2018

Preservice Teachers' Creation of and Beliefs about Culturally Responsive and Critical Mathematics Tasks, and Their Beliefs about the Students for Whom Their Tasks Were Intended

Tisa Trask
Illinois State University, tmtrask@ilstu.edu

PRESERVICE TEACHERS' CREATION OF AND BELIEFS ABOUT CULTURALLY RESPONSIVE AND CRITICAL MATHEMATICS TASKS, AND THEIR BELIEFS ABOUT THE STUDENTS FOR WHOM THEIR TASKS WERE INTENDED

TISA M. TRASK

275 Pages

In this study, case study methodology was used to explore secondary mathematics preservice teachers (PSTs) attempts to construct tasks for lower income, predominantly African American students at a cultural immersion site who PSTs encountered frequently and interviewed. PST beliefs about their tasks and their students were also investigated.

The first research aim of this study was to investigate PSTs' attempts to create culturally responsive mathematics tasks for themselves and for the students. PSTs incorporated students' personal and cultural details in tasks for the students. However, they had greater difficulty integrating cultural backdrops into the primary mathematics activities of tasks they created for their students than integrating cultural backdrops into tasks they created for themselves. Additionally, they distorted students' cultural contexts by filtering student details through their own lenses.

The second research aim was to investigate PSTs' attempts to create critical mathematics tasks for the students, as well as PSTs' beliefs about the tasks they created. Most PSTs identified a social justice issue in their tasks, but did not require students to question the fairness of the disparate treatment of the disenfranchised. Also, most tasks explicitly related to social class issues. Despite expressing critical consciousness and agency benefits, PSTs believed that their

tasks were inappropriate for middle school-aged students because of the tasks' "uncomfortable" or "controversial" nature.

The study's final aim was to investigate micro-transformations, or shifts, in PSTs' beliefs about the students. All of the four PSTs chosen for this part of the examination experienced micro-transformations in their beliefs about the students. PSTs with past encounters with lower income or minority students experienced micro-transformations earlier than other PSTs. The study identified a need for professional development that allows PSTs to learn about cultural others and disenfranchised people from culturally different and disenfranchised students, critical educators, and critical friends, and a need for instrument development that assesses PST tasks and determines appropriate support for PSTs in the construction of tasks for culturally different and disenfranchised students.

KEYWORDS: culturally responsive curriculum; critical mathematics curriculum; cultural immersion; teacher preparation; equity; preservice teacher beliefs

PRESERVICE TEACHERS' CREATION OF AND BELIEFS ABOUT CULTURALLY RESPONSIVE AND CRITICAL MATHEMATICS TASKS, AND THEIR BELIEFS ABOUT THE STUDENTS FOR WHOM THEIR TASKS WERE INTENDED

TISA M. TRASK

A Dissertation Submitted in Partial
Fulfillment of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

Department of Mathematics

ILLINOIS STATE UNIVERSITY

2018

PRESERVICE TEACHERS' CREATION OF AND BELIEFS ABOUT CULTURALLY RESPONSIVE AND CRITICAL MATHEMATICS TASKS, AND THEIR BELIEFS ABOUT THE STUDENTS FOR WHOM THEIR TASKS WERE INTENDED

TISA M. TRASK

COMMITTEE MEMBERS:

Tami S. Martin, Chair

Cynthia W. Langrall

Venus E. Evans-Winters

Joi A. Spencer

ACKNOWLEDGMENTS

Dr. Martin, my advisor and chair of my committee, thank you for your continued support at every stage of my professional project and dissertation. You have pushed me beyond what I thought myself capable. I have grown exponentially in my writing and intellectual thinking as a result of your support.

To my committee members, Dr. Cynthia Langrall, Dr. Venus Evans-Winters, and Dr. Joi Spencer, thank you for your continued support. You have stretched me to think about what it means to be a critical educator and scholar. I have appreciated your insight and your belief in me to finish this long race.

This dissertation is dedicated to my husband, Jeffrey Trask Sr., who has been my rock. I would not have continued on without your encouragement. It is also dedicated to my children, James, Aja, Jeffrey Jr., and Maria. I can only imagine the sacrifices you have made in my journey to complete this degree. I love you. Mom and Dad, Lanett and Wilford Stevenson, thank you for your assistance, for taking care of us. “We did it.”

This research was supported in part by a Dissertation Completion Grant from the Illinois State University Graduate School. Any opinion, findings, and conclusions are those of the author and may not necessarily reflect the views of the Illinois State University Graduate School.

T.M.T.

CONTENTS

CHAPTER II TABLES

CHAPTER III TABLES

CHAPTER IV TABLES

CHAPTER I FIGURES

CHAPTER II FIGURES

CHAPTER III FIGURES

CHAPTER IV FIGURES

CHAPTER I: THE PROBLEM AND ITS BACKGROUND

The National Council of Teachers of Mathematics (NCTM) (2000) stated, "Excellence in mathematics education requires equity—high expectations and strong support *for all students* [emphasis added]" (p. 12). To underscore this ideal of equal opportunity to learn, the NCTM highlighted that mathematics teachers should possess the necessary skills and tools to provide each student, regardless of race, ethnicity, or other characteristics, instruction that promotes mathematics learning. In early U.S. schools of the 1800s, teachers were only required to be prepared to teach mathematics to European American students, because the students in many schools were racially homogenous and many schools excluded many racial and ethnic minority youth (Oakes, 2005). However, the need for teachers who are adequately prepared to teach mathematics to minority students has become more urgent over time as schools have become more racially and ethnically diverse. Frey (2016) found that in 2015, the under 18 year-old age group consisted of 51.5% European Americans and 48.5% ethnic minorities. In this same year, in fourteen states, ethnic minorities accounted for more than half of the under 18 year-old age group. Moreover, Frey (2016) noted, the aging European American population and decreasing number of European American women at child bearing age are contributing to a projection that the under 18 year-old age group will become increasingly ethnically diverse. According to research conducted by the U.S. Department of Education (2013), in 2014, for the first time, ethnic minority students (e.g., African Americans, Latin@s, Asian Americans, and Native Americans) were projected to outnumber European American students. This projection was realized in the 2014–2015 school year when more ethnic minority students were enrolled in public schools than European American students (Yosinaga, 2016). If, as the NCTM suggested, schools are to provide all students access to high quality mathematics education, teachers must

be equipped with the skills and tools to identify and address the mathematics learning needs of all students, including those who are ethnic minority students.

Currently, there is a "demographic divide" (Ahmad & Boser, 2014, p. 2) between the teacher and student populations. That is, the percentage of ethnic minority students is increasing (U.S. Department of Education, 2016) while the percentage of ethnic minority teachers is decreasing (Ahmad & Boser, 2014; Ingersoll & May, 2011). The predominantly European American preservice teacher (PST) population will further compound this divide (Ingersoll & May, 2011; Sleeter, 2017; U.S. Department of Education, 2016). Given the ethnic gap between students and their teachers, it is likely that many prospective teachers will instruct students with cultural backgrounds different than their own. Thus, it is of central importance to prepare all PSTs (European American and non-European American, as well as the interested and the disinterested in teaching ethnic minority students) to teach ethnically diverse student populations.

To respond to the cultural needs of diverse students, mathematics PSTs must be capable of incorporating into students' tasks their "cultural assets"[1], or "factors related to positive outcomes for a particular ethnic group" (Thomas, Davidson, & McAdoo, p. 282). However, with few exceptions (e.g., Aguirre et al., 2012; Ramsay-Jordan, 2017; Turner et al., 2012), there is scant research on prospective mathematics teachers' preparedness to create culturally responsive tasks, or tasks incorporating students' cultural assets, for an increasingly diverse student body.

Literature Review

Teacher education programs are sites for preparing PSTs for culturally responsive

[1] Thomas, Davidson, and McAdoo's (2008) cultural assets construct is derived from Frison, Wallander, and Brown's (1998) "culturally relevant factors" (p. 614).

teaching. These programs may increase PST knowledge of culturally diverse students and PST knowledge of culturally responsive teaching. Furthermore, teacher programs may provide PSTs opportunities to critically reflect on their beliefs about cultural diversity.

Knowledge of Students

Hollins and Guzman (2005) and Kolano and King (2015) found that PSTs enter their programs with few cross-cultural experiences. Fortunately, in teacher education programs, PSTs may gain knowledge of culturally diverse students through direct interaction with them in cross-cultural field experiences (Leland & Harste, 2005). For instance, direct interaction with culturally different people enhanced the cultural understanding of the PSTs in Nieto's (2006) study, helped them form positive dispositions towards minorities, and decreased their fear of ethnic minority students and their communities. Shadowing—following ethnic minority students to locations and events of personal or cultural significance to them—and critical reflection grew Ukpokodu's (2004) PSTs' cultural diversity knowledge base. Moreover, PSTs gained a deeper understanding of students' experiences and accommodated new, positive perspectives of minority students into their belief schema.

Knowledge of Culturally Responsive Teaching

Teacher education programs can articulate a clear vision of culturally responsive teaching gained from the scholarship of critical educators. For instance, Gay (2002) defined culturally responsive teaching as "using the cultural characteristics, experience, and perspectives of ethnically diverse students as conduits for teaching them more effectively" (p. 106). Ladson-Billings (1995) wrote, "I suggest that culturally relevant teaching must meet three criteria: an ability to develop students academically, a willingness to nurture and support cultural competence, and the development of sociopolitical or critical consciousness" (p. 483). Villegas

and Lucas (2002) added:

> Six Strands…give coherence to our curriculum proposal for preparing culturally responsive teachers: 1) gaining sociocultural consciousness; 2) developing an affirming attitude towards students from culturally diverse backgrounds; 3) developing the commitment and skills to act as agents of change; 4) understanding the constructivist foundations of culturally responsive teaching; 5) learning about students and their communities; and 6) cultivating culturally responsive teaching practices. (p. 26)

Summarily, PSTs might learn in their teacher education programs that culturally responsive teachers have high expectations for all students and hold affirming beliefs about their ability to learn (Gay, 2002; Ladson-Billings, 1995; Villegas & Lucas, 2007). Also, culturally responsive teachers encourage the development of students' cultural identities in school contexts (Gay, 2002; Ladson-Billings, 1995; Villegas & Lucas, 2002). These teachers seek an understanding of ethnically diverse students' cultural experiences though consultation with students and community stakeholders (Villegas, 2007). Finally, culturally responsive teachers are purposeful in providing minority students skills and knowledge to understand their experiences and empower them to effect change in their communities (Gutstein, 2003; Tate, 1995). For instance, culturally responsive mathematics teachers provide students culturally responsive tasks to help students use mathematics to critique issues that affect members of their communities. Students then use this analysis to develop mathematically-based arguments to institute change for their communities.

Researchers (e.g., Cajete, 1994; Cleary & Peacock, 1998; Gay, 2002, 2010; Gilliand, 1992; Ladson-Billing, 1995; Van Hamme, 1995; Villegas & Lucas, 2002) have found that the use of culturally responsive tasks may promote academic growth for ethnic minority students in

mathematics and other content domains. In their completion of a mathematics task on basketball, Nasir's (2000) students engaged in mathematics analyses, thinking, and discourse. Both Tate (1995) and Gutstein (2003) investigated teacher engagement of minority students in tasks related to social justice issues. The use of critical mathematics tasks had dual outcomes. Students learned mathematics and they had an increased awareness of the social justice issues they and members of their community faced.

Culturally responsive tasks. There is limited research on teacher preparation, especially on mathematics teacher preparation (Turner et al., 2012), to incorporate students' cultural assets into tasks. The existing research indicates that mathematics educators have had mixed success training teachers to create culturally responsive tasks. Herron and Barta (2009) helped in-service teachers make superficial changes (e.g., name or location changes) to traditional curricular tasks that may have been unreflective of students' cultural experiences. Some of Rubel and Chu's (2012) in-service teachers created tasks with appropriate cultural contexts, but with inappropriate mathematics contexts. Like Rubel and Chu's (2012) teachers, some of Turner et al.'s (2012) PSTs drew emergent connections in tasks. That is, PSTs created tasks with meaningful cultural contexts but with mathematics activities that would be artificial to the cultural actors. Other PSTs created tasks with cultural contexts that matched the mathematics activities. Hence, they drew meaningful connections in their tasks. One such task, written in Spanish and English, involved details from a parent-led trip to a Lavandería (Laudromat). PSTs incorporated authentic contextual details, such as those relating to wash sizes and expenses and the family's budget for cleaning multiple loads of clothing.

Critical mathematics tasks. Culturally responsive teachers use critical mathematics to assist students in analyzing social injustice (Frankenstein, 1990; Gutstein, 2003, 2006; Tate,

1995). The analytic goals of the NCTM—developing students' ability to think critically and solve problems—align with the aims of critical mathematics—developing students' critical thinking skills to understand and communicate mathematics. Yet, critical mathematics differs from reform mathematics because mathematics is used as a tool to understand sociopolitical contexts. The contexts of critical mathematics tasks involve social justice issues. These tasks have multiple purposes: to raise awareness of social justice issues, to empower students to work towards a more just world, and to teach mathematics.

Gau (2005) is one of few mathematics educators to investigate teacher preparation to construct and administer critical curricular materials. Gau's in-service teachers created critical mathematics tasks, but they failed to fully engage students in the social justice components of tasks. Few of the teachers identified teaching mathematics as an objective of social justice pedagogy. Finally, teachers preferred to present students tasks with topics they were more knowledgeable of or perceived as uncontroversial.

Beliefs about Culturally Diverse Students

PST beliefs about culturally diverse students may influence the learning opportunities they provide these students in their future classes (Gay, 2000, 2002; Sheets, 2003). Zheng (2009) asserted that beliefs are "psychologically held understandings, premises, or propositions felt to be true; as a result, beliefs are the permeable and dynamic structures that act as a filter through which new knowledge and experience are screened for meaning" (p. 74). PSTs' beliefs about cultural diversity are based on their own or others' experiences (Nespor, 1987). Beliefs may originate from various sources, including family members and friends, literature, or a variety of forms of communicative multimedia. Brown (2004) and Pajares (1992)

found that it is difficult to change PSTs' beliefs about teaching because they perceive themselves as knowledgeable of the education process having observed it as students.

Researchers have found that PSTs' often hold negative beliefs about minority students as being less capable and less well behaved than majority students (Shultz, Neyhart, & Reck, 1996; Terrill & Mark, 2000). If mathematics teachers' beliefs influence their practice (1992), teachers' negative beliefs of minority students might help explain their poor treatment of these students, as well as minority students' lower academic outcomes in mathematics classes (Carter, 2008; Gamoran, 1992; Atwater, 2000). Mathematics teachers with low perceptions of minority students have dissuaded them from participating in classroom discussions (Carter, 2008), provided them fewer opportunities to learn (Gamoran, 1992; Oakes, 2005; Wheelock, 1992), and prevented or discouraged them from taking higher-level mathematics classes (Atwater, 2000; Catsambis, 1995; Martin, 2006; Oakes, 1995). Whether intentionally or unintentionally, teachers may engage in practices that negatively influence minority students' school experiences, leading to school failure.

Courses on cultural diversity are important for disrupting PSTs' negative beliefs of minority students and for offering PSTs new perceptions of minority students and their experiences. In fact, some researchers have found that multicultural education courses may shift PSTs' beliefs about diversity (Amatea, Cholewa, & Mixon, 2012; Middleton, 2002). However, Garmon (2004) found that open, self-aware PSTs who possess critical consciousness are more likely to benefit from diversity classes than their peers. Milner (2005) found that shifts in PST beliefs about diversity came from the interactions between PSTs, their course participation, and cross-cultural people and contexts.

My Position

It is important to discuss my position, which would include my "stances, ideologies, politics, identities, frameworks, and how [I make] sense of the world" (D'Ambrosio et al., 2013). I am an African American female from a lower income family, and I was raised in a predominantly (90%) Midwestern European American community. The number of minority students in the high track mathematics classes I took was disproportionately low compared to the minority population in the community. I cannot recall a single curricular task in my K–12 mathematics classes with cultural actors who looked like me or who were celebrating African American traditions or engaging in activities I participated in with my family and other members of my African American community. Moreover, my mathematics curriculum lacked tasks that acknowledged and confronted issues I faced as a student from a lower income bracket and a member of a minority group in a town where I was marginalized due to my race and social class.

When I became an adult mother of three, I was determined to raise my children in a town with a greater numbers of African American community members, and to send them to schools with students who understand their cultural background and with teachers who had experience teaching minority students. To my dismay, my children's experiences in their schools mirrored my own. Their teachers privileged European American norms, values, and knowledge. They failed to teach in ways that drew on my African American children's brilliance. Although mathematics curricula with which my children engaged included more African American representation than I had seen, the tasks were often tangentially related to African American role models or the cultural actors in the mathematics tasks performed activities that were inauthentic to members of our community.

But then, so what? Despite the lack of minority representation or acknowledgment of racial minorities' or lower income people's disparate experiences in school mathematics tasks, an African American can successfully learn mathematics. I am proof of that, and my navigation of K–12 mathematics has afforded me educational and occupational opportunities. I became a mathematician, of sorts. I earned my bachelor's and master's in mathematics, and I have taught mathematics to college students for nearly 20 years. However, I have observed that lower income and minority learners of mathematics (like me) are restricted in the ways they participate in mathematics learning when they do not see themselves reflected in their teachers, fellow students, and curriculum. In my case, I aspired to earn a PhD in mathematics, however, the higher the level of mathematics I studied, the less convinced I became that people from my racial and social class backgrounds could become mathematics "experts" because so few of us had. I have also observed that because lower income and minority students are provide little cultural or experiential representation in the curriculum, they are forced to learn mathematics in ways that are not meaningful to them. So, yes. I, and others like me, can learn mathematics using traditional Eurocentric curriculum. But how much more might I have learned it if I could project myself into the narratives provided in mathematics tasks? How much more motivated to learn would I have been if I could empathize with the cultural actors in tasks? These questions made my dissertation investigation on PST creation of culturally responsive and critical mathematics tasks for lower income and minority students and PST beliefs about the students for whom they wrote the tasks more personally meaningful and satisfying.

Purpose of the Study

In 2016, I investigated the relationship between PSTs' cultural diversity knowledge base (Gay, 2002) (knowledge of students and their cultural experiences) and PSTs' ability or

willingness to create culturally responsive mathematics tasks for minority students (Trask & Martin, 2015). I learned that the PST having a desire to teach minority students and the PST who had at least one discussion about the role race plays in minority students' education were more willing or able than other PSTs to create what they perceived as cultural mathematics tasks for African American and Latin@ students. The purpose of this 3-article dissertation study was to further investigate the tasks PSTs created to reflect the cultural experiences of minority students. The primary goal of the investigation was to gain an in-depth understanding of the tasks PSTs created for African American and Latin@ students from participating in a formal cultural learning segment (see Appendices F, G, H, I, J, and K) in which PSTs read and discussed literature from critical scholars related to the instruction of African American and Latin@ students, and after having direct contact with minority students during a 20-hour cultural immersion experience and after gaining specific cultural knowledge from interviewing students (see Appendix O). The cultural learning segment related to the instruction of African American and Latin@ students; PST homework for the learning segment entailed reflection on the school experiences of African American and Latin@ students; and PSTs were volunteering at a program with lower income students who were predominantly African American. Still, some PSTs' wrote culturally responsive tasks for European American students or wrote critical mathematics tasks that did not explicitly address the disparate experiences of African Americans or Latin@s. My original primary focus on PSTs' preparation for the instruction of African American or Latin@ students' was altered based on the aforementioned PST decisions.

For Article 1, I focused on PSTs' cultural diversity knowledge base and how that was associated with their abilities to create culturally responsive mathematics tasks. I also investigated PSTs' beliefs about these tasks.

For Article 2, I focused on PSTs' abilities to create critical mathematics tasks for disenfranchised students, such as lower income and minority students, as well as PSTs' beliefs about the value and appropriateness of critical mathematics tasks for disenfranchised students and for students in other groups.

For Article 3, I focused on PSTs' written reflections indicating their beliefs about lower income and minority students (about their behaviors and circumstances) and the evolution of these beliefs during the course of a 20-hour cultural immersion experience with lower income and minority students.

Theoretical Framework

In Article 1, I drew on Gay's (2002, 2010) Culturally Responsive Teaching framework, which describes culturally responsive pedagogy, including the tools (e.g., the written curriculum) teachers use to motivate minority students to learn. I also drew on Critical Race Theory (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002) because the creation of culturally responsive tasks required the privileging of minority student voice.

In Article 2, I used Freire's (2000) Critical Theory, which highlights the role teachers may play in assisting students in gaining critical consciousness and agency for challenging institutions of power. Also, I used Critical Race Theory (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002) because, in particular, it sheds light on the disenfranchisement of minority students.

In Article 3, I drew on Posner, Strike, Hewson, and Gertzog's (1982) Conceptual Change Theory to understand micro-transformations, or shifts, in PST beliefs about lower income and minority students.

Design of the Study

Case study research (Stake, 1995, 2006) was used in all of the studies in this dissertation. I investigated PSTs from a 16-week semester-long introductory secondary mathematics education course (see Appendices A, B, C, D, and E). PSTs participated in a 3-week learning segment on culturally responsive teaching that occurred from the 10th to the 12th week of the course. PSTs also experienced a 20-hour cultural immersion that could have spanned for up to 12 weeks of the 16-week semester, as PSTs could have started volunteering at the cultural immersion site two weeks after the semester had begun and ended as late as two weeks from the close of the class (see Figure 1).

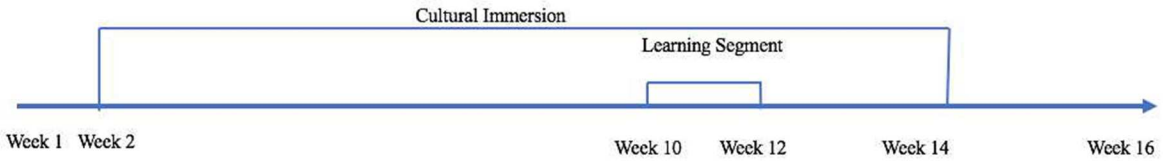

Figure 1. Timeline for cultural immersion and learning segment.

