house, but in a brand new carbon footprint of a monster. Moreover, my McMansionite is not eating up farmland, but actually lives in an upscale subdivision. Of course I know it's wrong to assume and I would love to be above such practices. Lesson learned, but I am sure one that will need repeating. The bottom line… don't judge, don't assume.

For a couple of teachers, surfacing their assumptions in the CEP project meant explicitly rejecting essentialist conceptions of their students' cultures. One teacher initially thought that by visiting the home of one of her Hispanic students, she would be able to generalize what she learned to other Hispanic students. She rejected this notion after the home visit, although it is not clear why. It might be that this student's home life was not what she expected. The other teacher wrote about his rejection of essentialism: "Even though one may speak of the culture of an area, generalizations are difficult to make." This reflection also seems likely to be a result of making false assumptions. Given that the teachers were explicit in not wanting to label or essentialize students, it was interesting that a couple of teachers found they did, in fact, hold essentialist ideas.

Another few teachers expressed views on how students' home lives related to students' engagement in school. One teacher saw this as a positive influence, while two teachers did not. One of these latter teachers visited a trailer park community where some of her students lived. She said that prior to her visit she had not considered where her students lived or what their home lives were like. She reflected, "Knowing that many families house anywhere from 3 to 7 people within one trailer, many individuals may not even have a bed of their own to sleep in, was a rude awakening for me." After noting her surprise, this teacher wrote how she thought these students' home lives negatively affected their learning at school:

> What is really important for me to think about is what it must be like for my students trying to complete their homework in a small space that they are sharing with so many other people. They may not have a quiet room of their own to go into, to shut out the rest of the world and to focus on math. How does this affect my expectations of their ability to complete out of class work? … While these experiences prompted a lot of personal reflection, the largest shock value came from my perceptions of what the trailer park must be like at night. Do my students feel afraid? How often are they outside of their homes after dark? What sort of situations have they seen or heard? How does this affect their ability to focus on schoolwork?

The teacher further reflected that while she was uncomfortable doing so, she felt it was important to discuss these issues with her students.

In contrast, one teacher judged what she learned about the community to be an asset for her and her students. She wrote,

> I think the most important lesson that I will take away from this is that people do care about kids and their schools and they show their support in many ways. I may not always think that parents support their kids in school but just because their way and

mine aren't the same doesn't diminish what they do. Parents will support their community schools, teachers, and children to the extent that we allow them to *in their own way*.

In this case, the teacher was able to recognize behaviors different from those she expected and they were not necessarily inferior or wrong; instead, she found value in them.

Cultural inquiry process project

About midway through the course, teachers engaged in a third project, the Cultural Inquiry Process (CIP) project (Jacob et al. 1996). The project was designed to help teachers maximize student success through action research about cultural influences on students' participation and learning. In this project, the teacher selected a student whom they were puzzled about with respect to the student's behavior, disposition, or learning. The teacher then hypothesized cultural influences, gathered information about the student, designed an intervention for the student, and concluded with reflecting on the outcomes of the intervention. The CIP project provided teachers the opportunity to gain personal, in-depth knowledge of one student with the goal of personalizing information about cultural influences.

Cultural awareness

Only a few teachers mentioned something related to their cultural awareness in their CIP reports, all of whom discussed realizing they had not been very aware of the nuances or differences in students' cultures. One teacher wrote, "This study has shown me how little I truly know about cultural issues and how easy it is for stereotypes to overshadow the actual cultural issues that need to be addressed." Another teacher wrote, "I also found that I am not as tuned into cultural undertones as I would like to be or perhaps need to be."

Cultural responsiveness

Many teachers discussed ideas related to cultural responsiveness, such as seeing the value in and taking responsibility for knowing ones' students. Teachers' reflections on taking responsibility for knowing students seemed to emerge as a result of teachers realizing they had been passive in knowing students or had expected students to take more initiative in asking for help. One teacher reflected,

> I was able to realize that there is disconnect between students' learning styles and how mathematics is now taught. I learned that every student that is not being successful needs to have a connection made. I need to discuss with them in a private, comfortable setting what interventions need to be made and how they feel they can be successful.