For the learning segment, PSTs submitted 3 types of tasks: tasks with their own cultural details (culturally responsive to PST tasks), tasks with interviewed students' cultural details (culturally responsive to student tasks), and tasks with social justice issues (critical mathematics tasks). A timeline of the topics covered in the learning segment and the tasks are included in Figure 2.

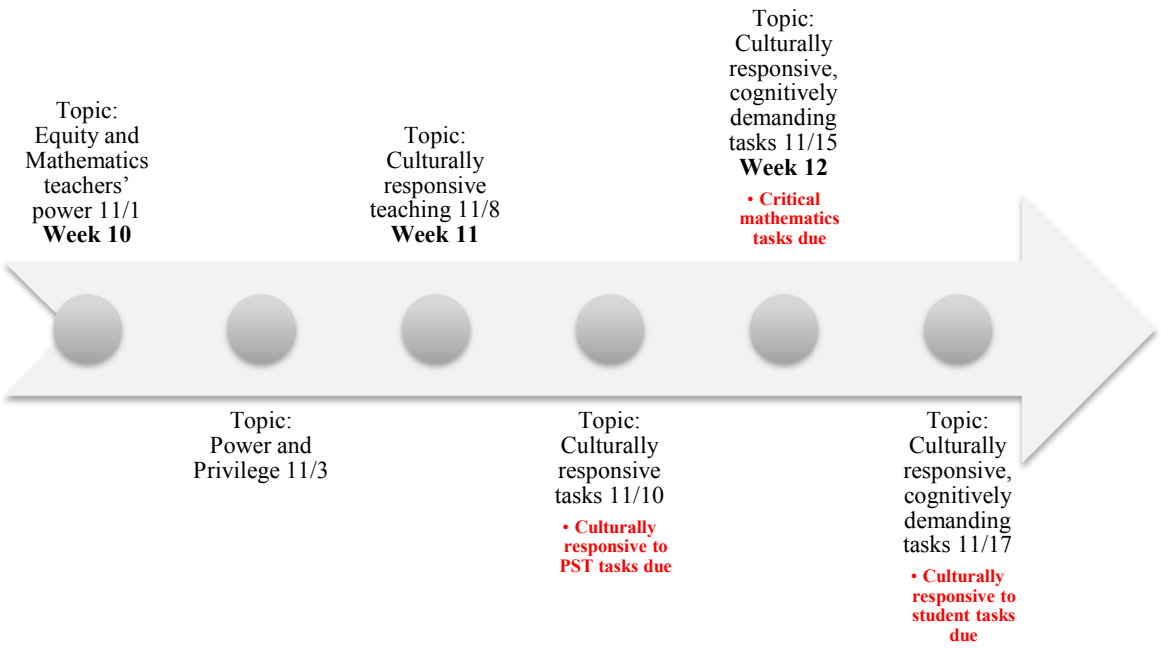

Figure 2. Learning segment topics and culturally responsive and critical mathematics tasks.

For Article 1, I asked PSTs to create culturally responsive tasks for themselves (see Appendix H) and their students (see Appendix J). I requested PSTs to create tasks for themselves to determine if they could draw on their own cultural assets. If so, I contended that they might also be able to construct cultural tasks for minority students. PSTs gave written reflections on the nature of the tasks they created for themselves and for students. PSTs also submitted audiotaped interviews of the students they interviewed at the cultural immersion site. Finally, I interviewed three PSTs about the culturally responsive tasks created for themselves and students (see Appendix N). The following research questions were addressed:

1. To what extent can PSTs incorporate personal and cultural assets when developing mathematics learning tasks for themselves and for their students?
2. In what ways are cultural elements integrated into PSTs' mathematics tasks?
3. What challenges do PSTs face when constructing culturally responsive mathematics tasks?

For Article 2, I had PSTs create critical mathematics tasks (see Appendix I). PSTs also provided written reflection on their perceptions of critical mathematics tasks. I addressed the following research questions:

1. To what extent do PST-created critical mathematics tasks have the potential to foster the development of critical consciousness of disenfranchised students, such as lower income and minority students, for whom they were developed? What type of social justice topics do PSTs include in their tasks?
2. What do PSTs report about the appropriateness and value of critical mathematics tasks?

For Article 3, PSTs were asked to provide written reflections on their experiences at a cultural immersion site (see Appendix M). Some PSTs were interviewed about beliefs expressed in these written reflections and on their reflections on the readings and activities for the learning segment on culturally responsive teaching (see Appendix N). The research questions that were addressed follow:

1. What beliefs were evident in PST reflections?
2. How were those beliefs transformed as they accumulated more hours at the cultural immersion site?

Structure of My Dissertation

In this introductory chapter, I have provided an overview of my study, including the background, related literature, my research goals, theoretical framings, and the study design. Article 1 explores the nature of PSTs' culturally responsive mathematics tasks for specific students. In Article 2, the nature of PSTs' critical, or social justice-oriented, mathematics tasks is investigated. For Article 3, I researched PSTs' beliefs about minority students at the cultural

immersion site. Finally, in the last chapter I discuss themes observed across the three studies, as well as the limitations and implications of my investigation. I also point to areas for future research on culturally responsive teaching.

References

Ahmad, F. Z. & Boser, U. (2014). *America's leaky pipeline for teachers of color: Getting more teachers of color in the classroom*. Retrieved from http://www.americanprogress.org/wp-content/uploads/2014/05/TeachersOfColor-report.pdf

Aguirre, J. M., Turner, E. E., Bartell, T. G., Kalinec-Craig, C., Foote, M. Q., McDuffiee, A. R., Drake, C. (2012). Making connections in practice: How prospective elementary teachers connect to children's mathematical thinking and community funds of knowledge in instruction. *Journal of Teacher Education, 64*, 178–192. doi: 10.1177/0022487112466900

Amatea, E., Cholewa, B., & Mixon, K. (2012). Influencing teachers' attitudes about working with low-income and/or ethnic minority families. *Urban Education, 47*, 801-834. doi: 10.1177/0042085912436846

Atwater, M. M. (2000). Equity for Black Americans in pre-college science. *Science Education, 84*(2), 154–179. doi: 10.1002/(SICI)1098-237X(200003)84:2<154::AID-SCE2>3.0.CO;2-R

Brown, K. (2004). Assessing preservice leaders' beliefs, attitudes, and values regarding issues of diversity, social justice, and equity: A review of existing measures. *Equity & Excellence in Education, 37*, 332–342. doi: 10.1080/10665680490518948

Cajete, G. (1994). *Look to the mountain: An ecology of indigenous education*. Durango, CO: Kavaki Press.

Carter, D. (2008). On spotlighting and ignoring racial group members in the classroom. In M. Pollock (Ed.), *Everyday antiracism: Concrete ways to successfully navigate the relevance of race in school* (pp. 230–234). New York, NY: The New Press.

Catsambis, S. (1995). Gender, race, ethnicity, and science education in the middle grades. *Journal of Research in Science Teaching, 32*, 248–257. doi:10.1002/tea.3660320305

Cleary, L. M. & Peacock, T. D. (1998). *Collected wisdom: American Indian education*. Boston, MA: Allyn and Bacon.

D'Ambrosio, B., Frankenstein, M. Gurierrez, R., Kastberg, S., Martin, D. B. Moschkovich, J., & Taylor, E. (2013). Positioning oneself in mathematics education research [Special issue]. *Journal for Research in Mathematics Education, 44*, 11–22. doi: 10.5951/jresematheduc.44.1.0011

Frankenstein, M. (1990). Incorporating race, gender, and class into a critical mathematics literacy curriculum. *Journal of Negro Education, 59*, 336–347. doi: 10.2307/2295568

Freire, P. (2000). *Pedagogy of the oppressed: 30th anniversary edition*. New York, NY: Continuum.

Frey, W. H. (2016, June 28). Diversity defines the millennial generation. Retrieved from https://www.brookings.edu/blog/the-avenue/2016/06/28/diversity-defines-the-millennial-generation/

Gamoran, A. (1992). Is ability grouping equitable? *Educational Leadership, 50*(2), 11–17.

Garmon, M. A. (2004). Changing preservice teachers' attitudes and beliefs about diversity: What are the critical factors? *Journal of Teacher Education, 55*, 201–213. doi: 10.1177/0022487104263080

Gau, T. R. (2005). *Learning to teach mathematics for social justice* (Unpublished doctoral dissertation). University of Wisconsin-Madison, Madison, WI.

Gay, G. (2000). *Culturally responsive teaching: Theory, practice, and research.* New York, NY: Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). New York, NY: Teachers College Press.

Gilliland, H. (1992). *Teaching the Native American* (2nd ed.). Dubuque, IA: Kendell/Hunt Publishing.

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*, 37–53. doi: 10.2307/30034699

Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York, NY: Routledge.

Herron, J., & Barta, J. (2009). Culturally relevant word problems in second grade: What are the effects? *The Journal of Mathematics and Culture, 4*(1), 23–49.

Hollins, E. R., & Guzman, M. E. (2005). Research on preparing teachers for diverse population. In M. Cochran-Smith & K. M. Zeichner (Eds.), *Studying teacher education: The report of the AERA panel on research and teacher education* (pp. 477–548). Mahwah, NJ: Lawrence Erlbaum.

Ingersoll, R. M., & May, H. (2011). Recruitment, retention and the minority teacher shortage (Report No. RR-69). Retrieved from http://www.cpre.org/recruitment-retention-and-minority-teacher-shortage

Kolano, L. Q., & King, E. T. (2015). Preservice teachers' perceived beliefs towards English language learners: Can a single course change attitudes? *Issues in Teacher Education, 24*(2), 3–21.

Ladson-Billing, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*, 465–491. doi: 10.3102/00028312032003465

Leland, C. & Harste, J. (2005). Doing what we want to become: Preparing new urban teachers. *Urban Education, 40*(1), 60–77. doi: 10.1177/0042085904270374

Major, E., & Brock, C. (2003). Fostering positive dispositions toward diversity: Dialogical explorations of a moral dilemma. *Teacher Education Quarterly, 30*(4) 7–26.

Martin, D. (2006). Mathematics learning and participation as racialized forms of experience. *Mathematical Thinking & Learning, 8*, 197–229. doi: 10.1207/s15327833mtl0803_2

Middleton, V. A. (2002). Increasing preservice teachers' diversity belief and commitment. *Urban Revie*w, 34, 343–361. doi: 10.1023/A:1021372801442

Milner (2005) Stability and change in US prospective teachers' beliefs and decisions about diversity and learning to teach. *Teaching & Teacher* Education, 21, 767–786. doi: 10.1016/j.tate.2005.05.010

Nasir, N. S. (2000). Points ain't everything: Emergent goals and average and percent understandings in the play of basketball among African American students. *Anthropology & Education Quarterly, 31*, 283–305. doi:10.1525/aeq.2000.31.3.283

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Curriculum Studies, 19*, 317–328. doi: 10.1080/0022027870190403

Nieto, J. (2006). The cultural plunge: Cultural immersion as a means of promoting self awareness and cultural sensitivity among student teachers. *Teacher Education Quarterly, 33*(1), 75–84.

Oakes, J. (1995). Two cities' tracking and within school segregation. *Teachers College Record, 96*, 681–690.

Oakes, J. (2005). *Keeping track: How school structure inequality*. New Haven, CT: Yale University Press.

Pajares, M. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307–332. doi: 10.3102/00346543062003307

Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education, 66*, 211–227. doi: 10.1002/sce.3730660207

Rubel, L. H., & Chu, H. (2012). Reinscribing urban: Teaching high school mathematics in low income, urban communities of color. *Journal of Mathematics Teacher Education, 15*, 39–52. doi: 10.1007/s10857-011-9200-1

Sheets, R. (2003). Competency vs. good intentions: Diversity ideologies and teacher potential. *International Journal of Qualitative Studies in Education, 16*, 111-120. doi: 10.1080/0951839032000033554

Shultz, E. L., Neyhart, K., & Reck, U. M. (1996). Swimming against the tide: A study of prospective teachers' attitudes regarding cultural diversity and urban teaching. *Western Journal of Black Studies, 20*, 1–8.

Sleeter, C. E. (2017). Critical race theory and the whiteness of teacher education. *Urban Education, 52*, 155–169. doi: 10.1177/0042085916668957

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: SAGE Publications.

Stake, R. E. (2006). *Multiple case study analysis*. New York, NY: Guilford Press.

Tate, W. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*, 166–173. doi:10.1080/00405849509543676

Terrill, M., & Mark, D. (2000). Preservice teachers expectations for schools with children of color and second language learners. *Journal of Teacher Education, 51*, 149–155. doi: 10.1177/002248710005100209

Thomas, O., Davidson, W., & McAdoo, H. (2008). An evaluation study of the Young Empowered Sisters (YES!) program: Promoting cultural assets among African American adolescent girls through a culturally relevant school-based intervention. *Journal of Black Psychology*, *34*, 281–308. doi:10.1177/0095798408314136

Trask, T. M. & Martin, T. S. (2015). *Culturally responsive mathematics tasks: A pilot study*. Unpublished manuscript, Department of Mathematics, Illinois State University, Normal, IL.

Turner, E. E. Drake, C., McDuffie, A. R., Aguire, J., Bartell, T. G., Foote, M. Q. (2012). Promoting equity in mathematics teacher preparation: A framework for advancing teacher learning of children's mutiple mathematics knowledge bases. *Journal of Mathematics Teacher Education, 15*, 67–82. doi: 10.1007/s10857-011-9196-6

Ukpokodu, O. N. (2004). The impact of shadowing culturally different students on preservice teachers' dispositions toward diversity. *Multicultural Education, 12*(2), 19–28.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (2013). Enrollment and percentage distribution of enrollment in public elementary and secondary schools by race/ethnicity and region: Selected years, fall 1995 through fall 2023. Retrieved from http://nces.ed.gov/programs/digest/d13/tables/dt13_203.50.asp

U.S. Department of Education. (2016). *The state of racial diversity in the educator workforce*. Washington, DC: U.S. Department of Education, Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service. Retrieved from https://www2.ed.gov/rschstat/eval/highered/racial-diversity/state-racial-diversity-workforce.pdf

Van Hamme, L. (1995). American Indian cultures and the classroom. *Journal of American Indian Education, 35*(2), 21–37.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. Albany, NY: State University of New York Press.

Villegas, A. M., & Lucas, T. (2007). The culturally responsive teacher. *Educational Leadership, 64*(6), 28–33.

Wheelock, A. (1992). *Crossing tracks*. New York, NY: New World Press.

Yoshinaga, K. (2016, July 1) Babies of color are now the majority, Census says. Retrieved from https://www.npr.org/sections/ed/2016/07/01/484325664/babies-of-color-are-now-the-majority-census-says

Zheng, H. (2009). A review of research on EFL Pre-service teachers' beliefs and practices. *Journal of Cambridge Studies, 4*(1), 73–81.

CHAPTER II: PRESERVICE TEACHERS' CREATION OF AND BELIEFS ABOUT CULTURALLY RESPONSIVE MATHEMATICS TASKS

Abstract

Teachers may promote learning for African American and Latin@ students through the use of culturally responsive curriculum. To create culturally sensitive tasks, teachers must have gained knowledge of African American and Latin@ students' culture and experiences to ensure that mathematics problems mirror students' experiences. In my study, I documented preservice teacher attempts to create culturally responsive mathematics tasks for themselves and for African American and Latin@ students who they interviewed and encountered repeatedly in a cultural immersion experience. Preservice teachers incorporated students' personal and cultural details in tasks. However, they had greater difficulty integrating cultural backdrops into the primary mathematics activities of tasks they created for their students than integrating cultural backdrops into tasks they created for themselves. Additionally, they distorted students' cultural contexts by filtering student details through their own lenses. These results hold implications for mathematics education research on preservice teacher preparation for culturally diverse classes.

Introduction

According to Ginsberg (2005), "Across cultural groups, all students are motivated, even when they are not motivated to learn what a teacher has to offer" (p. 219). Student motivation cannot be divorced from culture (Wlodkowski & Ginsberg, 1995), and researchers have found that ignoring student behavioral and communication norms may result in student refusal to participate in the learning process (Olneck, 1995). Conversely, by responding to students' cultural needs, student participation is elicited. In particular, researchers have found that the inclusion of familiar cultural contexts leads to greater minority student engagement (Altieri,

1993; Hefflin, 2002; Heflin & Barksdale-Ladd, 2001; Tatum, 2006). Therefore, teachers must have knowledge of students' cultures and must integrate students' cultural experiences into curricular materials. They must teach to engage all students, including ethnic minority students, in the learning process.

Researchers (e.g., Cajete, 1994; Cleary & Peacock, 1998; Gay, 2002, 2010; Gilliand, 1992; Ladson-Billing, 1995; Van Hamme, 1995; Villegas & Lucas, 2002) have taken important steps in defining culturally responsive teaching so that current and future teachers can plan instruction and tasks to meet their students' cultural needs, including those from ethnic minority groups. Researchers contend, for instance, that culturally responsive teachers hold students to high expectations because they believe all students can learn (Gay, 2002; Ladson-Billings, 1995; Villegas & Lucas, 2002). Additionally, culturally responsive teachers help students embrace and develop their cultural identities (Gay, 2002; Villegas & Lucas, 2002). These teachers consult students and community stakeholders to gain an understanding of students' cultures and experiences and the role they can play in ethnically diverse students' education (Villegas & Lucas, 2007). Finally, culturally responsive teachers are intentional in helping students gain tools to effect change in their communities (Gutstein, 2003; Tate, 1995; Villegas & Lucas, 2002). For instance, culturally responsive mathematics teachers help students learn to use mathematics to analyze issues that affect members of their communities. This analysis may then be used to develop mathematically based arguments for change in their environments.

Researchers have investigated the potential of teachers to enhance the academic growth of ethnic minority students in mathematics and in other content domains by attending to and incorporating aspects of students' culture and experiences into their lessons (August & Shanahan, 2006; Gay, 2010; Gutstein, Lipman, Hernandez, & de los Reyes, 1997; Ladson-

Billings, 2007, 2009; Nelson-Barber & Estrin, 1995; Orosco & O'Connor, 2013). Ladson-Billings (2001) found that when a teacher used African American students' music as a conduit for learning, the students' understanding of poetry surpassed the requirements of their local district and of the state department of education. Tate (1995) and Gutstein (2003) found that incorporating students' culture in mathematics curriculum may have dual outcomes: (a) enhanced mathematics achievement, and (b) the development of students' sociopolitical consciousness. Tate (1995) discovered that students used mathematics to solve problems, communicated mathematics to each other and to their teacher, reasoned about mathematics, extended mathematics to other contexts, and developed procedural fluency when engaged in mathematics projects centered on issues they perceived had affected their community (e.g., the AIDS epidemic, drugs, and sickle cell anemia). Furthermore, students used what they learned in their mathematics class to develop suggestions to effect change in their communities. Taken together, these studies illustrate the potential for academic gains and sociopolitical awareness when incorporating minority students' culture and experiences into school experiences, and, in particular, into mathematics lessons.

That schools are becoming increasingly ethnically diverse (Banks, 2003; U.S. Department of Education, 2013) suggests a need for culturally responsive mathematics teachers who can incorporate into students' work their "cultural assets"[2], which Thomas, Davidson, and McAdoo (2008) defined as "factors related to positive outcomes for a particular ethnic group" (p. 282). Yet, with few exceptions (e.g., Aguirre et al., 2012; Ramsay-Jordan, 2017; Turner et al.,

[2] Thomas, Davidson, and McAdoo's (2008) cultural assets construct is derived from Frison, Wallander, and Brown's (1998) "culturally relevant factors" (p. 614).

2012), little is known about prospective mathematics teachers' preparedness to create culturally responsive tasks for the increasingly ethnically diverse group of students (Banks, 2003; U. S. Department of Education, 2013), which will include African American and Latin@ students. In a previous investigation (Trask & Martin, 2015), it was discovered that a preservice teacher (PST) who had meaningful conversation with a student of color was more willing or able than other PSTs to adapt instruction for African American and Latin@ students. Baker (1989) and Bergen (1989) have argued that similar experiential learning is important for PSTs to gain understanding of culturally different groups. Moreover, researchers have found that both in-service (Mahan & Rains, 1990) and preservice teachers (Nieto, 2006) have reported that direct experiences with members of minority cultures have increased their knowledge of these groups.

In a study of middle school teachers' perceptions of the effectiveness of cultural activities in increasing teachers' learning about Native and Mexican Americans, Mahan and Rains' (1990) participants reported that they learned the most about these ethnic minorities from a cultural immersion experience in which participants lived and worked in Native and Mexican American communities. Middle school teachers ranked workshops, lectures, or classes held by Native and Mexican Americans as second most important in increasing learning of these ethnic minorities. Of lesser importance to middle school teachers were reading books about cultural groups, attending lectures by university instructors, and completing sociology or anthropology courses. In short, middle school teachers reported that knowledge gained from firsthand interaction with ethnic minority stakeholders was most valuable in enhancing their learning of ethnic minority groups.

Furthermore, Nieto (2006) found that PSTs' knowledge of minority groups grew from engagement in "cultural plunges" (p. 77). By her definition, a cultural plunge is "individual

exposure to persons or groups markedly different in culture (ethnicity, language, socioeconomic status, sexual orientation, and/or physical exceptionality) from that of the 'plunger'" (Nieto, 2006, p. 77). Nieto found that most participants' reactions to the plunges shifted from apprehension to enthusiasm to appreciation. According to the PSTs in Nieto's study, the plunges reduced their fear of unfamiliar people, allowed them to face their preconceived notions of cultural members with whom they were interacting, and supplemented their cultural diversity knowledge base. One PST noted,

> The plunges that we were sent on helped me face my fears, biases, and most of all the truth. It is amazing what firsthand experience can do to a person. The plunges I experienced have changed the way I think and look at things forever. (Nieto, 2006, p. 82)

Other students in Nieto's study reported that they would use their cultural knowledge and experiences in the future as they construct lesson plans and curricular tasks for the instruction of ethnically diverse students.