The teachers indicated that the value of being more proactive in knowing students was that this sometimes made teachers aware of incorrect assumptions they held about students. For example, one teacher implicitly referred to making assumptions about students' motivation: "I have learned that sometimes I need to look deeper into a student's reason for lack of success. It may not be about laziness, ability, or desire to learn. There are many factors that can play into a student's success." A few teachers wrote that the value of being proactive in knowing their students was an improved relationship with their students, which some teachers believed was responsible for improvements in students' attitudes or achievement.

Additionally, many teachers noted that their project helped them develop ways to support students' learning. For example, a few teachers noted that by delving deeply into how to better support one student, they learned strategies for helping other similarly situated students. To illustrate this, one teacher learned strategies to help an English language learner and reflected, "By taking the extra steps outlined by the CIP to find underlying causes for student difficulties, even for just one student, has helped open up the possibility that I have found interventions to potentially support others as well." Another idea a few teachers discussed was their learning about ways to involve multiple adults to support students rather than only relying on themselves. One teacher reflected, "I discovered support systems that are already offered in the school infrastructure, specifically the availability of the Special Education and ESL departments through the CIP. These departments were very accommodating and helpful in the implementation of my intervention." While teachers typically talked about involving other adults, one teacher found that by inviting a student and their friends to tutoring, the focus student was more likely to attend. In this case, the teacher was relying on peer support.

It is important to note that in a few cases, teachers' reflections indicated ethnocentric views. That is, teachers evaluated or interacted with students based on the teachers' worldview rather than moving to understand the students' perspectives. For example, one teacher wrote, "I anticipate that showing students that they can be a 'school kid' rather than a 'street kid' and providing simple strategies for making that possible are essential to also making it an acceptable choice for the child." The underlying expectation here is that the student will give up their identity of "street kid" to adopt the more acceptable identity of "school kid." The teacher is not looking to understand school from the student's perspective or for ways to support the student in maintaining their cultural identity while also building the knowledge and dispositions to more effectively engage in school. Furthermore, the teacher speaks of "providing simple strategies" to the students, indicating a belief that the student, as opposed to the school or teacher, needs to change, and that this change process is "simple." As this teacher discovered in her CIP project, supporting students to become more academically successful is not typically simple.

Motivation project

The fourth project of the course, the Motivation project, engaged teachers in using a student survey based on Wlodkowski and Ginsberg's (Ginsberg 2005) Motivational Framework for Culturally Responsive Teaching, which describes four classroom conditions (inclusion, attitude, meaning, and competence) that support students' intrinsic motivation. The survey consisted of Likert-type items for students to indicate the degree to which they agreed that these conditions existed in class (Powers and Parker 2013). Using the survey results, the teachers designed and implemented modest instructional changes and administered a post-survey to evaluate the effectiveness of those changes.

Cultural awareness

As with the CEP and CIP projects, cultural awareness was not a significant theme in teachers' reflections in the Motivation project. The only reference to becoming aware of the role of culture in learning was by a couple of teachers who discussed recalling or realizing the powerful influence of the teacher on classroom culture and students' feelings about being in class. One teacher wrote, "As secondary mathematics instructors, we have a

great deal of influence on the culture and learning environment of our classrooms. We can 'make or break' the mathematics learning experience for our students."

Cultural responsiveness

Most of the teachers discussed ideas related to cultural responsiveness in their Motivation project reflections. Many teachers, for example, reflected on the viability and value of asking students for their perspectives about their classroom experiences, something that is essential to being culturally responsive. Several of the teachers stated that the Motivation Survey was a means to better understand their students' perspectives because it was fairly easy to administer and provided meaningful information. One teacher wrote, "It is important to continue analysis of the different aspects that drive student motivation, and the survey has brought awareness to areas that I can keep in mind when planning lessons in the future." Several teachers also discussed that gaining insight into students' thinking surfaced assumptions the teachers held about students. For example, one teacher reflected,

> I learned that it is important to listen to what the kids have to say. Sometimes, I think
> I know how my students feel about my class and don't take the time to actually ask
> them. If someone had asked me what I thought the initial results of my survey would
> have been, I would have guessed motivation to be low and classmate inclusion to be
> very high and I would have been completely wrong.