Again, there is limited research on the preparation of teachers, especially mathematics teachers (Turner et al., 2012), who can appropriately integrate into instruction and tasks students' cultural assets, such as those observed by Mahan and Rains' (1990) teachers and Nieto's (2006) PSTs. Existing mathematics education research reveals that assisting teachers in creating culturally responsive tasks is a complex activity with mixed outcomes. Herron and Barta (2009) assisted in-service teachers in altering traditional mathematics curricular tasks by changing names, physical contexts, recreational activities, celebrations, and foods to match the cultural components of their students. The authors did not report if the resulting cultural contexts were meaningful to students. Thus, it is possible that teachers made superficial changes, which resulted in tasks that were not completely authentic to students' cultural experiences. Rubel and

Chu (2012) investigated in-service teachers' attempts to create tasks that "mathematiz[ed] students' everyday experiences" (p. 46). They found that while some teachers appropriately drew on students' cultural contexts, others created contrived tasks that lacked appropriate cultural and mathematical contexts. For instance, one teacher provided students a list of basketball jersey numbers for instruction on set concepts and notation. The authors noted, "Set notation, however, does not illuminate aspects of the game of basketball, and conversely, the basketball context illuminates neither the concept of set nor its notation" (p. 49).

Turner et al. (2012) required their PSTs to create culturally relevant mathematics tasks after taking walks through the community with students or community members. The researchers discovered that some PSTs drew "meaningful connections" (p. 77); in their tasks, PSTs appropriately integrated students' cultural contexts into their mathematics activities. One such task, which was written in Spanish and English, was based on details from a parent-led trip to a Lavandería (Laudromat). PSTs used appropriate contextual details, such as those relating to washer and dryer sizes (and corresponding expenses), laundry detergent expenses, and the family's budget for cleaning 10 loads of clothing. Other PSTs in this study drew "emergent connections" (p. 77) in their tasks. Although the cultural details in tasks were authentic, the mathematical activities for tasks were inauthentic, as illustrated in the following word problem: "A student has $15. How many different combinations of nachos, small tosti-locos, large tosti-locos, and pico de gallo can the student buy?" (p. 77) The researchers stated that this task provides evidence of emergent connections because the included mathematics would not necessarily be performed by cultural actors in this context in this specific way.

Grossman, McDonald, Hammerness, and Ronfeldt (2008) argued, "It is not enough to prepare teachers with…knowledge of their students' cultural and linguistic resources. Teachers

need to know how to use such knowledge in order to help students develop intellectual skills and to succeed academically" (p. 244). Given this call for practical use of students' cultural assets in their instruction, more must be known about PSTs' cultural training[3], and, more specifically, how PSTs use specific knowledge of cultural others to enhance the learning experience of culturally different students. Moreover, the mathematics education community requires a deeper understanding of the complexities of creating culturally responsive mathematics tasks.

Rationale

From Chu's (2012) and Turner et al.'s (2012) studies, the research community learned that some in-service teachers and PSTs had difficulty creating culturally responsive tasks for students. However, in both cases, a focus on incorporating cultural contexts that were unfamiliar to teachers and PSTs made it difficult to discern whether in-service teachers' and PSTs' were struggling to create culturally responsive tasks, in general, or whether they were challenged by the need to incorporate unfamiliar cultural details. This study continued where Chu (2012) and Turner et al. (2012) left off by comparing PST-created culturally responsive tasks with their own, familiar, cultural details, to PST-created tasks involving less familiar cultural details. In the class activity, the creation of culturally-responsive-to-self problems preceded the creation of culturally-responsive-to-others problems. This problem creation order served two purposes. PSTs were able to practice the creation of a culturally responsive problem in a familiar context, focusing on the expectation of what should be incorporated into such a task, without also coping with the additional demand of unfamiliar cultural details. In addition, this gave me, as a researcher, the ability to isolate the difficulty due to incorporating cultural details. Additionally,

[3] According to Gay (2002), cultural training entails growing PSTs' knowledge of students' cultural backgrounds and experiences, helping PSTs construct culturally responsive tasks, helping PSTs develop positive dispositions towards culturally diverse students and their communities, and growing PSTs' knowledge of students' preferred learning styles.

because prior research (Chu, 2012; Turner, 2012) did not draw a contrast between culturally responsive tasks for students and (in-service or preservice) teachers, it was unclear what PSTs might report on the differences in creating tasks from the perspective of a cultural insider—one who shares the culture, background, and language (Ergun & Erdemir, 2010)—or outsider. I sought to deepen understanding of PSTs' curricular tasks through PST testimonies.

The purpose of this study was to investigate PSTs' attempts to create mathematics tasks for African American and Latin@ students who they encountered repeatedly in a cultural immersion (CI) experience and who they had interviewed (see Appendix O). In a 3-week learning segment that was a part of a semester long introductory secondary mathematics education course, PSTs read and discussed literature on culturally responsive teaching. In addition, as a support for students' cultural task development, PSTs created tasks that mirror their own cultural experiences. Inadvertently, these tasks served as a baseline for determining if PSTs could incorporate cultural contexts into tasks. The following research questions were addressed in this investigation:

1. To what extent can PSTs incorporate personal and cultural assets when developing mathematics learning tasks for themselves and for their students?
2. In what ways are cultural elements integrated into PSTs' mathematics tasks?
3. What challenges do PSTs face when constructing culturally responsive mathematics tasks?

Conceptual and Theoretical Framings

Because I was focused on teacher preparation for the instruction of culturally diverse students, I used Gay's (2002, 2010) Culturally Responsive Teaching framework, which describes the skills culturally responsive teachers must possess and the tools (e.g., the written curriculum)

they must use to ease learning for ethnically diverse students. Additionally, the framework describes the impact of culturally responsive teaching on student learning. Gay's (2002, 2010) framework was helpful for identifying the type of cultural details PSTs should place into culturally responsive tasks, namely those of cultural significance. I also used Critical Race Theory to frame this study because the culturally responsive tasks PSTs created required the privileging of racial minority student voices. In particular, I used this theory to further examine the cultural significance of the culturally responsive tasks PSTs created for students. Through the lens of Critical Race theory, I looked for evidence of whether PSTs had distorted student narratives by adding their [PSTs'] own details or by removing student-derived details.

Culturally Responsive Teaching

Gay (2002, 2010) offered a pedagogical model, Culturally Responsive Teaching, that identified what teachers should know about students' culture and how teachers should use their knowledge of culture to promote academic excellence for students. Gay (2002) stated that culturally responsive teachers must (a) form a cultural diversity knowledge base, (b) construct culturally relevant instruction materials, (c) show cultural caring and create a learning community, (d) engage in cross-cultural communications, and (e) align instruction to ethnically diverse students' learning needs. In this study, I limited my focus to two of Gay's (2002) attributes of culturally relevant teachers that pertained to PSTs' use of cultural details obtained from particular students to create culturally responsive tasks for them: cultural diversity knowledge base and culturally relevant instruction materials.

Cultural diversity knowledge base. According to Gay (2002), culturally responsive teachers must have knowledge of the diversity of backgrounds students of various cultures bring to the classroom. Gay stated that culturally responsive teachers acknowledge, respect, and

understand the differences between cultural groups. Culture includes "values, traditions, communication, learning styles, contributions, and learning patterns" (Gay, 2002, p. 108). According to Hong (2009),

> culture…is (a) shared (albeit incompletely) among a collection of interconnected individuals who are demarcated by race, ethnicity, or nationality; (b) externalized by rich symbols, artifacts, social constructions, and social institutions (e.g., cultural icons, advertisements, and news media); (c) used to form the common ground for communication among members; (d) transmitted from one generation to the next…; (e) undergoing continuous modifications. (p. 4)

Culturally responsive teachers obtain specific information about different ethnic groups for the purpose of making learning more interesting and meaningful for ethnically diverse students. This information includes students' "funds of knowledge"[4] (Moll, Amanti, Neff, & Gonzalez, 1992, p. 133), that are not only acknowledged in classrooms, but also are legitimized as valuable contributions to student learning. Finally, culturally responsive teachers acquire knowledge related to multicultural education, namely knowledge of the contributions of members of various racial or ethic groups and also of theory, research, and scholarship on the teaching of the different racial or ethnic groups (Gay, 2002).

Culturally relevant instruction materials. Once teachers have knowledge of students' cultures, interests, and experiences, they can use this important information to create curricula and alter instruction. Style (1998) provided a convincing rationale for the use of students' culture

[4] Moll, Amanti, Neff, and Gonzalez (1992) drew on Greenberg's (1989), Tapia's (1991), and Vélez-Ibáñez's (1988) works to define funds of knowledge as "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning or well being" (p. 133).

and experiences in the curriculum. According to Style (1998), the curriculum should act as a window or a mirror to students' experiences. Style (1998) argued:

> If the student is understood as occupying a dwelling of self, education needs to enable the student to look through window frames in order to see the realities of others and into mirrors in order to see her/his own reality reflected. (p. 150)

Style (1988) and Sleeter and Grant (2010) further noted that curricular materials are often imbalanced in the number of mirrors and windows provided to students. Style (1988) asserted:

> White males find, in the house of curriculum, many mirrors to look in, and few windows which frame others' lives. Women and men of color, on the other hand, find almost no mirrors of themselves in the house of curriculum; for them it is often all windows. (p. 4)

Therefore, ideally, mathematics curricular materials provide all students opportunities to see their culture, experiences, and interests reflected in the curriculum and also provide students opportunities to see others' cultures, experiences, and interests in the curriculum as well. However, by Style's argument, teachers, including mathematics teachers, must be intentional about providing ethnic minority students, such as African American and Latin@ students, mirrors to their cultural experiences, as traditional curriculum often lacks material that authentically reflects their experiences.

Hefflin and Barksdale-Ladd's (2001) criteria for acceptable, reflective, cultural literature for African American children may be applied to other groups and to mathematics curricular tasks. According to the authors, cultural actors in the literature must be well-developed, placed in authentic contexts, and using their authentic language. Furthermore, information found in the literature must accurately reflect minority student experience. In short, these curricular materials

provided to minority students in mathematics and in other content domains must truly mirror their lived experiences.

Critical Race Theory

Critical race theorists assert that race dictates Americans' life experiences (Delgado, 1995). Furthermore, theorists articulate a direct link between power divisions seen in society at large and the opportunities that racial minority groups, such as African Americans and Latin@s, can access. Theorists state that power disparities by class are historically linked to power disparities by race (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002) and they call for an examination of racial minorities' experiences within a political, social, and economic context (Bell, 1980). The theory calls into question U.S. structures, beliefs, and practices that are based on Eurocentric norms.

To redress past inequities, alleviate current inequities, and buffer future racial injustice, Critical Race Theory aims to (a) hold race and racism central, (b) challenge power and dominant legal notions of meritocracy, impartiality, and color blindness, (c) privilege the voices and experiences of the marginalized, (d) strive for social justice, and (e) provide a historical, interdisciplinary analysis of race and racism (Martin, 2006; Matsuda, Lawrence, Delgado, Crenshaw, 1993). To de-center European American experience and knowledge, critical race theorists privilege racial minorities' narratives and stories (Ladson-Billing & Tate, 1995). This serves liberatory purposes for marginalized groups and transformative purposes for dominant groups. It legitimizes racial minorities' experiences. Moreover, it allows members of the dominant group to view racial minorities' experiences through the eyes of oppressed minority people. PSTs' creation of culturally responsive tasks is important for the legitimation of

minority students' knowledge and experiences and for decentering Eurocentric knowledge and experiences often found in school text.

Methods

In the fall semester of 2016, PSTs were engaged in a 3-week learning segment on culturally responsive teaching, which was a part of a semester-long introductory secondary mathematics education course meeting twice a week for 1 hour and 35 minutes per session at a large Midwestern university. Simultaneously, the PSTs participated in a cultural immersion (see Figure 1) in an informal after-school education setting with lower income students who, for the most part, also were African American.

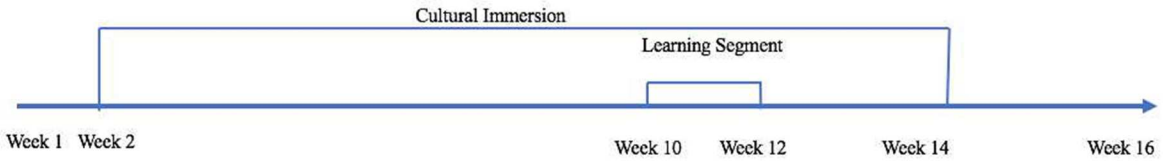

Figure 1. Timeline for cultural immersion and learning segment.

A case study was conducted with these PSTs. Stake claimed (1995),

> The real business of case study is particularization, not generalization. We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis is on understanding the case itself. (p. 8)

A case study is a thorough examination of an actor or set of actors within a particular setting. The researcher attempts to provide the reader rich contextualized information about the case. The researcher uses "thick description" (Geertz, 1973) to give the reader a clear understanding of the study participants and their behavior in the setting in which they occur.

A case study sheds light on an occurrence or phenomenon that previously was obscured. PSTs' culturally responsive mathematics tasks represent the case in this study. The aim of this study was to gain in-depth understanding of the processes and beliefs associated with creating these tasks.

Setting

Participants. The PSTs consisted of 11 PSTs: 9 European American students, an African American student, and a Jewish, European American student. There were three female students and eight male students. By the beginning of the study, PSTs had completed at least 45 hours of coursework (roughly three full-time semesters at the university), and had completed or were enrolled in multivariable calculus. Therefore, participants should have had adequate knowledge of mathematics concepts that were included in the culturally responsive mathematics tasks completed for this study. PSTs were recruited from an introductory secondary mathematics education class for two primary reasons: they had direct contact with minority students (i.e., African American and Latin@ students) and as a result of participating in the 3-week learning segment on culturally responsive teaching, PSTs engaged in critical reflection on issues relating to African American and Latin@ students.

Learning segment. During the learning segment on culturally responsive teaching (see Appendices F, G, H, I, J, and K), PSTs read literature on the instruction of ethnically diverse students, especially African American and Latin@ students. PSTs also read and wrote written reflections on the National Council of Teachers of Mathematics' (NCTM's) (2000) Equity Principle, as well as other literature (see Table 1) relating to teacher identity, the teaching of ethnic minority students, and the role mathematics plays in gaining access to post-secondary educational and occupational opportunities. In-class discourse involved the readings and class

activities, and PSTs provided written reflections on the readings and our in-class discussions. I co-facilitated classroom discussions along with the primary instructor, a European American male.

Table 1

Class Themes, Readings, Activities, and Homework

Day	Intended Themes	Readings	In-class Activities	Homework
Day 1	(In)Equity in mathematics classes and its consequences -Tracking by race and socioeconomic status -The link between access to higher mathematics and access to post-secondary education and good jobs The power mathematics educators wield	Moses, Kami, McAllister-Swam, & Howard (1989) Oakes (1995) NCTM (2000)	Small and whole group discussion of the readings	Discuss the extent to which you, a future mathematics teacher, will be in a position of power in school. In your own words, define equity. Assume you have a class of African American and Latin@ students, such as those at [the CI site]. Your students are not performing as well as those from other racial groups. Who is responsible for their performance?
Day 2	Acknowledging biases/preconceived notions Acknowledging own position in society, particularly in relation to others'	None	Physical Appearance Categorization Activity (Ryan & Simpson, 2016) Position of Privilege or Power Activity (by Trask)	To what extent do you believe you are in a position of power? Are you in the same position of power as [the students at the CI site]? How do similarities or differences in position of power between teacher and student influence instruction or learning?
Day 3	Culturally responsive teaching	Gay (2002) Kea, Campbell-Watley, & Richards (2006) *Strategies for Promoting Culturally Responsive Classrooms* (n.d.)	Video interview about culturally responsive teaching (https://www.youtube.com/watch?v=eSwr6vsrqb0) Small and whole group discussion on characteristics of culturally responsive teacher PST to PST Cultural Information Interview	Please create a mathematics task that reflects your own experience. Create a list of information (or questions one might ask you) that would be helpful to create this culturally-responsive-to-you task. Please research a social justice issue you perceive a [student at the CI site] or the student's family member may be facing (e.g., racism, sexism, homelessness, poverty, food desert, joblessness, domestic violence, ageism, lack of health care/health care coverage). Look for statistics that illustrate this issue. In particular, please find statistics that show how the issue affects your student's group and other racial groups. Please bring this information to class.
Day 4	Culturally responsive tasks	Kea, Campbell-Watley, & Richards (2006) Ten quick ways to analyze children's books for racism (n.d.) Gutstein (2003) Ladson-Billings (2009) Nasir (2000) Style (1998) Tate (1995)	Whole group discussion on the readings Analysis of the cultural responsiveness of some mathematics tasks Analysis of a critical mathematics task Videos on African American secondary students discussing perspectives of culturally responsive teaching and tasks Examination of a rubric with cultural aspects of a task based on Gay's (2002)	Use the information you gathered about the issue you perceive your [student at the CI site] or a family member faces to create a culturally and critically responsive word problem. Please reflect on the difficulties you had in making this problem (and in making it significant to this group of people). In what ways might your student benefit from your culturally and critically responsive word problem? In what ways might students from other groups benefit from your word problems?

(Table Continues)

Day	Intended Themes	Readings	In-class Activities	Homework
Day 5	Cognitively demanding tasks	National Council of Teachers of Mathematics (2000) Smith & Stein (1998)	Video of Trask interviewing African American secondary students using the Cultural Information Interview Protocol Analysis of the cognitive demand of tasks in Smith and Stein's (1998) article	Using the Cultural Information Interview Protocol, complete your interview with an African American or Latin@ [student at the CI site]. Use information from this interview to create a culturally-responsive-to-student mathematics task. Describe the type of student who should receive high cognitive demand tasks. Describe the type of student who should receive low cognitive demand tasks.
Day 6	Cognitively demanding and culturally responsive tasks	None	Whole group discussion of the cognitive demand and cultural responsiveness of a reform-oriented word problem	None

Note. CI=Cultural immersion.

PSTs submitted 3 types of tasks for the learning segment: tasks with their own cultural details (culturally responsive to PST tasks), tasks with interviewed students' cultural details (see Appendix O) (culturally responsive to student tasks), and task with social justice issues (critical mathematics tasks). The topics covered in the learning segment and the tasks are included in Figure 2.

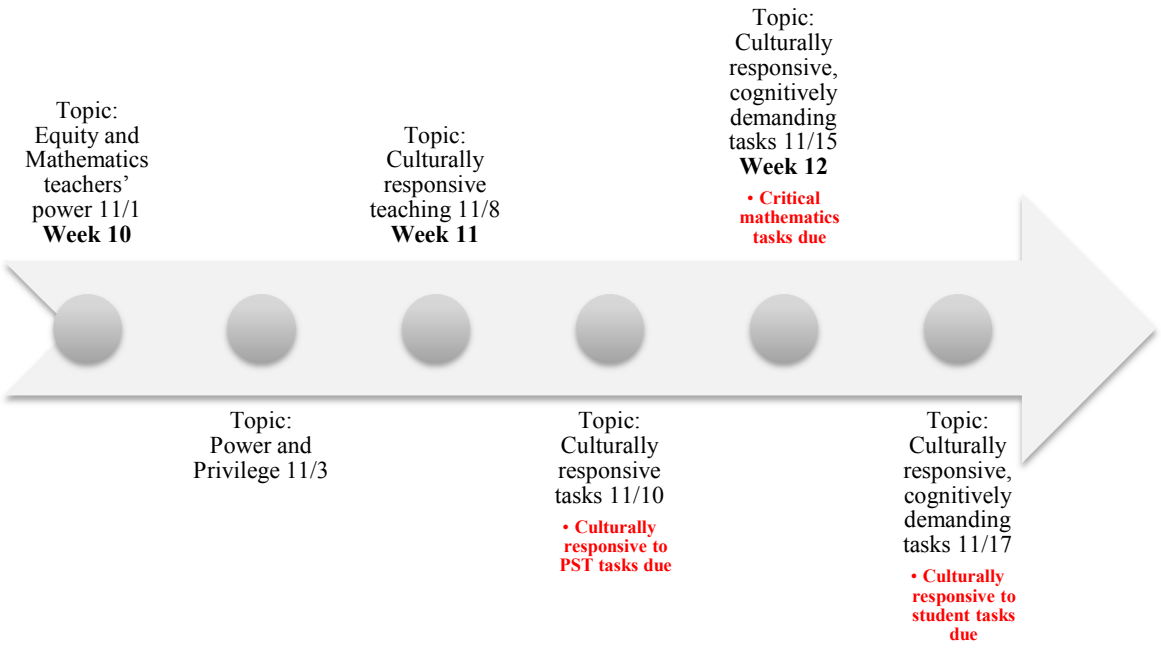

Figure 2. Learning segment topics and culturally responsive and critical mathematics tasks.

Cultural immersion. From their course participation, PSTs participated in a cultural immersion with lower income students, who also largely were African American. Mahan and Rains (1990) and Nieto (2006) discovered that from direct interaction with ethnic minorities, teachers' knowledge of the background and experiences of cultural others grew. For example, Nieto (2006) found that cultural immersion helped assuage teachers' fears of ethnic minorities students and the members of their community. Additionally, increased knowledge of ethnic minority students gained through these direct interactions may contribute to the construction of culturally appropriate tasks for them (Gay, 2002). Taken together, PSTs' direct interactions with ethnic minority students through a CI experience may have influenced the culturally responsive mathematics tasks they created for students.

PSTs engaged in 20 hours of cultural immersion with lower income and minority students, such as African American and Latin@ students. The primary mathematics instructor permitted PSTs to decide the amount of sessions and amount of hours per session they would volunteer at the cultural immersion site. He informed PSTs that he preferred that they distribute their 20 hours over roughly 12 weeks; yet, this decision was left to the PSTs. PSTs' cultural immersion occurred in an afterschool program at a local junior high school where PSTs tutored students in mathematics and other subject domains, supervised students, and played with students during recess periods. There was a mismatch between the grade level PSTs aspired to teach (secondary) and students' grade level (middle school) at the CI site, and PST duties at the CI site did not always involve mathematics. However, early in the semester, the primary instructor for the secondary mathematics education course had conveyed that he was confident that meaningful interaction with the ethnic minority students was central to furthering PST

understanding of culturally responsive pedagogy. PSTs' submitted reflections on their CI experiences after 7-, 14-, and 20-hours of volunteering.

Data sources. Eleven PSTs from the secondary mathematics education class submitted at least one culturally responsive task. Data consisted of (a) culturally responsive-to-PST (CRP) tasks, which included PSTs' cultural details; (b) culturally responsive-to-student (CRS) tasks, which included cultural details from students at the CI site; (c) PSTs' written reflections on their CRP and CRS tasks; (d) audiotaped interviews of middle school students at the CI site on their cultural background and experiences, (e) a survey on the information PSTs obtained from interviewing middle school students, and (f) post-learning segment interviews with three PSTs. Only three PSTs agreed to being interviewed. Their reports were included in the study.

To attend to my first research question, each PST was asked to create two culturally responsive tasks as a class assignment: one that was culturally responsive to themself and one that was culturally responsive to a student. At the time of the assignment, PSTs had read about culturally responsive teaching and tasks, had watched a video of me interviewing African American secondary students about their culture, and had conducted two separate interviews of middle school students about (a) their mathematics education and (b) their culture. The culturally responsive-to-PST (CRP) task included the PST's personal and cultural details, while the culturally responsive-to-student (CRS) task included the same type of details obtained from interviewing a specific African American or Latin@ middle school student at the CI site[5]. According to Gay (2002), curriculum should be analyzed according to "the quantity, accuracy, complexity, placement, purpose, variety, significance, and authenticity of the narrative texts, visual illustrations, learning activities, role models, and authorial sources used in the

[5] Some PSTs ignored the instructions to interview an African American or Latin@ student. Instead, these PSTs interviewed Caucasian American students.

instructional materials" (p. 108). I used one of Gay's (2002) culturally responsive curriculum criteria, specifically the authenticity of narrative texts, to classify PST tasks. For the sake of analysis in this study, each CRP and CRS task was separated into two parts: the backdrop, which provided the contextual scenario for the rest of the task, and the primary mathematical activity, which required students to perform a mathematical process. CRP and CRS tasks were examined to determine the extent to which PSTs could identify personal or cultural details and incorporate those elements into mathematical tasks for themselves and students. I verified the authenticity of details in the backdrops of CRP tasks by comparing tasks to PST reflections and audiotaped post-learning segment interviews. The authenticity of CRS details were verified by comparing tasks to audiotaped PST interviews of middle school students for whom the tasks were written. CRS details were also authenticated by comparing tasks to PST survey responses about cultural elements included in tasks.

To address the second research question, I used another of Gay's (2002) culturally responsive curriculum criteria, namely significance, for examining how PSTs had included elements of culture in the backdrop of their CRP and CRS tasks. I used Hong's (2009) and Gay's (2002) definitions of culture to create categories (i.e., cultural actors, artifacts or traditions, or activities) for classifying the cultural components of the backdrops of PSTs' CRP and CRS tasks. Each PST task was also examined to determine alignment between the primary mathematical activity and the cultural backdrop. To further attend to the second research question, using a Word Problems Distortion rubric (Trask, 2016) created for this study, I examined the extent to which PSTs integrated cultural components in the ways the middle school students had intended, evidenced by the appropriateness of the use of students' self-reported cultural elements.

Finally, to address my third research question, I conducted semi-structured, open-ended interviews with three PSTs. In the interviews, I asked PSTs about the challenges they faced in creating mathematics tasks reflective of their students' cultural experiences.

Analyses

My first analysis for this study involved an examination of the cultural significance (Gay, 2002) of PSTs' narrative texts. I examined the backdrop of CRP tasks, which provided the contextual scenario for the rest of the task, to determine the extent to which PSTs could identify cultural details for themselves and incorporate those elements into mathematical tasks. This examination stemmed from information PSTs provided in their reflections or post-learning segment interviews. If PSTs could identify and incorporate those details into tasks for themselves, I reasoned, they would have the skills to also recognize and incorporate those same elements into tasks for their students. For each cultural component category, tasks were rated as consistent, potentially consistent, inconsistent, difficult to discern, no rating, or missing data. Consistency classification criteria are provided in Table 2. No rating was applied when PSTs did not include names, contexts, or activities in the tasks they created. Data were classified as missing for PSTs who did not submit their task, student interview, or survey.

Table 2

Consistency Classification Criteria for Personal or Cultural Information

Classification	Explanation
X (Consistent with PST reports)	PSTs included the exact information provided in their reflections or post-learning segment PST interviews, or student interviews.
X^- (Potentially consistent with PST reports)	PSTs included information that may have been alluded to, but not explicitly stated, in the reflections or post-learning segment PST interviews, or in student interviews.
Inc (Inconsistent with PST reports)	PSTs included information that did not match data in the reflections or post-learning segment PST interviews, or in student interviews.
DD (Difficult to discern)	PSTs included information that matched data in the reflections or post-learning segment PST interviews, or in student interview; however, it was difficult to determine its personal or cultural nature.

Using Gay's (2002) and Hong's (2009) definitions of culture, I determined that there was a cultural backdrop if tasks included cultural actors (e.g., family, cultural community members, and cultural role models); artifacts or traditions from the culture (e.g., cultural holidays, events, objects, or writings); or cultural activities (e.g., activities tied to the cultural context, such as group members preparing a cultural dish or performing a cultural dance). If the primary mathematical activity included details from the cultural context provided in the backdrop, then I classified the cultural backdrop as being incorporated into the primary mathematics activity. If PSTs provided cultural details in the cultural backdrop but did not include them in their primary mathematics activity, (i.e., PSTs ignored the cultural details in their cultural backdrop as they wrote their primary mathematics activities.), I classified their cultural backdrop as not being incorporated into the primary activity. When PSTs failed to provide a cultural backdrop, I classified the cultural backdrop as not being incorporated into their primary mathematics

For the next analysis of the cultural content in CRS tasks, I used the Word Problems Distortion rubric (Trask, 2016) created for this study to determine if tasks accurately reflect the personal or cultural information middle school students provided. According to critical race theorists, cultural narratives should privilege the voices and experiences of racial minorities (Ladson-Billings & Tate, 1995). In each CRS word problem, I sought to discover who told the story, what story was told, and who assigned significance to what was told. If PSTs failed to use the information students provided them in the way it was intended by the students or their community, I determined that PSTs have distorted student narratives. In this study, PSTs could have distorted student narratives by adding their own details or by removing student-derived details. Both distortions (see Table 3) are incongruous to the tenets of Critical Race Theory.

Table 3

Word Problem Distortions from Changes in Authentic Details Provided by Students

Narrative Distortions	Significance Distortions
$\underline{Narrative\ distortion^{+}}$ This distortion occurs when a PST supplements the information provided him or her by the racial minority student. By adding his or her own "cultural" details to the student's narratives, the PST attempts to fill gaps in the student's story. However, in doing so, the PST is constructing a word problem that it makes sense to him or her [PST]. Any information that is added is not derived from the student and, therefore, cannot be interpreted using the student's lens. This new information can only be understood from the perspective of the PST or the source the PST has utilized.	$\underline{Significance\ distortion^{+}}$ This form of distortion involves more than the inclusion cultural details. When PSTs assign greater meaning to the narrative than did the students or their community members, they commit $significance\ distortion^{+}$. Some PSTs may fall short of providing a word problem that reflects the significance of African Americans or Latin@s if they misconstrue the level of importance the included event has to the students or members of their community.
$\underline{Narrative\ distortion^{-}}$ When a PST ignores information that is given to him or her by the racial minority student, this form of narrative distortion occurs. Some PSTs may omit students' information because it seems irrelevant to the mathematics storyline. Yet, the PST, not the student, is making the decision to withhold cultural details. The lack of student-PST consensus on this decision suggests that the PST is filtering cultural details and interpreting the word problem through his or her own lens.	$\underline{Significance\ distortion^{-}}$ This distortion occurs when PSTs diminish the meaning their students or community members assign to events. For instance, PSTs may minimize the role of race in their word problem or may downplay the significance of an event that is important to students or to their community. Both decisions may indicate a refusal to privilege African American or Latin@ voice or a refusal to confront issues, such as race or racism, that are pertinent to African American and Latin@ students and their community members.

In this study, I focused primarily on PSTs' narrative distortions, as I did not consult the students they interviewed or members of these students' community to determine the level of significance they attached to personal or cultural details provided in the student interviews. I could only garner student significance from the interviews they provided PSTs. If students stressed the importance of particular cultural details that PSTs ignored, I made note of these significance

distortions.

Lastly, I examined PSTs' post-learning segment interviews to better understand the practice of creating culturally responsive mathematics tasks. In the present study, I documented PST reports of the process of constructing culturally responsive mathematics tasks through post-learning segment interviews, which provided evidence of PST struggles while creating such tasks. I analyzed PSTs' post-learning segment interviews through open coding (Corbin & Strauss, 2008). Constant comparative methods (Corbin & Strauss, 2008; Creswell, 2007) were used to determine major themes on the PST process of creating culturally responsive tasks.

Findings

The findings are organized in terms of PST attempts to create culturally responsive tasks and their reports regarding the construction of such tasks.

PST Attempts at Culturally Responsive Mathematics Tasks

In a preliminary analysis of the data, I discovered that PSTs could incorporate personal details into the backdrops of CRS and CRP tasks (see Appendix L). For this paper, the backdrops of PST tasks were examined for their cultural significance. Tasks were further examined to determine the significance of reported cultural details in mathematical and in cultural contexts. To create culturally responsive tasks, PSTs must have included details that were culturally relevant to them. Culturally relevant details are defined by the student. A cultural actor might include the student, a family member, or a role model within the student's cultural group. A cultural garment or a religious holiday deemed meaningful and communicated by the student are examples of what might constitute a cultural artifact or tradition. Finally, Hong (2009) argued that culture is shared by the members of a group; therefore, in this study, any activity performed by or with more than one cultural actor is deemed a cultural activity. Notably, in other contexts,

it is possible that a single actor can participate in an activity that is cultural in nature. A summary of PSTs' inclusion of cultural components (i.e., cultural actors, artifacts or traditions, or activities) in the backdrop of CRP tasks and their CRS task is given in Table 4.

Table 4

Summary of PST Tasks Based on the Authenticity of Cultural Details

PST	Angela	Brian	Carmel	David	Eli	Faith	Henry	Ivan	Javi	Keenan	Micah
Culturally Responsive to Preservice Teacher (CRP) Tasks											
Actors	X	X	X	X⁻	Inc	DD	X	X⁻	X	X⁻	X
Artifacts or Traditions	X	X	X	X	DD	DD	X	X		X	X
Activities	X	X	X	X⁻	DD	DD	DD	X		X	X
Culturally Responsive to Student (CRS) Tasks											
Actors	X	X		MissI MissS	DD	X	X	MissT	X	X	X
Artifacts or Traditions	X	DD	DD	MissI	DD	X	X	MissT	Inc	X⁻	
Activities	X	DD	DD	MissS MissI MissS	X	X	DD	MissT	Inc	X⁻	X

Note. PST=Preservice teacher. X=Consistent with reflection or post-learning segment PST interview, or student interview. X⁻=Potential connection with reflection or post-learning segment PST interview, or student interview. DD=Difficult to discern. Inc=Inconsistent with reflection or post-learning segment PST interview, or student interview. MissI=Missing interview. MissS=Missing survey. MissT=Missing task.

PSTs incorporated their own and students' culture into tasks to varying degrees. In CRP tasks, 9 of the 11 PSTs who provided tasks included actors, 8 of the 11 included artifacts or traditions, and 7 of the 11 included activities that explicitly were or could have been culturally relevant to themselves. Eight of the 11 PSTs who provided tasks included at least two cultural components, and more than half of those providing tasks (7 of 11) included three cultural components that explicitly were or could have been culturally relevant to themselves. Nine PSTs provided CRS tasks for analysis. Seven those 9 tasks included actors, 4 of 9 included artifacts or traditions, and 5 of 9 included activities that explicitly were or could have been culturally significant to their students.

Categories for sets of PSTs' CRP and CRS tasks. I discovered that every set of the CRP and CRS tasks provided by PSTs fell into three categories: those with some or all of the cultural components (a) in both the CRP and CRS tasks, (b) in only the CRS tasks, and (c) in only the CRP tasks. I provide illustrations of each category below.

In both tasks. Six PSTs incorporated some or all of the cultural components in both tasks. Angela (see Table 5) included all the components (i.e., cultural actors, artifacts or traditions, and activities) in both of her tasks.

Table 5

Angela's CRP and CRS Tasks

PST	CRP Task	CRS Task
Angela	At Angela's Grandma's house, Grandma is making a 10-lb turkey for Christmas. Grandma has 3 hours to finish cooking the turkey before the family arrives at 5. If it takes 1-pound of turkey meat 30 minutes to cook, will Grandma finish cooking the turkey in time? If Grandma does not have enough time, when should she have begun cooking the turkey?	Afia and her family made yams to bring to her Nana's house in *City 1* for Thanksgiving. From *City 2*, Afia and her family go straight East for 50 Miles, and then they go straight North for 110 miles to arrive in *City 1*. Using the Pythagorean Theorem, determine if it would have been more or less miles to take I-55 to *City 1*, which runs diagonal to the city. Explain your reasoning.

In the backdrop of her CRP task, Angela included herself and her grandmother as cultural actors who are preforming a family tradition of cooking a turkey for a holiday. In the backdrop of the task created for her student, Angela included the student and her family who are traveling to her grandmother's house after making a cultural dish. Thus, the cultural actors in the cultural backdrops of Angela's CRP and CRS tasks are engaged activities meaningful to them.

In only the CRS task. Two PSTs created CRP tasks for which all of the details were difficult to definitively classify as having cultural significance to their PSTs. Faith had no distinctly cultural components in the CRP task (see Table 6). However, she included all three cultural components in her CRS task.

Table 6

Faith's CRP and CRS Tasks.

PST	CRP Task	CRS Task
Faith	A group of five friends go to a donut shop. The group decides to order one dozen identical donuts. Lauren wants at least one donut, Sanjana wants less than three, Mateo only wants 3 donuts, Deja wants at least two donuts, and Adam would like less than four donuts. How many different ways can the dozen donuts be distributed to the five friends?	Christmas time is coming and Gabriela's parents want to fool Gabriela into thinking that she received the new iPhone. Gabriela's parents put her new phone inside of a box of clothing. Gabriela knows that the total weight of the new iPhone in a box is 145 grams, and with wrapping paper, 150 grams. Gabriela has been weighing all presents with her name on it in order to figure out the one present she is allowed to open on Christmas eve. If a paper clip weighs 6 grams, a fun size snickers bar weights 38 grams, and a dollar bill weighs 13 grams, the box weights 20 grams, and the wrapping paper weighs 5 grams, how many paper clips, snickers, and dollar bills are needed to be placed in the box in order to stump her if we want to place at least one of each item in the box?

In her CRP task, Faith described friends from different, but not specifically identified, cultures who are frequenting a donut shop. Consequently, Faith did not include a distinctively cultural activity in the backdrop of her task. In contrast, Faith included cultural details her students told her in the CRS tasks. In the student interview, Gabriela, had described her pre-Christmas traditions with her cultural actors, her parents, involving the opening of gifts. Although Faith had

difficulty creating a culturally responsive task for herself, she could incorporate her students' cultural details into a task.

In only the CRP task. Only one PST, Carmel, provided all three components for her CRP task (see Table 7), but failed to provide any distinctly cultural components for her CRS task.

Table 7

Carmel's CRP and CRS Tasks

PST	CRP Task	CRS Task
Carmel	Sarah is cooking Rosh Hashanah dinner this year for 9 relatives. She wants to cook sweet honey carrots, bake honey into the challah bread, and have honey on the table to dip apples and other foods in to celebrate the beginning of a sweet year. One dish of sweet honey carrots feeds 3 people and uses 1 tablespoon of honey. One batch of challah bread is more than enough for everyone and, to bake it with honey, you need to add 4 tablespoons into the mixture. Each person will need about 2 tablespoons of honey to dip into in addition. She already has bought a new 8oz container of honey (1 oz=2 tablespoons). Does Sarah have enough honey for Rosh Hashanah dinner or will she need to buy more?	Your aunt, uncle, and cousin are coming to visit on Saturday. They are driving all the way to *City 2* from the *Group of cities*, which is about 150 miles. They can choose to either drive or to take the bus. If they drive, they will average about 55 miles an hour and 25 miles per gallon. Gas is about $2.00 per gallon. If they take the bus, bus tickets are $36.50 per person. Create an equation for the cost of each method of transportation. Then determine how much money it will cost for your family to drive or ride the bus the one way. How should your family travel and why?

The backdrop of Carmel's CRP task is rich with her own cultural details about a cultural tradition of cooking a traditional Jewish dinner with her sister. In comparison, she wrote a CRS task about the student's generally labeled family members. For instance, Carmel wrote, "Your aunt, uncle, and cousin are coming to visit on Saturday." Moreover, she wrote of a non-cultural activity, traveling to the city in which the student lived.

Summarily, most PSTs could incorporate some cultural details into both the tasks created for themselves or their students. A few only incorporated cultural details either into their CRP or their CRS tasks.

Appropriate use of culturally significant details in mathematical contexts. It is noteworthy that most PSTs could, to some degree, incorporate cultural details into their mathematics tasks. However, it is also important to further understand *how* cultural details were utilized in these mathematics-based tasks. I aimed to discover if PSTs incorporated their primary mathematics activities into their cultural backdrops. That is, I wondered if they could relate the primary mathematics activity to the cultural actors, artifacts or traditions, or activities in the culturally responsive tasks. A summary of the cultural backdrops and primary activities in PSTs' CRP and CRS tasks is provided in Table 8. Cultural backdrops must have included at least two cultural components. Any primary mathematics activity involving traveling to a cultural event was regarded as being unrelated to the cultural backdrop. All tasks lacking cultural backdrops were deemed as also lacking a culturally relevant primary mathematics activity.

Table 8

Cultural Backdrops and Associated Primary Mathematics Activities

PST	Culturally Responsive to PST (CRP) task		Culturally Responsive to Student (CRS) task	
	CB	CB incorporated into PMA	CB	CB incorporated into PMA
Angela	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Cooking cultural artifact)	Yes. (Cultural actor, artifact or tradition, and activity)	No. (Traveling)
Brian	Yes. (Cultural actor, artifact or tradition, or activity)	Yes. (Serving cultural artifact)	No. (Only a cultural actor)	No.
Carmel	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Cooking cultural artifact)	No. (No discernable cultural elements)	No. (Traveling)
David	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Serving cultural artifact)	MissI, MissS.	MissI, MissS.
Eli	No. (No distinctively cultural details)	No.	No. (Cultural activity in task not performed by cultural actors in student interview)	No.
Faith	No. (No distinctively cultural details)	No.	Yes. (Cultural actor, artifact or tradition, and activity)	No. (Weighing non-cultural item)
Henry	Yes. (Cultural actor and artifact or tradition)	No. (Calculating the cost of game attendance)	Yes. (Cultural actor and artifact or tradition)	No. (Traveling)

(Table Continues)

PST	Culturally Responsive to PST (CRP) task		Culturally Responsive to Student (CRS) task	
	CB	CB incorporated into PMA	CB	CB incorporated into PMA
Ivan	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Participating in cultural tradition)	MissT	MissT
Javi	No. (Only a cultural actor)	No.	No. (Only a cultural actor)	No.
Keenan	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Participating in cultural tradition)	Yes. (Cultural actor, artifact or tradition, and activity)	Yes. (Making cultural "artifact," puff puffs)
Micah	Yes. (Cultural actor and activity)	Yes. (Participating in cultural tradition)	Yes. (Cultural actor and artifact or tradition)	No. (Traveling)

Note. CRP=Culturally responsive to preservice teacher. CRS=Culturally responsive to student. CB=Cultural backdrop. PMA=Primary mathematics activity. MissI=Missing interview. MissS=Missing survey. MissT=Missing task.
*A PST could have included as few as two cultural components for the task to be classified as having a cultural backdrop.

In general, PSTs' who provided cultural backdrops in their CRP tasks were able to incorporate them into their primary mathematics activities (7 of 11). Henry, the one PST who created a task with a cultural backdrop and failed to create a PMA, admitted in class that the cultural tradition he described, attending a football game on Thanksgiving, was not one in which his family participated. Eli and Javi (see Table 9) failed to provide cultural backdrops and primary mathematical activities in both tasks because they provided too few details that were distinctively cultural in nature.

Table 9

Javi's CRP and CRS Tasks

PST	CRP Task	CRS Task
Javi	If you play a minimum of four hours a night and additional hour for each class that you have an A in. How can you write this as an equation with c for the number of classes and h being the number of hours that you play video games.	Jordan's family is trying to plan a vacation to take over winter break, but money is tight in the family. In order to figure out how far the family can travel, there is some budgeting that needs to be done. The family can barely make it to the end of every month, and they have only been able to save $250 for this vacation. Gas costs $3 per gallon, and their car can gets 20 miles per gallon. They also want to spend at least $100 of the money on activities during the vacation. How far can the family travel and still spend money during the trip? What is the maximum that the family can spend on activities? How far do they travel in this situation? Hint: Remember that a trip requires driving there and back. What are the independent and dependent variables to this situation? Can you graph this as a function using x and y? What is the function? What is its domain and range?