Teachers also discussed creating instructional practices that are supportive of students' engagement and learning. About half of the teachers expressed the desire to continue the instructional change from their project work because it seemed to improve students' engagement or learning. Overall, teachers' instructional changes were not unusual or significant in scope, which may have been related to the project requirement of implementing a modest instructional change and the relatively short time teachers had to complete the project. A few teachers considered how to relate the mathematical content to relevant contexts. For example, one teacher typically presented linear relationships without any context, but decided to teach this material in the context of temperature as local temperatures had plummeted. Another teacher typically had students explore linear relationships in a context he provided, but for this project allowed students to select a context. Several teachers focused on how they facilitated whole-class discussions. A couple of teachers worked to improve their questioning of students by eliciting students' prior knowledge and asking higher-order questions. A couple of other teachers focused on improving participation during discussions using strategies such as asking a wider variety of students to present solutions, encouraging students to support each other, and making explicit the value of everyone's thinking.

Despite relatively modest instructional changes, most teachers wrote that these changes were productive as indicated by what they observed in their classrooms. As one teacher stated, "The results in the second survey showed good growth towards students having a better view of the attitude category. In the future I plan to allow all of my classes an opportunity to choose their own topics for projects." Similarly, another teacher wrote, "I will definitely continue to spend more class time focusing on small group discussions, and I will also start incorporating some full class discussions in an effort to help students feel safe voicing their thinking in class."

Cross-project summary

Table 2 contains the ideas in the teachers' reflections related to cultural awareness and cultural responsiveness for each project. One way to characterize how the four projects contributed to the teachers' cultural awareness and culturally responsiveness is that the DCM project deepened the teachers' cultural awareness, which then served as a foundation for the teachers to build their knowledge about cultural responsiveness. With the DCM project, teachers wrote about the existence of culture in students' lives and the role of culture in relation to both how students felt about and engaged with school as well as in mathematics curriculum (e.g., contextualized problems are not culture-free).

Each project seemed to influence teachers' perceptions related to cultural responsiveness slightly differently. The DCM project appeared to move teachers to want to know their students on a more "personal" level, such as gaining a better understanding of students' prior and outside school mathematics experiences. The other three projects afforded the teachers more opportunity to refine their conceptions of knowing students and about how to use this information to better support students in school. The CEP project provided teachers a means to know their students outside school, which sometimes led the teachers to realize they had made erroneous assumptions about their students' lives. In the CIP project, the teachers employed an inquiry-based process for better understanding and supporting a particular student, which often led them to generalize how the process and/or

Table 2 Cross-project summary of teachers' cultural awareness and cultural responsiveness

Project	Cultural awareness	Cultural responsiveness
Does Culture Matter (DCM)	Increased awareness of the existence of culture in students' lives Increased awareness of the influence of culture on students' feelings about school and in the mathematics curriculum	Formed new ideas about knowing students "personally" Began to consider how mathematics problems could be culturally relevant Emphasized not essentializing students
Community Engagement project (CEP)	Little/no evidence of changed perceptions	Recognition of students' knowledge of their communities Realization of making invalid assumptions about students and their families Evaluation of connection between students' home lives and students' engagement in school
Cultural Inquiry Process (CIP)	Little/no evidence of changed perceptions	Expressed desire to take responsibility for knowing students Realization of making invalid assumptions about students Learned new ways to support students' academic success
Motivation project (MP)	Little/no evidence of changed perceptions	Learned how to access and use students' perceptions related to their engagement in class Realization of making invalid assumptions about students Implemented instructional practices to improve students' engagement

interventions could be used to support other students. In the Motivation project, teachers used the Motivation Survey to learn about the perspectives of their class as a whole. In both the CIP and Motivation projects, the teachers found that student information was accessible and valuable for developing ways to improve students' engagement and achievement in mathematics.

Common to the CEP, CIP, and Motivation projects was that teachers realized they had made invalid assumptions about their students. In the CEP project, some teachers realized they had made invalid assumptions about students' families, such as where they lived and what they valued. In the CIP project, some teachers found they had assumed particular students lacked motivation to learn, but found this not to be the case. Misunderstanding students' motivation also surfaced for some teachers in the Motivation project.