In his CRP task, Javi only provided a cultural actor, "you." His CRS task only included cultural actors, the student and his family.

Most PSTs struggled to incorporate cultural backdrops into primary mathematics activities when creating tasks for their students. Seven PSTs provided at least one cultural component in their cultural backdrops for their CRS tasks; however, most of these did not link their primary activities to their cultural scenarios. Brian and Javi (see Table 9) only provided a cultural actor and, therefore, were unable to manufacture a cultural mathematical activity around this singular detail. Angela (see Table 5), Henry, and Micah provided at least two cultural components in the cultural backdrops, and all of these PSTs used traveling as their cultural mathematical activity. Faith (see Table 6) provided all three cultural components in her cultural backdrop; however, her mathematics activity involved a practice her student did not mention in the interview, namely weighing her Christmas presents.

Only Keenan (see Table 10) created primary mathematical activities that integrated his cultural backdrops for both the CRP and CRS tasks.

Table 10

Keenan's CRP and CRS Tasks

PST	CRP Task	CRS Task
Keenan	Jaleel accompanied his grandfather to church one Sunday morning. While at church, he notices that approximately 33% of the congregation give verbal confirmations to the pastor whenever he makes a good point. Today, there are 396 people in attendance at church today. About how many people will there be to give the pastor verbal confirmations whenever he makes a good point?	Beye's mother is preparing puff puffs for her children. She only makes puff puffs for the children who have come in from playing. The children, on average, eat 12 puff puffs each. There were 4 children present, but one left, then 2 arrived. How many puff puffs will Beye's mother have to prepare for her children?

Keenan, an African American, is the only PST who shared a racial background with a minority student, an African. Upon further examination of Keenan's task and his student interview, I discovered that even he did not fully transfer cultural details from the interview to the task. When Keenan described puff puffs, a fried pastry he thought the student ate, he [the student] agreed that this was "basically" what his family enjoyed on Christmas. Thus, Keenan fell short of accurately incorporating cultural details into the task he created for this student because he did not clarify with the student whether the fried pastry truly was a puff puff as he assumed or if it was something else.

Appropriate use of culturally significant details in cultural contexts. As seen in Keenan's case, it is important to understand how students' cultural details were translated into the cultural contexts of the tasks. I aimed to discern if PSTs used details in the ways that were *intended by the students*. I wondered if PSTs altered student meaning by adding details to or omitting details from student narratives. I used the Word Problems Distortion rubric for this

analysis. With one exception (Angela), all of the PSTs who provided student interviews for comparison to their tasks distorted student narratives by adding details not found in student interviews. In her CRS task (see Table 5), Angela only included cultural actors, traditions, and activities reported to her by her student.

Adding PST-derived details. There was an inconsistency with which PSTs' added cultural details. Henry added cultural actors. In Henry's interview of his student, the student did not mention the names of any visiting relatives. However, Henry created names of the students' relatives for his task.

Table 11

Henry's CRS Task

PST	CRS Task
Henry	Devonte's family has a big celebration on Christmas Eve at his house. While most of the family doesn't travel far for the occasion, his Uncle Dave travels from State 2 and his Aunt Lisa travels from State 3. If Uncle Dave travels 90 miles east and 150 miles south and Aunt Lisa travels 75 miles west and 164 miles south to get to his house, which person lives the furthest? (Hint: Use what you know about right triangles.)

Eli and Keenan (see Table 10) added cultural artifacts or traditions to their tasks. Again, in Keenan's interview of his student, the student did not explicitly state that puff puffs was a cultural dish his family enjoyed. Faith (see Table 6) and Micah (see Table 12) added cultural activities.

Omitting student-derived details. PSTs providing student interviews were less likely to remove than add details surrounding students' narratives. Only 3 of the 7 PSTs who submitted student interviews were identified as omitting significant cultural details from their CRS tasks. Eli omitted a culturally significant actor. He wrote a task about two football teams playing each other. However, in the interview, the student stated, "I like to play football with my friends and I

play with my mom because my mom likes to play with me." Therefore, the PST omitted the cultural actors the student provided that gave meaning to playing football. Finally, Keenan (see Table 10) and Micah (see Table 12) omitted traditions.

Table 12

Micah's CRS Task

PST	CRS Task
Micah	Paul George, from the Indiana Pacers, and Eddie Murphy, an actor and comedian, decide to play one another in a game of basketball. They decide to meet each other at the *College 1* to play each other. If Paul is traveling from *City 3* to *City 4*, which is approximately 868 miles, at a rate of 60 miles per hour, how long will it take him to get to *City 4*? If Eddie Murphy is traveling from *City 5* to *City 4*, which is approximately 2,412 miles, at a rate of 70 miles per hour, how long will it take him to reach Gainesville?

Micah's student reported that he went to "City 4" to attend family reunions. However, in the CRS task, he describes two of the students' role models traveling to City 4 to play basketball. Thus, the tradition the student articulated is misaligned with the context Micah created in his CRS task. There was no clear pattern between those supplementing student narratives and those subtracting from them.

PST Reports of the Challenges of Placing Culture and Mathematics in Culturally Responsive Mathematics Tasks

The three interviewed PSTs, Micah, Carmel, and Keenan, successfully created culturally responsive tasks for themselves. However, they were less capable of creating culturally relevant tasks for their students due to their [PSTs'] limited knowledge of their students or their limited experience creating rich or varied word problems.

Micah. Micah included several cultural details from his student interview in his CRS task, such as cultural role models, a location in a state the student mentioned, and basketball, a personal and cultural activity. However, the assembly of the cultural elements in his CRS task indicated that Micah had difficulty creating a task truly reflective of his student's experience.

Micah: Okay. What type of things do you like to do outside of school or on the weekends?

Student: Play ball, basketball and go to the mall.

M: Does your family have a special activity they do or are there special trips they take?

S: Every year we go to Florida.

Micah also gathered details about the student's role models.

M: Who are your role models?

S: Like famous people?

M: Like famous people. Could be people from family. Just give me three.

S: My dad, Eddie Murphy, and Paul George

M: So, why do you admire your dad?

S: 'Cause he's one of the smartest dudes I know. He is like… He's a good father. Not a lot of African American kids grow up with a father, so it's good that he's still around. And he teaches more like than a teacher could teach me. And he just tell it how it is.

M: What does your dad do?

S: He's, um…he owns a trucking business.

M: Alright. What about Eddie Murphy? Why Eddie Murphy?

S: It's just how he carry himself…with all the money, he's still loyal to family.

M: So why Paul George?

S: The same thing. He's just like the role model type.

M: If you wanted to be a basketball player, who would you want to be?

S: Paul George.

M: How about Eddie Murphy as far as him being a comic.

S: Like his jokes be dirty sometimes but he just funny…like I don't know. Like he's naturally funny. And when he talk fast, it makes you like want to keep up.

Although Micah identified details that were meaningful to his student, the details in Micah's task were unrelated and, therefore, unreflective of his student's cultural experience when randomly combined in a mathematics task.

Also, Micah missed an opportunity to write a task about a cultural actor in the student's immediate community who the student clearly indicated was an individual he respects, his father. The student praised his father for his intelligence, his parental skills, physical presence, teaching skills, and ability to "tell it how it is." The student also shared that his father owns a trucking business. It is possible that Micah committed $Significance\ Distortion^{-}$, as it seems that he may have distorted the significance his student placed on cultural actors he [student] provided. By giving his father the greatest amount of glowing details, the student seemed to indicate that his father was the most important figure in his life. The student clearly highlighted his father but the Micah ignored the relevance of these details to the student.

In addition to the composition of cultural details in the backdrop of his CRS task, Micah's primary mathematical activity is of interest. Micah stated that he chose to use a traveling

context for his primary mathematical activity of his CRS task because it was challenging to think of an appropriate context and the driving scenario was one with which he was familiar.

Tisa: I was wondering about your rationale for choosing traveling as a larger context for your math word problem. What were you thinking?

Micah: Oh. It was the Car A, Car B problem.

T: Eddie Murphy and a basketball player were getting together to play basketball at...

M: Florida or something like that...

T: Yeah! Why did you choose driving as the larger context?

M: I just kind of remembered in Physics class it'd be like, "Car A is traveling this far and car B..." Honestly, it wasn't easy to think of a problem. Creating problems is hard. It's not easy.

Therefore, it was not necessarily that Micah lacked a desire to link the primary mathematics activity to the cultural backdrop in his task, but rather, he had difficulty thinking of mathematics processes related to his student's cultural information. Because of his struggles, he resorted to using a fail-safe primary mathematical activity from his high school education involving cars traveling from one location to another.

Carmel. Carmel created a CRS task devoid of specific cultural details the student mentioned in his interview. She could have written a task about the student's mother's Halloween themed wedding or his participation in a vacation Bible study. However, Carmel expressed that her limited understanding of her student's experiences influenced her decision to disregard these details and instead write a general task involving driving as a primary mathematical activity. According to Carmel, this was "the safest path."

Tisa: In the word problem itself, you talk about [traveling]. . . . What influenced the [primary mathematical] path that you took?

Carmel: I think it was kind of the lack of details to kind of create a story. Here [her CRP task] I was able to create a story much better because I know myself. I know my traditions a lot more. Whereas, in this situation, I didn't really know all of the details so I was just trying to kind of grasp on to what I could. I knew they were traveling for this like family get-together and the get-together was a big deal every year. . . . Given the Halloween situation, I didn't know how I could relate that at all mathematically. I couldn't really think of a situation in which I could use that information. And with the vacation Bible study, I didn't even know what was really going on. I didn't have enough information to write anything on it because I was just so unfamiliar. So I kind of just went with what felt like the safest path.

T: What would you consider the safest path?

C: Things that I know the most about. Things that I have the most information for and was able to see some mathematical relation.

T: So [in] the driving context you could see the math? Was it a context that you were familiar with or. . . ?

C: I mean, yeah, I'm familiar with having to drive down all the way there, so I had enough information. I could see there were numbers involved. If I thought longer on the Halloween situation, I might have been able to figure something out. Maybe talk about like the pricing of like the wedding…have it themed towards that, but I didn't really feel like I had enough information to kind of write

> something that actually had more of a story…rather than have it one sentence, "Oh, it was Halloween." And nothing else relates.

Carmel spoke of the relative ease with which she could create a culturally responsive mathematics task for herself because of her intimate knowledge her own personal and cultural details. In contrast, Carmel felt limited by the lack of personal and cultural details she was able to obtain in the student interview and her ignorance of the cultural contexts her student provided. Carmel, who is Jewish, said she was too unfamiliar with the student's Christian vacation Bible study experience to create a task involving these details. Carmel stated that she was also unfamiliar with the student's mother's experience of being married at a Halloween themed wedding; therefore, she could not easily conceive mathematics processes that would be appropriate for this cultural backdrop. Still, Carmel acknowledged that she might have been able to write a problem involving the Halloween themed wedding if she "thought longer." Carmel even gave an example of the primary mathematical activity she would use involving calculating the cost of the wedding. Carmel noted that she did not choose to write her CRS task about the Halloween themed wedding because she was hesitant to write a word problem with a single cultural detail that was unrelated to the rest of the task. In specific, she stated she didn't want to write, "Oh, it was Halloween" if "nothing else relates."

Ultimately, Carmel did not "grasp" onto enough details to create a task that reflects her student's experience. Carmel's CRP task, which is rich in cultural details, stands in stark contrast to her CRS task, which lacks distinguishably cultural components. To circumvent her lack of familiarity with the student's culturally significant details, Carmel took "what felt like the safest path," namely writing about what she is most familiar with and can clearly see is connected to mathematical processes.

Carmel attributed her difficulty in drawing out personal and cultural details from her student to the limited opportunities she had to build relationships with him.

T: In your reflection for the culturally responsive-to-self task, you wrote, "I would ask them", meaning the students, "about family traditions, what types of activities they do, who participates, what they do, how they do it, and it would be tailored around the specific activity." … Were you able to do those things in your [student] interview?

C: No. I don't think I was able to get a good enough picture. I think it was really difficult to …I know it wasn't difficult to ask the right questions, but it was difficult to get the responses I wanted out of the kids. I only got to see them like once a week every other week. So, we didn't build up a relationship so that they wanted to talk so much about it and they'd much rather than answering my questions be working on something or playing a game or hanging out with their friends there.

According to Carmel, she would need more than the twice-a-month interactions she had with the student to develop a meaningful relationship that would allow the student to open up to her and divulge the kind of personal and cultural information she sought for her task. Carmel reported that she could sense that her student would have preferred engaging in other activities over being interviewed.

I learned more about some of the environmental factors at the CI site that hindered Carmel from obtaining her student's details when I asked her about why she hadn't pursued her inquiries about her student's mother's Halloween themed wedding or the student's time in vacation Bible study.

T: I was curious. You could have [asked about] the Halloween [wedding] to gather some cultural information. Was there something that stopped you from digging into that?

C: He didn't really seem very interested. The more I asked, the more the student was looking around, getting distracted by what was around him, so he just didn't seem very interested to talk more about it.

T: Was that similar to what happened in the vacation Bible study discussion?

C: Yeah. The room was very distracting. We were in the 8th grade room. Everybody else around was playing games and talking. So it was a really distracting environment to ask any of these questions. He didn't seem really interested in talking about it.

Thus, Carmel attempted to gather cultural details; however, she ultimately responded to what she perceived as unspoken messages from the student indicating a lack of interest in the interview.

Keenan. Keenan provided a CRS task that included, albeit inaccurately, the student's cultural elements. Keenan reported that he had sufficient time to develop a meaningful relationship with his student to gather cultural details for his CRS task. On the days he was not doing his CI requirement, Keenan worked at the CI site. Keenan's work schedule allowed him to interact with his student at least three times each week. Despite his relatively frequent interactions with the student, Keenan demonstrated an incomplete understanding of his student's personal and cultural details that may have influenced his decision to alter these details when he wrote the cultural backdrop for his CRS task. For instance, Keenan wrote of the student's mother making puff puffs for children who are coming in from play and, in doing so, Keenan may have

inappropriately projected a cultural artifact onto his student's experience that he had learned about in discussion with another African student.

Keenan: What does a Christmas celebration look like to your family?

Student: Well, Christmas Eve, we usually eat at my house or my uncle's house or my, um, my mom's dad's son's house. We eat on Christmas Eve. Sometimes we sleep over there until Christmas, but it's usually on Christmas Eve.

K: What do y'all eat? What kinds of food do you make?

S: We got the…It's like this dough and then they put it…they fry it. And then they wait until it turns golden brown.

K: So is it like a puff puff?

S: Yeah. Basically.

The student did not explicitly state that the pastry Keenan described to him was the same as that enjoyed by those in his culture, but rather that the pastries are "basically" the same. In his post-learning segment interview, Keenan articulated why he asked his student about this particular pastry.

K: I learned about puff puffs about 2 or 3 days before [the student interview] from another African student. I'm like okay is that just you or is that multiple African students. So when I asked him...and I asked his sister later...and they face kind of lit up like..."Where they at? You got some?" So I'm guessing it's common. I mean two people...two different people is not enough...but...

Keenan viewed his student's cultural "artifact" through his own lens and that of another African student—who may or may not have been from the same country or tribe. Therefore, this cultural "artifact" may be unrepresentative of the student's cultural experiences.

Another way Keenan may have changed contextual details in his CRS task involved the Christmas tradition, which included the consumption of a puff puff-like pastry. The student indicated to Keenan that the fried pastry was eaten during a Christmas celebration, but in Keenan's word problem the dish is being prepared for playing children. According to Keenan, this change in activity was a subconscious decision.

Tisa: You got that information [on the cultural "artifact"] from the student talking about a Christmas celebration. So, I was curious as to why you changed your context for your word problem to playing outside. Why did you go from [celebrating] Christmas to playing?

K: Um, I don't know. I don't think that was a conscious thing that I went from Christmas to playing….I think in the interview I was trying to learn more about the culture. I found out that they were Christian and that they celebrate Christmas and so I wanted to see how their Christmas differed from mine. I think I was just trying to incorporate something I found out in the interview into a problem.

In an attempt to insert cultural details, Keenan did not fully reflect on how they were being used by the student, and in the process of interpreting student details, he distorted the student's narrative by changing the context for the eating of the cultural "artifact."

Interestingly, Keenan argued that those outside his culture must pay attention to context to understand the African American experience. When asked about what information is necessary for understanding him or African American students in K-12 settings, Keenan emphasized that outsiders must have a strong grasp of contextual details.

K: Context. I think that would be necessary in order to give an outsider the understanding.

T: What do you mean by that? What type of contextual details are necessary?

K: So, maybe like in a church thing why people shout so much. From the outside looking in, from the outside it might just look like people like to interrupt or like they may just like to be noisy or something. Going a little deeper into it, giving some contextual details, some people just experience personal, personal problems that you know once they...moving past it, they can't help but be vocal about how they feeling….The fact that it's so welcomed. It's welcomed in our church. It's not seen as unruly. The fact that it's welcome, there is another contextual detail.

According to Keenan, a foreigner to his African American culture must seek a deeper understanding of cultural actors, artifacts and traditions, and activities. In addition to knowing what is occurring in a cultural setting, they must also seek to know its history or why it is occurring.

Conclusions

I found that most PSTs who experienced learning segment on cultural responsiveness and interacted with culturally different students, to some extent, could make emergent connections (Turner et al., 2012). PSTs could draw on cultural actors, artifacts or traditions, and activities in the tasks they created for themselves and for students who they interviewed and interacted with on multiple occasions. Although PSTs could place cultural details into tasks, they struggled more with incorporating cultural backdrops into primary activities in the tasks created for their students than for those created for themselves. That is, they were less likely to make meaningful connections (Turner et al., 2012) in tasks created for their students. Additionally, most PSTs distorted the narratives provided by the students by adding or omitting details.

PSTs faced multiple challenges when constructing culturally responsive tasks for their students, including limited knowledge of students and limited experience creating rich or varied mathematics problems. All of the interviewed PSTs also lacked experience drawing out culturally significant contexts in their student interviews. In Micah's case, the student offered culturally significant details but it seemed that Micah may have had limited experience identifying them as such.

Discussion

Rubel and Chu (2012) found that in-service teachers and Turner et al. (2012) found that PSTs have had mixed results incorporating students' cultural details into tasks after experiencing cultural training. In this investigation, after a learning segment on culturally responsive teaching and cultural immersion at a site with lower income and minority students, some PSTs privileged student voice though the use of students' cultural details, others did not incorporate student-expressed details into tasks, opting instead to create "gray"[6] word problems.

There are several possible reasons for this choice. First, I discovered from my interviews of PSTs that some may have felt they had insufficient details about or inadequate knowledge of students' personal and cultural components to factor them into a word problem. Carmel articulated this in her post-learning segment interview when she stated that she knew too little about a Halloween themed wedding and vacation Bible study to create a word problem for her student. Her inexperience as an interviewer made it difficult for her to draw out student details and to extract the significance of the details she was able to obtain. PSTs like Carmel might have benefited from conducting a second interview to clarify student details. PSTs may also have required interview training beyond what was offered in the LS. I showed PSTs a video of me

[6] A secondary student who was a part of the dissertation investigation used this term to indicate tasks that are devoid of explicitly cultural details.

using the Interview Protocol (see Appendix O) with African American secondary students, and, prior to gathering cultural details from students, PSTs conducted a separate introductory interview of their students regarding their perceptions of their mathematics education. However, the modeling and practice may have been insufficient for PSTs to develop skills to ask clarifying questions about students' personal and cultural contexts that they did not fully comprehend. Second, PSTs may have needed student assistance to identify the most culturally significant details. Micah's student expressed how important his father is to him, yet Micah chose to write a task about other cultural actors the student had mentioned. Although Micah completed the assignment to incorporate student cultural details into a mathematics task, he may have fell short of incorporating the most significant (and meaningful) cultural details into the task. In the gathering of cultural details, the PSTs may have benefitted from having students identify their most meaningful cultural details, as opposed to having them identify some general cultural details that are pertinent to their experience. Third, PSTs may have needed more opportunities to strengthen relationships with the interviewed students to make students feel comfortable sharing (Turner et al., 2012), especially when there are distractions in the immediate interview environment competing for students' attention. Either PSTs needed to spend more time with specific culturally different students, as Carmel desired, or they needed to spend time growing their knowledge of culturally different students, in general, as Keenan had. Keenan's CRS task reveals that even he would have benefited from a time investment in increasing his understanding of his African student's cultural experience.

It is noteworthy that all PSTs, regardless of their ethnic, cultural, or racial background, struggled to privilege students' *authentic cultural* voices in the CRS tasks. Both Gay's (2002) Culturally Responsive Teaching Model and Critical Race Theory (Ladson-Billings & Tate, 1995)

emphasize the centrality of minority students' experiences in their education and liberation. Furthermore, Hefflin and Barksdale-Ladd (2001) argued that personal and cultural details about minorities must be placed in authentic contexts that students can relate to and understand. Therefore, it is insufficient that PSTs create tasks that include student details, but they must also assemble cultural components in ways that reflect the meaningful experiences of their minority students.