Discussion

The cross-project analysis indicates that teachers' perceptions related to cultural awareness and cultural responsiveness did change as a result of their engagement in the four projects. A key question is the degree to which this change supported ways of knowing students that are pertinent for culturally responsive teaching as laid out in our analytic framework. In the framework, we included two perspectives of cultural awareness related to knowing students. The first was: *Recognizing the existence of culture, power, and privilege in society and their influence on students' engagement with and learning in school*. Teachers' understanding of what culture is and how it might influence students' engagement in school developed, primarily as a result of teachers' work with the DCM project. However, teachers did not explicitly discuss issues related to power or privilege in school or in society in their initial conceptions or project work. This could be due to the course content only referencing power and privilege briefly or the project reflections not asking teachers to address these issues, but may also be related to how people in the majority culture develop understandings of power and privilege.

During the course meetings, we noticed that many of the teachers were uncomfortable considering anything "political" in the mathematics classroom, suggesting they may have perceived power and privilege to be separate from, rather than integral to, understanding the role of culture in mathematics education. The teachers may have recognized power and privilege outside education, but still held conceptions of school mathematics as culture-free (Bishop 1988) or schools as impartial institutions (Villegas and Lucas 2002). Another possibility is that, as a group, the teachers were not at a learning stage to be receptive to these ideas. Process-oriented frameworks that model developmental stages of cross-cultural competence generally place the recognition of oppressive structures in the later stages of development (McAllister and Irvine 2000). Aligning with these process models, Mills and Ballantyne (2010) found evidence of a developmental hierarchy in prospective teachers' multicultural awareness that consisted of openness, then self-awareness/self-reflectiveness, and lastly, a commitment to social justice. Mills and Ballantyne and others (c.f. Sleeter 2007) suggest that one course may not be sufficient to change teachers' dispositions enough to be committed to social justice. Thus, the Culture in the Mathematics Classroom course may have not been sufficiently long for teachers to undergo the belief changes required to be more aware of power and privilege in society or in school.

The teachers' reflections included less discussion about the second perspective related to cultural awareness: *Recognizing and attending to the role of culture in mathematics and mathematics teaching and learning*. Teachers' comments related to this perspective tended to occur in the DCM project and related to how some of the vignettes helped them see that problem contexts were not necessarily culture-free. Often teachers did engage in considering the role of culture in mathematics teaching and learning in their CIP and Motivation projects, but they did not discuss what they learned about the role of culture in mathematics teaching and learning in their reflection. For example, some teachers viewed their classrooms as cultural spaces that may or may not be supportive to students from different backgrounds and considered strategies for students to feel more included. A few teachers, though, exhibited ethnocentric views when they expected students to adapt to the classroom culture rather than considering a change to the culture.

In our analytic framework, we identified four dispositions related to cultural responsiveness. For the first disposition, *Working to understand students' cultures and backgrounds*, teachers' statements related to culture became more nuanced and consequently, we argue, teachers' knowledge of what it meant to know their students from a cultural perspective changed. Teachers implemented new ways of learning about their students in the CEP, CIP, and Motivation projects, which increased their awareness of the ways in which they had made invalid assumptions about students. Many teachers wrote at the outset of the course that essentializing students was problematic, which may have supported them in recognizing their erroneous assumptions. Knowing students individually was also revealed in teachers' strong preference for good student–teacher relationships, which ties to the second disposition of: *Developing supportive student–teacher relationships based on culturally responsive caring*. Similarly to the previous disposition, though, teachers did not initially discuss a cultural perspective on student–teacher relationships. A few teachers did mention caring for students, but there was no strong evidence to indicate what caring meant to the teachers. Consequently, it is difficult to gauge teachers' development or change in their perspectives with respect to culturally responsive caring. But overall, the teachers did appear to feel that they had gained new tools and perspectives that would help them to improve the relationships they had with students or to be more effective in developing relationships with a greater range of students. Growth with respect to these two dispositions supports the notion that teachers, including White teachers, bring resources to multicultural education (Lowenstein 2009). Although most teachers began the course noting that they had limited conceptions of the role of culture in students' engagement in school, perhaps derived from the individualist bent of US culture (Markus and Kitayama 1991), the teachers' expressed desire to value students possibly provided a leverage point for them to expand their notions of what it means to know students in culturally responsive ways.

Less evidence existed for the third and fourth dispositions as compared to the first two dispositions. The third disposition was: *Having positive attitudes towards students' abilities, knowledge, and experiences and holding high expectations for student learning and achievement*. The project reflections did not contain many explicit references about the attitudes teachers held about students' abilities, knowledge, and experiences nor about their expectations for students. However, in the CIP projects, many teachers chose to focus on students with low grades as they believed the students were capable of improving their academic achievement. If teachers held conceptions of some students not being capable of learning mathematics, they were not visible.