That PSTs struggled to create *cultural* contexts for their students is evident when contrasting the linkages between the cultural backdrops and the primary mathematics activities in the tasks PSTs created for themselves and those in tasks created for their students. PSTs were five times more likely to incorporate their primary mathematics activities in tasks for themselves than for students. As Micah suggested in his post-learning segment interview, the differing performance may be due to PSTs' limited experience creating rich or varied tasks. Both Micah and Carmel expressed resorting to "safe" primary mathematics activities, having no cultural relevance to the cultural scenario they created for their task but mimicking mathematics contexts familiar to them [PSTs]. Carmel articulated another possible reason PSTs had greater success integrating primary mathematics activities into their cultural backdrops in their own tasks:

> I was able to create a story much better because I know myself. I know my traditions a lot more. Whereas, in this situation, I didn't really know all of the details so I was just trying to kind of grasp on to what I could.

Like Carmel, PSTs may have been hesitant to artificially manufacture cultural primary mathematics activities given the limited amount of cultural details obtained from students.

That PSTs struggled to create *authentic cultural* contexts is evident in their distortion of student details in the cultural backdrops of student tasks. With one exception, PSTs

supplemented their CRS tasks with their own details. Henry, for instance added cultural actors, Uncle Dave and Aunt Lisa, that, because of name choice, may be irrelevant to the student he interviewed. Keenan introduced a cultural artifact whose ingredients and preparation may differ from puff puffs and, therefore, may not carry the same cultural meaning for his African student. PSTs were less likely to omit relevant student-derived details from CRS tasks. Eli omitted a cultural actor, the student's mother, and Keenan changed the cultural tradition for the consumption of the cultural "artifact." Through their choices, both PSTs changed the significance of these cultural contexts to students. In all of the described cases, the PST served as a filter for students' cultural components, resulting in tasks that are inauthentic to students and unreflective of their cultural experiences. It is possible that PSTs' narrative distortions automatically led to significance distortions. However, this is difficult to determine without confirmation from the students for whom tasks were written.

The purpose of the learning segment and cultural immersion was to equip PSTs with the knowledge and tools to create curricular mirrors (Style, 1998) for African American and Latin@ students to increase minority student participation in school (Altieri, 1993; Hefflin, 2002; Heflin & Barksdale-Ladd, 2001; Tatum, 2006). However, with one exception, PSTs, regardless of their or their students' cultural backgrounds, created "funhouse" mirrors for their students, as students could likely see the semblance of particular personal or cultural details but the images of these details are distorted as they are filtered through the lenses of the PSTs.

Limitations

This investigation had some limitations. Although I desired to measure the significance students assigned to their cultural contexts, PSTs were not afforded opportunities to do follow-up interviews of students or to show students their CRS tasks to determine if the task contexts

meaningfully reflected students' experiences. PSTs' inexperience interviewing students likely also contributed to the difficulty in identifying the significance students assigned their cultural details. In short, due to the design of my study, in most cases, I could not definitively determine how, or if, PSTs altered the significance of student-derived details. I originally thought that three weeks of cultural training was sufficient for preparing PSTs to create culturally responsive mathematics tasks. However, we were unable to examine any of the topics presented in the cultural learning segment in enough depth to fully prepare teachers to create culturally responsive mathematics tasks.

Implications

Past researchers (Rubel & Chu, 2012; Turner et al., 2012) have found that some in-service or prospective-teachers struggle to create culturally responsive tasks for their students. However, they didn't identify if teachers generally struggled to create critically responsive tasks or if they particularly struggled to create tasks for student with culturally different backgrounds. Because I compared culturally responsive tasks PSTs created for themselves with those created for students, I discovered that PST could incorporate cultural details into the cultural backdrop of mathematic task, and they could also incorporate these details into the primary mathematics activity in culturally meaningful ways. Also, through the interviews I conducted with PSTs, I uncovered the difficulties they perceived in creating tasks for cultural others in comparison to the challenges faced in creating tasks for themselves. My findings have implications to teacher education and to research.

Because the culturally responsive tasks were submitted by PSTs at the end of the cultural learning segment, PSTs were not afforded opportunities to further reflect on (either by themselves, with their students, or with their mathematics educator or fellow PSTs) or revise

their tasks. This process is necessary to prepare PSTs to become culturally responsive teachers. Teacher education programs must provide PSTs opportunities to reflect on their culture to gain a clear sense of what it is to them. Then, they must provide PSTs opportunities to consider how culture might appear to cultural others. Next, PSTs need time to contemplate frameworks that account for the needs of culturally different students or supports for translating the frameworks into practical terms. Additionally, they need time immersed in their own mathematics education community of practice sharing and critiquing their CRP and CRS tasks as they engage in critical dialog about what it means to teach a cultural other. During this time, majority PSTs might have learned more about the perspectives and experiences of minority PSTs. In turn, this dialog might enhance understanding of culturally different students and their significant contexts. Teacher education programs need to provide an adequate amount of in-class time for PSTs to discuss and process cultural information. They may need to provide multiple cultural trainings over time as PSTs become more competent in their abilities, such as task or lesson development and implementation.

In this investigation, PSTs' filtered students' personal and cultural details through their own lenses, leading them to distort the cultural contexts communicated to them by students. Teacher education programs must play a key role in disrupting this cycle. Once PSTs have gathered students' cultural experiences, teacher education programs must put them in communication with critical friends. Costa & Kallick (1993) stated a critical friend is:

> a trusted person who asks provocative questions, provides data to be examined through another lens, and offers critiques of a person's work as a friend. A critical friend takes the time to fully understand the context of the work presented and the outcomes that the

person or group is working toward. The friend is an advocate for the success of that work. (p. 50)

PSTs who are creating culturally responsive tasks require critical friends who are members of students' communities and have knowledge of the minority students' personal and cultural details. Critical friends may help PSTs understand, as Keenan described, the perspective of an insider. Moreover, critical friends may provide PSTs historical and social or sociopolitical contexts for understanding the students' experience.

PST performance on their CRS tasks point to areas for further research. More research is necessary on professional development-cultural immersion that successfully grows PSTs' knowledge of culturally different students and reduces fear of their communities. Without such training, it is possible that PSTs will rely on previously held beliefs (or stereotypes) of culturally different students and may leave the current Eurocentric mathematics curriculum unchanged. Additionally, mathematics education researchers must work towards establishing clearer criteria for culturally responsive written mathematics curriculum. Because there is a limited amount of research on culturally responsive mathematics instruction (Turner et al., 2012), there is a corresponding limited amount of studies on criteria for such culturally appropriate tasks. Yet, additional stakeholders' voices must be heard. Although researchers and educators will contribute, central to this discussion must be the cultural minority students for whom the problems are being constructed, as well as minority stakeholders within their communities.

References

Aguirre, J. M., Turner, E. E., Bartell, T. G., Kalinec-Craig, C., Foote, M. Q., McDuffiee, A. R., Drake, C. (2012). Making connections in practice: How prospective elementary teachers connect to children's mathematical thinking and community funds of knowledge in instruction. *Journal of Teacher Education, 64*, 178–192. doi:10.1177/0022487112466900

Altieri, J. L. (1993). African-American stories and literary responses: Does a child's ethnicity affect the focus of a response? *Reading Horizons, 33*(3), 236–244.

August, D., & Shanahan, T. (Eds.). (2006). *Developing literacy in second-language learners: Report of the National Literacy Panel on language minority children and youth.* Mahwah, NJ: Lawrence Erlbaum.

Baker, F. (1989). How can you have experiential learning without experiential teaching? *Teacher Education Quarterly*, *16*(3), 35–43.

Banks, J. A. (2003). *Teaching strategies for ethnic studies* (7th ed.). Boston, MA: Allyn & Bacon.

Bell, D. (1980). Brown v. Board and the interest-convergence dilemma. *Harvard Law Review*, *93*, 518–584. doi: 10.2307/1340546

Bergen, T. J., Jr. (1989). Needed: A radical design for teacher education. *Teacher Education Quarterly, 16*(1), 73–79.

Cajete, G. (1994). *Look to the mountain: An ecology of indigenous education*. Durango, CO: Kavaki Press.

Cleary, L. M., & Peacock, T. D. (1998). *Collected wisdom: American Indian education*. Boston, MA: Allyn and Bacon.

Cook-Sather, A. (2015). Addressing the question of authenticity in middle grades student voice work: Wrestling with politics, power, and purpose in education. *Middle Grades Review, 1*(2), 1–10.

Costa, A. L., & Kallick, B. (1993). Through the lens of a critical friend. *Educational Leadership, 51(2),* 49–51.

Delgado, R. (Ed.). (1995). *Critical race theory: The cutting edge*. Philadelphia, PA: Temple University Press.

Del Rosario, M. M. (2016). *Simbang Gabi: A brief explanation of the Filapino Christmas tradition*. Retrieved from https://holidappy.com/holidays/Filipino-Christmas-Tradition-Simbang-Gabi

Ergun, A., & Erdemir, A. (2010). Negotiating insider and outsider identities in the field: ''Insider'' in a foreign land; ''Outsider'' in one's own land. *Field Methods, 22*, 16–38. doi: 10.1177/1525822X09349919

Frison, S., Wallander, J., & Browne, D. (1998). Cultural factors enhancing resiliency and protecting against maladjustment in African American adolescents with mild retardation. *American Journal on Mental Retardation, 102*, 613–626. doi: 10.1352/0895-8017(1998)102<0613:CFERAP>2.0.CO;2

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). New York, NY: Teachers College Press.

Gilliland, H. (1992). *Teaching the Native American* (2nd ed.). Dubuque, IA: Kendell/Hunt Publishing.

Ginsberg, M. (2005). Cultural diversity, motivation, and differentiation. *Theory into Practice*, *44*, 218–225. doi: 10.1207/s15430421tip4403_6

Greenberg, J. B. (1989, April). Funds of knowledge: Historical constitution, social distribution, and transmission. Paper presented at the *Annual Meeting of the Society for Applied Anthropology*, Santa Fe, N.M.

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*, 37–53. doi:10.2307/30034699

Gutstein, E., Lipman, P., Hernandez, P., & de los Reyes, R. (1997). Culturally relevant mathematics teaching in a Mexican American context. *Journal for Research in Mathematics Education, 28*, 709–737. doi:10.2307/749639

Hefflin, B. R. (2002). Learning to develop culturally relevant pedagogy: A lesson about cornrowed lives. *The Urban Review, 34*, 231–250.

Hefflin, B. R., & Barksdale-Ladd, M. A. (2001). African American children's literature that helps students find themselves: Selection guidelines for grades K-3. *The Reading Teacher, 54*, 810–819. doi: 10.1023/A:1020603323594

Herron, J., & Barta, J. (2009). Culturally relevant word problems in second grade: What are the effects? *The Journal of Mathematics and Culture, 4*(1), 23–49.

Hong, Y.-Y. (2009). A dynamic constructivist approach to culture: Moving from describing culture to explaining culture. In R. S. Wyer, C.-Y. Chiu, & Y.-Y. Hong (Eds.), *Understanding culture: Theory, research and application* (pp. 3–23). New York, NY: Psychology Press.

Kea, C., Campbell-Whatley, G. D., & Richards, H. V. (2006). *Becoming culturally responsive educators: Rethinking teacher education pedagogy* (practitioner brief series). Tempe, AZ: National Center for Culturally Responsive Educational Systems.

Ladson-Billing, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*, 465–491. doi: 10.3102/00028312032003465

Ladson-Billings, G. (2001). *Crossing over to Canaan: The journey of new teachers in diverse classrooms*. San Francisco, CA: Jossey-Bass.

Ladson-Billings, G. (2007). Culturally responsive teaching: Theory and practice. In J. A. Banks & C. A. McGee-Banks (Eds.), *Multicultural education: Issues and perspectives* (6th ed.) (pp. 221–245). Hoboken, NJ: John Wiley & Sons.

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American students* (2nd ed.). San Francisco, CA: Jossey-Bass.

Ladson-Billings, G., & Tate, W. F. (1995). Toward a critical race theory of education. *Teachers College Record, 97*, 47–68.

Mahan, J. M., & Rains, F. V. (1990). Inservice teachers expand their cultural knowledge and approaches through practica in American Indian communities. *Journal of American Indian Education, 29*(2), 11–23.

Martin, D. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking & Learning, 8*, 197–229. doi: 10.1207/s15327833mtl0803_2

Matsuda, M., Lawrence, C., Delgado, R., & Crenshaw, K. (Eds.). (1993). *Words that wound: Critical race theory, assaultive speech, and the first amendment*. Boulder, CO: Westview Press.

Moll, L., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice, 31*, 132–141. doi:10.1080/00405849209543534

Moses, R. P., Kami, M., Swap, S. M. & Howard, J. (1989). The Algebra Project: Organizing in the spirit of Ella. *Harvard Educational Review, 59*, 423–443. doi: 10.17763/haer.59.4.27402485mqv20582

Nasir, N. S. (2000). Points ain't everything: Emergent goals and average and percent understandings in the play of basketball among African American students. *Anthropology & Education Quarterly, 31*, 283–305. doi:10.1525/aeq.2000.31.3.283

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Nelson-Barber, S., & Estrin, E. (1995). *Culturally responsive mathematics and science education for Native American students*. San Francisco, CA: Far West Laboratories for Education Research and Development.

Nieto, J. (2006). The cultural plunge: Cultural immersion as a means of promoting self awareness and cultural sensitivity among student teachers. *Teacher Education Quarterly, 33*(1), 75–84.

Oakes, J. (1995). Two cities' tracking and within school segregation. *Teachers College Record, 96*, 681–690.

Olneck, M. R. (1995). Immigrants and education. In J. A. Banks & C. A. McGee-Banks (Eds.), *Handbook of research on multicultural education* (pp. 310–327). New York, NY: Macmillan.

Orosco, M. J., & O'Connor, R. (2013). Culturally responsive instruction for English language learners with learning disabilities. *Journal of Learning Disabilities. 47*, 515–531. doi:10.1177/0022219413476553

Parker, L., & Lynn, M. (2002). What's race got to do with it? Critical race theory's conflicts with and connections to qualitative research methodology and epistemology. *Qualitative Inquiry, 8*, 7–22. doi: 10.1177/107780040200800102

Ramsay-Jordan, N. (2017*). Examining the integration and use of culturally responsive mathematics pedagogy in preservice teacher reflections and practice: Implications for black children* (Unpublished doctoral dissertation). Georgia State University, Atlanta, Georgia.

Rubel, L. H., & Chu, H. (2012). Reinscribing urban: Teaching high school mathematics in low income, urban communities of color. *Journal of Mathematics Teacher Education, 15*, 39–52. doi:10.1007/s10857-011-9200-1

Ryan, B., & Simpson, M. D. (2016). *Physical appearance categorization activity.* Retrieved from http://breakingprejudice.org/teaching/group-activities/physical-appearance-categorization-activity/

Simbang Gabi. (2015). Retrieved from https://www.catholicsandcultures.org/philippines/christmas-epiphany/simbang-gabi

Sleeter, C. E., & Grant, C. A. (2010). Race, class, gender, and disability in the classroom. In J. A. Banks, & C. A. Mcgee-Banks (Eds.). *Multicultural education: Issues and perspectives* (7th ed.). New York, NY: Wiley.

Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practise. *Mathematics Teaching in the Middle School, 3,* 344–350.

Strategies for Promoting Culturally Responsive Classrooms in Alexandria City Public Schools. (n.d.). Retrieved from http://www.acps.k12.va.us/equity/strategies.pdf

Style, E. (1988). Curriculum as window and mirror. In M. Crocco (Ed.), *Listening for all voices: Gender balancing the school curriculum*. Summit, NJ: Oak Knoll School of the Holy Child.

Style, E. (1998). Curriculum as window and mirror. In C. Nelson & K. Wilson (Eds.), *Seeding the process of multicultural education* (pp. 149–156). Plymouth: Minnesota Inclusiveness Program.

Tapia, J. (1991). *Cultural reproduction: Funds of knowledge as survival strategies in the Mexican American community* (Unpublished dissertation). University of Arizona, Tucson.

Tate, W. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*, 166–173. doi:10.1080/00405849509543676

Tatum, A. W. (2006). Engaging African American males in reading. *Educational Leadership, 63*(5), 44.

Ten quick ways to analyze children's books for racism and sexism (n.d). Retrieved from http://cmascanada.ca/wp-content/uploads/2011/11/article-10-ways-to-analyze-childrens-books-for-sexism-and-racism.pdf

Thomas, O., Davidson, W., & McAdoo, H. (2008). An evaluation study of the Young Empowered Sisters (YES!) program: Promoting cultural assets among African American adolescent girls through a culturally relevant school-based intervention. *Journal of Black Psychology*, *34*, 281–308. doi:10.1177/0095798408314136

Trask, T. M. (2016). *Culturally responsive mathematics tasks: A dissertation proposal*. Unpublished manuscript, Department of Mathematics, Illinois State University, Normal, IL.

Trask, T. M. & Martin, T. S. (2015). *Culturally responsive mathematics tasks: A pilot study*. Unpublished manuscript, Department of Mathematics, Illinois State University, Normal, IL.

Turner, E. E. Drake, C., McDuffie, A. R., Aguire, J., Bartell, T. G., Foote, M. Q. (2012). Promoting equity in mathematics teacher preparation: A framework for advancing teacher learning of children's mutiple mathematics knowledge bases. *Journal of Mathematics Teacher Education, 15*, 67–82. doi: 10.1007/s10857-011-9196-6

Ukpokodu, O. N. (2004). The impact of shadowing culturally different students on preservice teachers' disposition towards diversity. *Multicultural Education, 12*(2), 19–28.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (2013). Enrollment and percentage distribution of enrollment in public elementary and secondary schools by race/ethnicity and region: Selected years, fall 1995 through fall 2023. Retrieved from http://nces.ed.gov/programs/digest/d13/tables/dt13_203.50.asp

Van Hamme, L. (1995). American Indian cultures and the classroom. *Journal of American Indian Education, 35*(2), 21–37.

Vélez-Ibáñez, C. G. (1988). Networks of exchange among Mexicans in the U. S. and Mexico: Local level mediating responses to national and international transformations. *Urban Anthropology, 17*, 27–51.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. Albany, NY: State University of New York Press.

Villegas, A. M., & Lucas, T. (2007). The culturally responsive teacher. *Educational Leadership, 64*(6), 28–33.

Wlodkowski, R., & Ginsberg, M. (1995). A framework for culturally responsive teaching. *Educational Leadership, 53*(1), 17–21.

CHAPTER III: PRESERVICE TEACHERS' CREATION OF AND BELIEFS ABOUT CRITICAL MATHEMATICS TASKS

Abstract

Critical mathematics tasks may assist teachers in exposing students to social justice issues. To create (and administer) these tasks, teachers must be aware of the concerns of disenfranchised students and their communities. Furthermore, teachers must be committed to growing students' sociocultural consciousness and to molding them into agents of change. In this study, I documented preservice teachers' attempts to create critical mathematics tasks for disenfranchised middle school-aged students at a cultural immersion site, as well as preservice teachers' beliefs about the tasks they created. Most preservice teachers identified a social justice issue in their tasks, but did not require students to question the fairness of the disparate treatment of the disenfranchised. Also, most tasks explicitly related to social class issues. Despite expressing critical consciousness and agency benefits, preservice teachers believed that their tasks were inappropriate for middle school-aged students because of the tasks' "uncomfortable" or "controversial" nature. The findings hold implications for teacher education programs and for mathematics education research on the preparation of critical educators.

Introduction

There have been many suggestions (and much debate) on best practices in the instruction of mathematics students (e.g., Dewey, 1906, 1966; National Council of Teachers of Mathematics (NCTM), 1989, 2000; Schoenfeld, 2004), including that of disenfrancised students. Through the 1970s, traditional mathematics education, with its focus on basic skills and procedures, was widely accepted (Schoenfeld, 2004). According to Freire (2000), through traditional education, schools employed a "banking model" of education. In the banking concept, the subject, the

teacher and possessor of knowledge, bestows knowledge upon the object, the student, an empty vessel. Freire (2000) described the banking model in the following way:

> The teacher talks about reality as if it were motionless, static, compartmentalized, and predictable. Or else he expounds on a topic completely alien to the existential experience of students. His task is to "fill" the students with the contents of his narrative—contents which are detached from reality, disconnected from the totality that engendered them and could give them significance. Words are emptied of their concreteness and become a hollow, alienated, and alienating verbosity. (p. 71)

Rittle-Johnson and Alibali (1999) found that traditional mathematics students were fairly competent in displaying procedural knowledge—they could memorize facts and procedures and repeat them. However, they struggled to show conceptual knowledge. Put another way, they had difficulty critically analyzing new, rich or complex mathematics content.

In the 1980s, reform mathematics emerged in response to these concerns of traditional mathematics and emphasized student development of both procedural and conceptual understandings of mathematics (Schoenfeld, 2014). With reform mathematics, teachers focus on student development of critical thinking skills (NCTM, 2000). Students are encouraged to communicate mathematics to their teacher and fellow classmates and to solve problems, demonstrating flexible understanding and seeking multiple entry points to problems. According to the NCTM (1989), these critical skills are gained, in part, through the use of real-world problems. The NCTM (2014) suggested, "An excellent mathematics program includes a curriculum that develops important mathematics along coherent learning progressions and develops connections among areas of mathematical study and between mathematics and the real

world" (p. 5). Therefore, the NCTM encouraged teachers to provide students tasks with scenarios and contexts that one might experience in life.

Towards Critical Mathematics

Reform mathematics presents students real scenarios for the purpose of providing opportunities to critically analyze mathematical content. However, Gutierrez (2002) observed that reform mathematics is lacking because it deprives students of opportunities to critically analyze social justice issues that impact the lives of disenfranchised students, such as lower income and minority students, and their communities. She noted, "I have seen very few reform materials that ask students to think critically about society or its major institutions" (p. 150). Murrell (1997) added, "Contemporary educational thought and policy neither take account of the cultural motifs of African Americans nor do they address the conditions of their subjugation in American society" (p. 26). Critical scholars have suggested that, in contrast to reform education, culturally responsive education fosters a sense of critical awareness necessary for all students to work towards a more just world. Culturally responsive teachers have high expectations for students, create a safe space for all students to embrace their cultural identities, gain cultural knowledge of students and their communities, and assist students in obtaining a critical consciousness to change their environment (Gay, 2000; Ladson-Billings, 1995; Villegas & Lucas, 2002).

Critical mathematics curriculum is a tool culturally responsive teachers use to aid students in critiquing social injustice (Frankenstein, 1990; Gutstein, 2003, 2005; Tate, 1995). Gutstein (2006) argued that analytical mathematics goals suggested by the NCTM—the development of problem solving and critical thinking skills—are aligned with critical mathematics goals, namely student development of higher order thinking skills for understanding

and communicating mathematics. However, unlike reform mathematics, critical mathematics politicizes task contents for the sake of empowering mathematics students.

There are two primary goals of critical mathematics: the development of (a) critical consciousness—acute awareness of social injustice and (b) critical agency—purposeful action to remedy unfair treatment of disenfranchised groups. Ayers (1998) argued that teaching for social justice "arouses students, engages them in a quest to identify obstacles to their full humanity, to their freedom and ends in action to move against those obstacles" (p. xvii). It is important to note that critical agency may take different forms dependent upon student characteristics, such as age. For instance, younger students may be limited in their abilities to influence social institutions; still, teachers can help them engage in meaningful critical reflection. According to Freire (2000),

> Action and reflection occur simultaneously. A critical analysis of reality may, however, reveal that a particular form of action is impossible or inappropriate at the present time. Those who, through reflection, perceive the infeasibility or inappropriateness of one or another form of action (which should accordingly be postponed or substituted) cannot thereby be accused of inaction. Critical reflection is action. (p. 128)

Thus, if students are too young to seek solutions to their disparate, and, perhaps, disadvantaged, experiences, teachers can still introduce critical mathematics curricula to spark critical discourse and reflection.

Preservice Teacher Beliefs about Critical Mathematics Education

Rokeach (1968) defined a belief as "any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase, 'I believe that…'" (p. 113). Hollingsworth (1989) noted that preexisting beliefs give meaning to preservice teacher [PST] preparatory experiences. She found that PSTs' "preprogram beliefs served as

filters for processing program content and making sense of classroom contexts" (Hollingsworth, 1989, p. 168). Brown (2004) and Pajares (1992) further found that it is difficult to alter PST beliefs. Pajares (1992) described PSTs as insiders who, because of their experience as students in schools, have knowledge of the trade and associated practices. He contrasted PSTs with other college students, such as architects, who are newly learning the profession. By Pajares' logic, PSTs' beliefs about acceptable behavior and practice are more cemented than architect majors' or those of other students because of PSTs' intimate knowledge of the norms of the classroom. Pajares (1992) argued,

> For insiders, changing conceptions is taxing and potentially threatening. These students have commitments to prior beliefs and efforts to accommodate new information and adjust existing beliefs can be nearly impossible. (p. 323)

Researchers have found that beliefs about instruction greatly influence practicing and prospective teachers' behaviors and practices (Hollingsworth, 1989; Pajares, 1992; Pohan, 1996). For this investigation it was important to understand the nature of PST beliefs about critical education because they may inform us of PSTs' future decisions to incorporate critical mathematics tasks into the curriculum. In their investigation, Price and Ball (1998) discovered that PSTs had difficulty accepting critical education ideas because of previously held beliefs about the nature of teaching and schooling. Researchers have found that mathematics PSTs, in particular, express reservations about incorporating critical education in their future classes (Bartell, 2006; Rodriguez, 2005). In her study of secondary mathematics PSTs, Bartell (2006) found that PSTs perceived that only after students have learned mathematics should they be allowed to use it to critically analyze issues of social justice. According to Bartell's PSTs, students could not grapple with mathematics content and social justice contexts simultaneously.

Rodriguez (2005) discovered that PSTs struggled to accept critical education as a viable option for teaching mathematics due to their "resistance to ideological change" (p. 5) and their "resistance to pedagogical change" (p. 7). That is, PSTs resist multicultural or critical education or they resist any idea that conflicts with their perceptions about teaching stemming from their experiences as learners. Taken together, mathematics PSTs' disposition toward utilizing critical education may be dictated by their pre-existing beliefs about the nature of teaching, in general, and particularly about disenfranchised students.

Teacher education programs are potential sites for challenging PST beliefs about the instruction of disenfranchised students; furthermore, teacher education programs can help develop PSTs' skills for critical education, such as creating critical mathematics curriculum, to teach and empower these students. However, Giroux and McLaren (1986) contended that teacher education programs give PSTs few opportunities to become critical educators (McLaren, 2003). In both of their investigations of teacher education programs, Edmundson (1990) and Goodlad (1990) found that PSTs were rarely engaged in meaningful or sustained discourse on critical issues. In particular, Edmundson (1990) reported, "In the majority of foundations courses that we observed, critical issues were dealt with superficially if at all" (p. 719).

Despite documented PST resistance to critical mathematics tasks, and because they have limited opportunities to be prepared as critical educators, we know little about how providing teachers the tools to see themselves as change agents might alter the curriculum they will use in their future classrooms or their perspectives on the appropriateness of critical mathematics tasks in schools. Gau (2005) is one of the few mathematics educators to investigate teacher preparation to construct and administer critical curricular materials. Gau's secondary mathematics in-service teachers participated in her 15-week graduate course. At the time of investigation, the teachers

were also participating in a district wide professional development on equity. For the class, teachers read and reflected on articles on teaching for social justice and created lesson plans on social justice issues. Gau formed two lesson plan groups: One group wrote tasks for students based on their online research of social justice issues. The other group based their critical tasks on accounts of disenfranchisement relayed to them from a one-time panel of minority high school students. The groups presented their social justice lesson plans to students, obtained feedback from Gau and their peers in the other group, and revised their lesson plans for re-administration to students. Gau found that students had difficulty fully engaging in the social justice component of teacher tasks because of how tasks were written and presented. Also, few teachers identified that a goal of social justice pedagogy is to teach mathematics. Moreover, teachers were uncomfortable broaching social justice tasks, preferring to present students tasks they [teachers] had more knowledge of or perceived as less controversial.

Rationale

From Gau's (2005) study, the research community learned that a one-time encounter with a panel of minority high school students was not enough to motivate teachers to want to reach beyond their comfort zone of familiar tasks or to feel compelled to broach what they perceived to be uncomfortable or potentially controversial social justice tasks. However, the research community did not learn whether a more extended personal encounter with students in a cultural immersion (CI) setting, where they interacted with students of different cultural backgrounds than teachers (Nieto, 2006), would have any effect on teachers' hesitancies to implement social justice tasks. Because a panel and readings may be considered arms-length encounters, it was plausible that the teachers in Gau's study were not personally affected enough to motivate a desire to change the circumstances of the disenfranchised students, by engaging them in critical

reflection about their circumstances. The study reported in this article continued where Gau left off by engaging teachers in such a CI experience and by focusing on a slightly more malleable population of preservice teachers. In addition, prior research (Gau, 2005) did not focus on the nature of the teacher-created social justice tasks themselves. It was not clear whether some teacher-created critical mathematics tasks might be more likely to facilitate the development of students' critical consciousness than others. I aimed to give a finer grained description of PST tasks about the extent to which tasks incorporated some critical components with the potential to grow students' critical consciousness. I felt this was important for identifying supports for PSTs according to their willingness (and possibly their abilities) to create critical mathematics tasks for disenfranchised students.

The purpose of this study was to investigate PST attempts to create critical mathematics tasks for disenfranchised students who they encountered repeatedly in a CI experience. Another goal was to investigate PST beliefs about the value and appropriateness of these tasks for disenfranchised students and for students in other groups. By Pajares' (1992) logic, these beliefs are important, as they are possible indicators of PSTs' future decisions to use critical mathematics tasks in instruction. The following questions were addressed:

1. To what extent do PST-created critical mathematics tasks have the potential to foster the development of critical consciousness of disenfranchised students, such as lower income and minority students, for whom they were developed? What type of social justice topics do PSTs include in their tasks?
2. What do PSTs report about the appropriateness and value of critical mathematics tasks?

Theoretical Framings

Critical Theorists question the nature of schools and other institutions that subjugate disenfranchised people (Gordon, 1995). Bourdieu (1973) and Bowles and Gintis (1976) argued that schools replicate social injustice and maintain social divisions found in our larger society. Thus, for disenfranchised students, schools block access to democratic participation in our society. Critical theorists shed light on inequitable situations and attempt to disrupt oppressive systems.

Paulo Freire, a prominent critical theorist, suggested that education should center on the political needs of the disenfranchised or oppressed who must play an active part in transforming their world (Jennings & Lynn, 2005). Freire (2000) described his emancipatory pedagogy as the "pedagogy of the oppressed" and stated it would be:

> forged with, not for, the oppressed (whether individuals or peoples) in the incessant struggle to regain their humanity. This pedagogy makes oppression and its causes objects of reflection by the oppressed, and from that reflection will come their necessary engagement in the struggle for liberation. And in the struggle this pedagogy will be made and remade. (p. 48)

Teachers must help oppressed students become literate to understand, critique, and transform their world. However, to do so, teachers must abandon the banking model of education in which students are merely recipients of knowledge. Students must be active participations in their liberation process as "critical co-investigators in dialog with the teacher" (Freire, 2000, p. 81) as they engage in a rich problem-solving curriculum to address concerns posed by disenfranchised students (Gutstein, 2003).

Critical mathematics theorists have adopted Freire's ideas and applied them to the field of mathematics. For instance, Skovsmose (1994) stated that students must have "matheracy," which is a "competence by means of which we are able to interpret and to understand features of our social reality" (p. 208). Frankenstein (1990), Gutstein (2003, 2005), and Tate (1995) have argued that students must have a strong grasp of mathematics concepts; they must gain mathematical literacy. Mathematical literacy, in turn, equips students to use mathematics to analyze and remediate social injustice. Frankenstein (1990), who focused on the development of matheracy through the use of statistical data, stated, "This critical understanding of numerical data thus prompts individuals to question taken-for-granted assumptions about how a society is structured and enables them to act from a more informed position on societal structures, and processes" (pp. 336–337). Thus, through the use of critical mathematics tasks, disenfranchised students may develop knowledge and tools to work towards achieving justice for themselves and members of their communities.

Like Critical Theory, Critical Race Theory questions hierarchies of power and systems of oppression. In particular, critical race theorists argue that race dictates the opportunities Americans are afforded (Delgado, 1995). For instance, theorists contend that racial minorities, such as African Americans and Latin@s, have different access to decision-making positions of power than their White counterparts. Moreover, critical race theorists argue that class disparities are often linked to race (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002). Critical race theorists analyze racial minority experiences through a political, social, and economic lens (Bell, 1980). Finally, critical race theorists critique Eurocentric U.S. structures, beliefs, and practices.

Critical race theorists center discourse on racial minority experiences (Ladson-Billing & Tate, 1995). To correct past injustices, confront current injustices, and moderate future inequities

critical race theorists: (a) squarely acknowledge the role of race and racism in minority experiences; (b) confront power and meritocratic, impartial, and color blind notions perpetuated by dominant institutions; (c) hold central the accounts and stories of the marginalized; (d) fight for social justice; and (e) place race and racism within a historical and cross-disciplinary context (Martin, 2006; Matsuda, Lawrence, Delgado, & Crenshaw, 1993). Critical analysis of disenfranchising structures liberates marginalized groups and transforms dominant groups. It validates the experiences of racial minorities and permits dominant group members to see racial minority experiences through the eyes of the disenfranchised.

Critical Theory informs this investigation, as PSTs created tasks to empower disenfranchised students with mathematics skills and knowledge for critical analysis of their unfair social circumstances. Moreover, these critical tasks are intended to make students feel empowered to effect change in their local or global communities. PSTs volunteered at a program consisting of mostly African American students. Thus, as suggested in Critical Race Theory, it was important for PSTs to consider the role race plays in minority students' experiences of disenfranchisement.

Methods

In the fall semester of 2016, PSTs participated in a 3-week learning segment on culturally responsive teaching (see Appendices F, G, H, I, J, and K), which was embedded in an introductory 16-week semester-long secondary mathematics education course meeting twice a week for 1 hour and 35 minutes per session at a large Midwestern university. The learning segment occurred in the 10^{th} through the 12^{th} week of the semester (see Figure 1). Over the 16-week course, the PSTs also had a 20-hour CI experience with lower income students who primarily also were African American, in an after-school informal education setting.

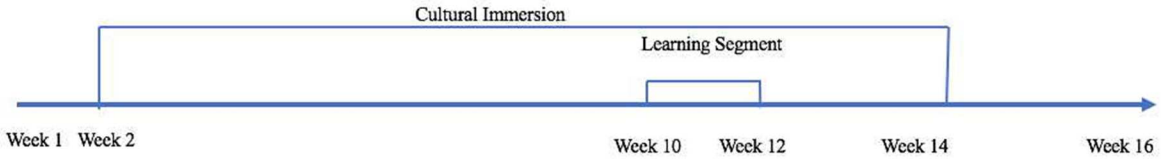

Figure 1. Timeline for cultural immersion and learning segment.

For the learning segment, PSTs created two mathematics tasks reflective of the experiences of the students at the CI site. In particular, PSTs created mathematics tasks using cultural details obtained in interviews of students at the CI site, and they created task on social justice issues they perceived these students and their community members face. Finally, PSTs created tasks reflective of their own experiences. The tasks and topics covered in the learning segment are provided in Figure 2.

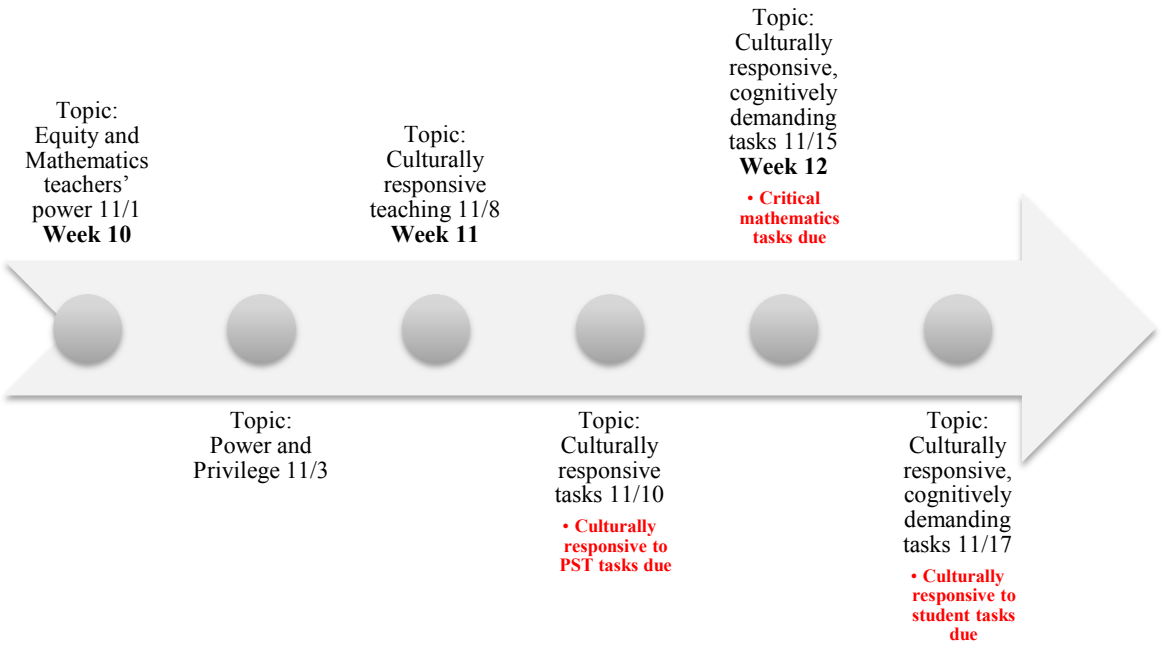

Figure 2. Learning segment topics and culturally responsive and critical mathematics tasks.

I conducted a case study with these PSTs. Stakes noted (1995),

> The real business of case study is particularization, not generalization. We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis is on understanding the case itself. (p. 8)

A case study is an in-depth examination of an actor or set of actors within a specific context. Emphasis is placed on the completeness of the observation and analysis and careful consideration is given to the details of the case. One objective of case study research is to provide rich contextualized information about the case. The researcher uses "thick description" (Geertz, 1973) to give the reader a clear picture of the actors and their behavior in the context in which they occur.

A case study is useful for shedding light on an occurrence or phenomenon that previously was unattainable. In this study, the case is the critical mathematics tasks created by a group of PSTs who participated in this investigation. The purpose of this study was to gain in-depth understanding of the processes and beliefs linked to constructing these tasks.

Setting

Participants. The PSTs consisted of ten individuals: 8 European American PSTs, an African American PST, and a Jewish, European American PST. There were 3 female and 7 male PSTs. Before the methods class began, PSTs had completed a minimum of 45 hours of coursework (approximately three full-time semesters at the university), and were enrolled in or had completed a multivariable calculus course. Thus, participating PSTs should have had sufficient knowledge of mathematics concepts that were a part of the critical mathematics tasks

they constructed for this study. I recruited PSTs from this class because they had direct contact with lower income and minority students (i.e., African American and Latin@ students) and because they were required to engage in critical reflection on issues relating to African American and Latin@ students.

Learning segment. During the learning segment, PSTs read literature on the teaching of ethnically diverse students, especially African American and Latin@ students. PSTs read the NCTM's (2000) Equity Principle. Other literature (see Table 1) involving teacher identity, the instruction of ethnic minority students, and the role mathematics plays in accessing post-secondary educational and occupation opportunities. They engaged in class discussions on the readings and class activities, and they reflected on their experiences at the CI site in weekly journal entries. I co-facilitated classroom discourse along with the primary instructor, a European American male.

Table 1

Class Themes, Readings, Activities, and Homework

Days	Intended Themes	Readings	In-class Activities	Homework
Day 1	(In)Equity in mathematics classes and its consequences -Tracking by race and socioeconomic status -The link between access to higher mathematics and access to post-secondary education and good jobs The power mathematics educators wield	Moses, Kami, McAllister-Swam, & Howard (1989) Oakes (1995) NCTM (2000)	Small and whole group discussion of the readings	Discuss the extent to which you, a future mathematics teacher, will be in a position of power in school. In your own words, define equity. Assume you have a class of African American and Latin@ students, such as those at [the CI site]. Your students are not performing as well as those from other racial groups. Who is responsible for their performance?
Day 2	Acknowledging biases/preconceived notions Acknowledging own position in society, particularly in relation to others'	None	Physical Appearance Categorization Activity (Ryan & Simpson, 2016) Position of Privilege or Power Activity (by Trask)	To what extent do you believe you are in a position of power? Are you in the same position of power as [the students at the CI site]? How do similarities or differences in position of power between teacher and student influence instruction or learning?
Day 3	Culturally responsive teaching	Gay (2002) Kea, Campbell-Watley, & Richards (2006) *Strategies for Promoting Culturally Responsive Classrooms* (n.d.)	Video interview about culturally responsive teaching (https://www.youtube.com/watch?v=eSwr6vsrqb0) Small and whole group discussion on characteristics of culturally responsive teacher PST to PST Cultural Information Interview	Please create a mathematics task that reflects your own experience. Create a list of information (or questions one might ask you) that would be helpful to create this culturally-responsive-to-you task. Please research a social justice issue you perceive a [student at the CI site] or the student's family member may be facing (e.g., racism, sexism, homelessness, poverty, food desert, joblessness, domestic violence, ageism, lack of health care/health care coverage). Look for statistics that illustrate this issue. In particular, please find statistics that show how the issue affects your student's group and other racial groups. Please bring this information to class.
Day 4	Culturally responsive tasks	Kea, Campbell-Watley, & Richards (2006) Ten quick ways to analyze children's books for racism (n.d.) Gutstein (2003) Ladson-Billings (2009) Nasir (2000) Style (1998) Tate (1995)	Whole group discussion on the readings Analysis of the cultural responsiveness of some mathematics tasks Analysis of a critical mathematics task Videos on African American secondary students discussing perspectives of culturally responsive teaching and tasks Examination of a rubric with cultural aspects of a task based on Gay's (2002)	Use the information you gathered about the issue you perceive your [student at the CI site] or a family member faces to create a culturally and critically responsive word problem. Please reflect on the difficulties you had in making this problem (and in making it significant to this group of people). In what ways might your student benefit from your culturally and critically responsive word problem? In what ways might students from other groups benefit from your word problems?
Day 5	Cognitively demanding tasks	NCTM (2000) Smith & Stein (1998)	Video of Trask interviewing African American secondary students using the Cultural Information Interview Protocol (see Appendix O) Analysis of the cognitive demand of tasks in Smith and Stein's (1998) article	Using the Cultural Information Interview Protocol, complete your interview with an African American or Latin@ [student at the CI site]. Use information from this interview to create a culturally-responsive-to-student mathematics task. Describe the type of student who should receive high cognitive demand tasks.

(Table Continues)

Days	Intended Themes	Readings	In-class Activities	Homework
				Describe the type of student who should receive low cognitive demand tasks.
Day 6	Cognitively demanding and culturally responsive tasks	None	Whole group discussion of the cognitive demand and cultural responsiveness of a reform-oriented word problem	None

Note. CI=Cultural immersion.

Cultural immersion. As a result of course participation, PSTs experienced cultural immersion with ethnic minority students. Mahan and Rains (1990) and Nieto (2006) found that teachers' knowledge of ethnic minorities grew as a result of direct interaction with members of these groups. In particular, Nieto (2006) discovered that immersion at a cultural site helped ease teachers' fears of ethnic minority students and their community members. Additionally, increased knowledge of ethnic minority students, which may be gained through these interactions, may contribute to the creation of appropriate tasks for them (Gay, 2002). Taken together, PSTs' critical mathematics tasks may have been influenced by their interactions with students as a result of their CI experience.