The fourth disposition was: *Using knowledge of students to support their learning and cultural competence*. Teachers' project reflections indicated they were able to draw on

their knowledge of students to develop strategies to help students be more engaged and sometimes more academically successful in mathematics classrooms. While teachers were not always as successful as they would have liked, they considered students' cultures and perceptions in supporting students' mathematical learning. In the CIP project, teachers primarily focused on individualized interventions based on their understanding of a student's needs. Typical interventions included offering additional tutoring to students outside class, supporting students' homework completion, and increasing the teacher's positive interactions with the student. In the Motivation project, teachers implemented changes in their classroom instruction. The changes they made often aligned with mathematics reform practices, such as asking students higher-order questions. Sleeter (1997) suggests that integrating multicultural education with teacher learning about reform practices should be considered, especially in situations where teachers' development of culturally responsive teaching might be limited by their conceptions of mathematics teaching. The course was situated in a master's program that addressed reform practices and teachers may have drawn on this learning for their Motivation projects.

No teachers discussed maintaining students' cultural competence and a couple of teachers made statements in their CIP projects indicating they expected students to give up at least some aspect of their personal identities. Overall, though, little evidence existed in the data to indicate teachers' perspectives about supporting students' cultural competence.

Conclusion

This study explored how teachers' perceptions about the role of culture in knowing and being responsive to students changed as a result of taking the Culture in the Mathematics Classroom course. The purpose of the course was to help teachers develop the knowledge and skills to grow their capacity for culturally responsive teaching. Overall, teachers appeared to adopt perceptions of cultural awareness and cultural responsiveness that align with culturally responsive teaching. Some limitations of our research include our findings being based on only one class of 13 teachers and the possibility of teachers' writing being influenced by a desire to "please" the instructors by mimicking course content. Also, we did not gather evidence of how teachers' practice was actually changed. However, our results have implications for both supporting and researching secondary mathematics teachers' learning about culturally responsive teaching.

The role of the four course projects in teachers' learning suggests possible implications for teacher professional development. First, initiating the project sequence with an exploration about what culture is and how it plays a role in mathematics classrooms may be important for teachers to have sufficient knowledge to engage productively in subsequent projects situated in their practice. Gay and Howard (2000) advocate sequencing knowledge acquisition prior to application in multicultural education programs. Second, the vignettes situated in mathematics education in the DCM project seemed particularly powerful for teachers to reflect on cultural awareness. Exploring vignettes in their context may be especially important for secondary mathematics teachers who often have a propensity to view mathematics as culture-free. We had difficulty finding appropriate vignettes related to mathematics, especially at the secondary level; thus, a need exists for an increased availability of such vignettes for mathematics teacher educators. Third, using projects grounded in teachers' practice may be an important pedagogical approach for supporting teachers' understanding of culturally responsive teaching as they support learning from

practice (Cochran-Smith and Lytle 1992; Sleeter 2007). Once teachers have engaged in inquiry-based practices related to the role of culture in mathematics teaching and learning, they may be able to continue developing their knowledge and skills related to culturally responsive teaching on their own.

This study contributes to the limited research based on the relationship between particular pedagogies in multicultural education and how teachers interpret and give meaning to their learning experiences (Lowenstein 2009). Teachers' work on the course projects demonstrated the teachers were capable of integrating course content with inquiry-based work in their setting to build their knowledge of cultural awareness and cultural responsiveness. While sometimes teachers made statements antithetical to knowing students in culturally responsive ways, these teachers also demonstrated more productive notions. Overall, teachers' reflections in this course may indicate that mathematics teacher educators should be cognizant of process-oriented developmental models (McAllister and Irvine 2000) in designing course content and activities as well as the resources teachers do bring to learning about culturally responsive teaching (Lowenstein 2009).

Our analytic framework consisting of *cultural awareness* and *cultural responsiveness* may be a useful tool for describing different, although related, dimensions of what teachers need to know about culturally responsive teaching. The descriptions of cultural awareness and cultural responsiveness in our framework related specifically to knowing and being responsive to students, but other researchers might consider detailing other aspects of culturally responsive teaching, such as teaching mathematics for social justice, using the two overarching components.

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