PSTs spent 20 hours at the CI site with lower income and ethnic minority students, such as African American and Latin@ students. The primary mathematics instructor allowed PSTs to decide the amount of sessions and amount of hours per session they would volunteer. He told PSTs that he preferred that they spread their 20 hours over roughly 12 weeks (from as early as the 2nd week of the course to as late as the 14th week of the course). However, he left this decision up to the PSTs. PSTs' CI experience occurred after school in a program that was held at a local junior high school where PSTs tutored students in mathematics and other subjects, monitored students, and interacted with them through play during recess periods. The grade level PSTs aspired to teach did not match that of the students at the CI site and PST responsibilities at the site did not always involve mathematics. However, early in the semester, the primary instructor for the secondary mathematics education course had expressed to me that he was

confident that meaningful interaction with the ethnic minority students was important to PST understanding of how to instruct them.

Data sources. Ten PSTs from the secondary mathematics education course created critical mathematics tasks. Data consisted of their critical mathematics tasks, and PSTs' responses to one written reflection assignment on their beliefs about critical mathematics tasks.

To address my first research question, during the learning segment, I asked each PST to gather statistics on a social justice issue and to use this information to create a critical mathematics task that allows a student at the CI site to "read the world" (Freire & Macedo, 1987). According to Gutstein (2003), to read the world in the context of mathematics classes is:

> to use mathematics to understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, class, gender, language, and other differences. Further, it means to dissect and deconstruct media and other forms of representation [and mathematics itself] and to use mathematics to examine these various phenomena both in one's immediate life and in the broader social world and to identify relationships and make connections between them. (p. 45)

According to Freire (2000), in addition to being able to use their education to critically examine their oppression, students must possess knowledge to change their world.

I classified PSTs' critical mathematics tasks according to their "social justice consciousness," which involves both PST acknowledgement of their disenfranchised students' experiences and an indication that an action to change an unjust world follows from an acknowledgement of disparities. Because a link between acknowledgement of disparity and action to address the disparity in a task can serve as a model for students, I looked for such links

as indicators that PST-created tasks that reflected disenfranchised students' experiences and had the "the potential to foster the development of critical consciousness of disenfranchised students, such as lower income and minority students, for whom they were developed" (quoted from the research question). A Social Justice Consciousness rubric was created for this study based on Villegas and Lucas' (2002) Gaining Sociocultural Consciousness rubric and Freire's (2000) critical consciousness and critical agency ideas. I examined PSTs' critical mathematics tasks to determine the extent to which they "named" social justice issues, which entailed including a social justice issue and linking it to those who are disproportionately affected by it. PSTs' critical mathematics tasks were also examined to determine the extent to which PSTs provided students' opportunities to critically reflect on social justice issues and to develop plans to take action to right the social injustice.

To attend to the second research question, I asked PSTs to give a written reflection on their beliefs about constructing their critical mathematics tasks for disenfranchised students and about the benefit of critical mathematics tasks to these and other students. On the third day of the learning segment, PSTs were given the following homework directions:

> Please research a social justice issue you perceive a [student at the CI site] or the student's family member may be facing (e.g., racism, sexism, homelessness, poverty, food desert, joblessness, domestic violence, ageism, lack of health care/health care coverage). Look for statistics that illustrate this issue. In particular, please find statistics that show how the issue affects your student's group and other racial groups. Please bring this information to class.

The homework directions for the fourth day of the learning segment were as follows:

> Part 1: Use the information you gathered about the issue you perceive your [student at the CI site] or a family member faces to create a culturally and critically responsive word problem.
>
> Part 2: Please reflect on the difficulties you had in making this problem (and in making it significant to this group of people). In what ways might your student benefit from your culturally and critically responsive word problem? In what ways might students from other groups benefit from your word problems?

PST beliefs may influence their future behaviors and teaching practices (Hollingsworth, 1989; Pajares, 1992; Pohan, 1996). I made inferences about PST beliefs about the appropriateness and value of critical mathematics tasks by gathering evidence from: (a) their written reflections on the difficulties they encountered in making their tasks; (b) their written responses to the questions, "In what ways might your "student" benefit from your culturally and critically responsive word problem?" and "In what ways might students from other groups benefit from your word problems?" and (c) their reports of other concerns mentioned in their written reflections about their critical mathematics tasks.

Analyses

PSTs' critical mathematics tasks were analyzed using a framework I created which is based on Villegas and Lucas (2002) Gaining Sociocultural Consciousness framework and Freire's (2000) notions of critical consciousness and critical agency. Villegas and Lucas (2002) argued:

> Six Strands…give coherence to our curriculum proposal for preparing culturally responsive teachers: 1) gaining sociocultural consciousness; 2) developing an affirming attitude towards students from culturally diverse backgrounds; 3) developing the

commitment and skills to act as agents of change; 4) understanding the constructivist foundations of culturally responsive teaching; 5) learning about students and their communities; and 6) cultivating culturally responsive teaching practices. (p. 26)

Although all of Villegas and Lucas' tenets of culturally responsive teaching are relevant to this investigation, I focused on PST attempts to create tasks that might help students gain sociocultural consciousness and develop the commitment and skills to act as change agents. For the sociocultural consciousness, Villegas and Lucas (2002) developed a framework that can be used for understanding the difference between teachers who are socioculturally dysconscious and those who are socioculturally conscious (see Figure 3).

Sociocultural dysconsciousness →	→ Sociocultural consciousness
Worldview: Unreflective way of thinking that takes one's worldview as universal; lack of awareness that one's experiences in life, as mediated by factors such as social class, race/ethnicity, and gender, influence how one comes to see the world.	Worldview: Heightened awareness that there are multiple perspectives on the world and that person's worldview reflects his/her location in the social order relative to such factors such as class, race/ethnicity, and gender; clear insight into one's perspective and how it is shaped by one's biography.
Power differentials: Unawareness of power differentials in society and how existing differences in power are structured into the standard practices of various institutions—including the education system; uncritical belief in the neutrality of school practices; unquestioned adherence to a meritocratic view of American society, which supports justification of existing inequities.	Power differentials: Profound understanding that power is differentially distributed in society and that social institutions, including the educational system, are typically organized to advantage the more powerful; critical of existing inequalities.

Figure 3. Gaining sociocultural consciousness framework. Reprinted from *Educating Culturally Responsive Teachers: A Coherent Approach* (p. 33), by A. M. Villegas, 2002, New York, NY: State University of New York Press. Copyright 2002 by State University of New York. Reprinted with permission.

It can be inferred from the framework (Villegas & Lucas, 2002) that PSTs who have a sociocultural dysconsciousness are ignorant (and perhaps willfully so) of the ways existing

power structures privilege the knowledge and norms of dominant groups. Socioculturally dysconscious PSTs might be hesitant to question school policies that have served them well. They might refuse to acknowledge that disparate treatment of students in schools may be based on student characteristics, such as race or social class. Instead, socioculturally dysconscious PSTs might argue that schools are meritocracies and that disenfranchised students' lack of advancement in school is based solely on their poor effort or low intelligence. In contrast, socioculturally conscious PSTs might dispute this ideology and acknowledge the role power plays in disenfranchised students' experiences in and out of school. These PSTs might acknowledge that standard curricular materials privilege the knowledge, experiences, and norms of European American middle-class students. Furthermore, they might acknowledge that oppressive class- and race-based policies, such as tracking, block disenfranchised students' access to high quality mathematics education.

Freire (2000) argued that teachers must help disenfranchised students gain a critical consciousness to change their world. As both Freire (2000) and Villegas and Lucas (2002) suggested, teachers must themselves be aware of social injustices. Furthermore, they must possess critical agency and the critical consciousness to counter injustices occurring in our society (Freire, 2000). They must be able to name injustices by identifying how unfair acts disproportionately affect disenfranchised populations. They must also be capable of helping students engage in critical reflection on social justice issues. And they must be ready to help students develop plans to challenge and remedy injustices.

The Social Justice Consciousness framework (see Table 2) that I developed as an analysis tool for this study builds on Villegas and Lucas' (2002) and Freire's works, which describes critical agency and highlights distinctions between critical consciousness and dysconsciousness.

Although Villegas and Lucas' (2002) work is helpful for understanding PSTs' perceptions of the world and their perceptions of how the world is experienced by the empowered and the disenfranchised, I required a framework for classifying perspectives aligned with critical consciousness (or dysconsciousness) that might be identifiable in the curricular tasks, developed by PSTs, designed to address social justice issues relevant to their students. Moreover, I aimed to differentiate between PST-developed tasks as those that are likely to lead to critical action and those that are unlikely to lead to critical action. Freire (2000) contended, "Critical reflection is action" (p. 128). Therefore, tasks that required critical reflection, or questioning of the fairness of social injustices, were placed in the social justice consciousness portion of my framework, indicating a likelihood of leading to action. In fact, an initial questioning of fairness, even without other actions, formed the border of inaction to action, or social justice dysconsciousness to social justice consciousness . Finally, I acknowledge that not all tasks leading to inaction or tasks leading to action, represent the same level of social justice consciousness. Rather, there may be more of a spectrum of dysconsciousness to consciousness. And, PSTs may create tasks that need a more nuanced classification system to detect real differences in their tasks, and, presumably, the perspectives that led to the construction of those tasks. Nuances included in my classification system pertain to distinctions among "denial of differences and disparities (i.e., the same, not oppressive)," "acknowledgement of differences," (i.e., not the same) and "acknowledgement of disparities" (i.e., very different or unequal, due to intrinsic power structures), as well as various levels of actions to take to correct injustices (i.e., questioning fairness, advocacy on behalf of individuals, disruptions of systemic injustices)

In my framework, PSTs' *social justice consciousness* is defined as their willingness to acknowledge and confront the disparate experiences of disenfranchised students. In this study,

PSTs were asked to write critical mathematics tasks that incorporated social justice issues that were relevant to the lives of the students from disenfranchised groups, such as lower income or minority groups, at the CI site. I had hoped that PSTs would write tasks on the experiences of disadvantage of African Americans or Latin@s because our readings and in-class discussions were on the educational experiences of members of those groups. In their class assignment, PSTs were asked to research social justice issues and identify statistics that compared the experiences of their student's group with "other racial groups." Considering that the program at the CI site consisted mostly of African American students, I assumed PSTs would explicitly compare the experiences of disadvantage of African Americans to the experiences of other racial groups. Still, I did not limit PSTs to solely including racial issues in their tasks; therefore, PSTs could have included other social justice issues, such as those related to gender, social class, and sexual orientation, as long as those issues were relevant to students at the CI site or members of their communities. My framework (see Table 2) was designed to describe the extent to which PSTs "named" a social injustice by acknowledging in their tasks the unjust treatment of disenfranchised groups. Also, I examined their critical mathematics tasks to identify the actions PSTs proposed for addressing the inequitable scenarios given in their tasks.

Table 2

Social Justice Consciousness of Mathematics Tasks

Level of social justice consciousness	0 Inaction	1 Inaction	2 Inaction	3 Action	4 Action	5 Action
Explanation	**Denial** of the **disparate experiences of the disenfranchised.**	**Acknowledgement** of the **different experiences** of sociocultural groups.	**Acknowledgement** of **disparate experiences of disenfranchised.**	**Acknowledgement** of the **disparate experiences of the disenfranchised** AND **questioning** of the **fairness** of these experiences.	Level 3 AND evidence of a willingness to be instrumental in the improve-ment of the **individual's experience** or desire to **effect change for the individual student or their immediate families.**	Level 3 AND evidence of a willingness to be instrumental in the improve-ment of the **group's experiences** or desire to **disrupt unfair systems.**

At level 0, PSTs make no mention of disenfranchised people's different or disparate experiences; or they mention disparate experiences, but then blame disenfranchised people for their condition. At level 1, PSTs acknowledge that disenfranchised groups have *different* experiences than majority members. At this level, there is no mention of power differences. Instead, PSTs might discuss the cultural experiences of disenfranchised groups. At level 2, PSTs acknowledge that power structures oppress members of disenfranchised people's communities, denying their rights and blocking their access to opportunities, thus acknowledging *disparate* experiences. At level 3, in addition to acknowledging oppressive power structures, PSTs engage students in critical reflection on social injustice. Level 4 builds on level 3 in that PSTs also indicate a willingness to help disenfranchised students seek solutions for themselves and for members of their local community. Like level 4, level 5 builds on level 3, but at level 5, PSTs indicate that they are attempting to give students tools to change their world by disrupting social systems that oppress members of their group. There is a distinction between critical action that

leads to addressing the condition of one's local community (in level 4 tasks) and critical action that leads to confronting the condition of one's disenfranchised group (in level 5 tasks). This key difference is described in a story about babies that were found floating downstream a river (Babies in the river, n.d.). In the tale, the townspeople who were downstream the river kept rescuing babies found floating in baskets. After several babies were saved, someone suggested going upstream to (a) determine why the babies were being sent downstream and (b) prevent other babies from being put in this precarious position. In this story, the townspeople committed a merciful act by rescuing the babies from the stream. In my framework, the act of saving the babies who were already in the stream would be associated with a level 4 task because it involves immediately addressing a critical need of those in the local community. In comparison, when the townspeople went upstream and took action to remedy the cause of the endangered babies, or disrupt the system that lead to babies in the stream. The upstream travel and action was an act of justice, which would be associated with a level 5 task in my framework. Through level 5 tasks, students will be asked to seek solutions that will change unfair systems for the benefit of all who are afflicted by the injustice.

The theoretical framework was used to understand PSTs beliefs about their tasks. For instance, initial codes related to PST beliefs about the critical consciousness and agency benefits of critical mathematics tasks. PST reflections related to the tasks had no bearing on the classification, by level, of their tasks. I used a constant comparative method (Corbin & Strauss, 2008; Creswell, 2007) to analyze the PST reflections in this case study. I began with initial readings of the data, followed by data reduction, where initial codes immerged. I then created broad categories for these multiple codes. All codes and themes arose from the data.

Findings

PST Tasks

First, I classified PST tasks according to their potential to develop disenfranchised students' critical consciousness, as indicated by the Social Justice Consciousness level of the tasks. Next, I examined the type of topics PSTs included in their tasks, as an indicator of the type of injustice that served as the focus of the task. I sought to identify if PSTs had explicitly stated that their task pertains to disenfranchised students. Also, because the lower income students at the CI site were predominantly African American, I was curious whether PSTs would be inclined to create tasks to develop the critical consciousness of racial minority students.

Social justice consciousness level. In this section, I present the PSTs tasks themselves, grouped by social justice consciousness level, with rationales for the classification decisions.

There were three PSTs whose tasks I classified as Level 3, because they included an acknowledgment of disparities and prompted some sort of questioning of the fairness of those disparities. These tasks are presented in Table 3.

Table 3

Level 3 Tasks

PST	Topic	Task
Faith	(Un)livable wage	In a family of four, it is stated that a family would need at least around $58,000 per year in order to live comfortably. The current poverty level amount is about $24,000 per year. In [a certain state], there is a current push to raise the minimum wage from $8.25 to $10. What would the minimum wage need to be for a single parent working full time (40 hours per week) in order to reach a salary to comfortably support a family of four? What would the minimum wage need to be for two parents working full time in order to comfortably support a family of four? What do you think a fair minimum wage might be if one parent works full time (40 hours per week) and one parent works part time (20 hours a week)? Would a minimum wage of $8.25 be enough to support a family of four in any of the previous situations stated?
Eli	(Un)livable wage	Suppose there is a family of four consisting of 2 adults and 2 children. Both adults work 40 hours per week and make minimum wage, which is $8.25/hour. Let's say that the average yearly cost of food is $6,602, housing $10,080, healthcare $3,631, transportation $9,004, and utilities $7,068. Can the family afford to pay for these with their current income? If not, then how much do they need to make? What are some other things that the family might need money for?
Javi	Racial profiling	On any given day, one hundred different people walk through downtown. Out of these walking pedestrians, seventeen are African-American, twenty-eight are Latino, and fifty-five are Caucasian. Police who work in town have been instructed to pull any suspicious persons to the side and arrest them because of a recent bombing situation that requires the police to be on watch. Of the given one hundred people, twelve African-Americans, nineteen Latinos, and twenty Caucasians were arrested. What percentage of each group was arrested? Does this seem fair? Why or why not?

In their tasks, Faith, Eli, and Javi *acknowledged social justice issues*. Faith and Javi highlighted disparate experiences by contrasted the experiences of the disadvantaged with those of the advantaged. For instance, Faith contrasted the wages of the impoverished with those fortunate enough to live "comfortably", and Javi contrasted minority incarceration with that of majority members. Both of these PSTs also *explicitly questioned the fairness* of the experiences of the disadvantaged. In comparison, Eli's task lacked a contrast between groups; however, a *question of fairness* of this situation for the people in the story might implicitly be raised as

students contemplate other commodities or services the full-time workers need but cannot afford. In all of these tasks, the PSTs did not suggest particular actions to improve the experiences of the disenfranchised in the local or global community. By the preponderance of the evidence, I classified these word problems as level 3 tasks.

Five PST tasks were classified as Level 2. Although PSTs acknowledged disparate experiences, they did not question the fairness of the experiences of the disenfranchised. Such tasks are given in Table 4.

Table 4

Level 2 Tasks

PST	Topic	Task
Keenan	Minority-White Incarceration gap	Donjuan and Romando have a project to complete in their Raza Studies[7] course. This project requires them to record some information from the United States 2010 census. According to the United states 2010 census, The United States ethnic composition is 64% White, 13% Black, and 16% Hispanic/Latino. There are currently 2.3 million people incarcerated in the United States. Of that 2.3 million, approximately 897,000 are white, 920,000 are black and 437,000 are Hispanic/Latino. Is the ethnic composition of the number of incarcerated persons in the United States consistent with the ethnic composition of the United States as whole? State your reasoning.
Carmel	Male-female wage gap	According to the Bureau of Labor Statistics, women who work an average of 40 to 44 hours a week earn 84.6% of what men working the same average amount of hours earn. If Ramiro earns about $400 after a 40-hour work-week, then how much would you expect his co-worker Andrea to earn after working the same hours?
Henry	Rich-poor college attendance gap	In America, students who come from high SES families go to post-secondary school more often than students from low SES families. For example, 44 out of 50 students from high SES families went to post-secondary school from [a certain high school]. Just 23 of 50 students from low SES families went to post-secondary school. What is the difference, in terms of percentage, between low and high SES students going to post-secondary school from [the high school]?
David	Access to transportation for school	Reggie, Steve, Ana, and Loreal have to walk to school on a daily basis because the school bus does not stop in their area. The [four] students live in the same apartment complex. For class today they need to have a poster board for class because they are all working on the same project for science class. So they decide to go to the local dollar store together. It is a 20-minute walk to their school and a 10-minute walk to the dollar store; however the dollar store is in the opposite direction of the school. If school starts at 8 o'clock in the morning, what is the latest time the [four] of them can leave the apartment complex to ensure they make it to school on time?
Angela	Domestic violence	Recently, one of Mr. Banks' students has been not performing well on his exams. Mr. Banks talks to the student about this and the student shrugs him off. However, after a parent-teacher conference, Mr. Banks suspects that the student has been exposed to domestic violence and contacts the counselor to talk to the student. Mr. Banks reads a 2009 article that says that students exposed to domestic violence can have test scores up to two-thirds lower than before. Mr. Banks looks up the student's past couple exam scores, which are all out of 100 points: 85, 93, 72, 64, 68. Based off these scores, does Mr. Banks have reasonable data to assume that domestic violence has been affecting the student's scores? Why or Why not?

[7] According to Cammarota and Romero (2014), "Raza studies students engage in critical literacy to understand the systematic and institutional forces that generate roadblocks preventing their progress" (p. 5).

Keenan, Carmel, Henry, and Angela *explicitly acknowledged social justice issues*. Keenan, Carmel, and Henry drew comparisons between the disadvantaged and advantaged, thereby shedding light on the disparate experiences of the disenfranchised. Angela *acknowledged* domestic violence as a *social justice issue,* but she *did not explicitly state* in the word problem *which group is disproportionately impacted* by this issue. Although David *identified* that lack of transportation is *an issue* for some students, *he did not acknowledge* in his task *the particular group* he intended to describe. Because neither Angela nor David drew comparisons between privileged and disadvantaged groups they could not highlight the disparate experiences of the disenfranchised. Keenan, Carmel, Henry, Angela, and David *did not explicitly question the fairness* of the experiences of the disadvantaged. Furthermore, none suggested plans to challenge local or global systems responsible for the disparities described in their tasks. By the preponderance of the evidence, these word problems were classified as level 2 tasks.

Only one task was classified as Level 1. In this task, the PST acknowledged the potentially different experiences of his cultural actors, but did not explicitly acknowledge disparities (see Table 5).

Table 5

A Level 1 Task

PST	Topic	Task
Brian	Health care costs	Jordan and his family recently purchased health insurance. Their insurance plan allows for $1,000 in annual medical coverage. All medical charges after that have to be paid from the family. Here are some standard rates for medical procedures at their health care clinic: Broken bone - $300, Cut requiring stitches - $100, any medical surgery - $800. This year, Jordan and his brother both played football. Jordan had two broken bones and his brother required stitches five times. How much money, if any at all, will Jordan's family have to pay out of their own money at the end of the year?

Brian *identified an issue,* namely limited health care coverage; yet, he *did not acknowledge the position of disadvantage* of the family he described. This family could have been affluent or European American or privileged in other ways. Further, Brian *failed to explicitly (and generally) acknowledge* that lack of health care is often experienced by the poor. Brian did not create a task that provided students opportunities to seek health care solutions for this family or for other individuals with lessor means. By the preponderance of the evidence, Brian's word problem was classified as a level 1 task.

One task was at Level 0. The PST failed to acknowledge disparities and the experiences of the disenfranchised (see Table 6).

Table 6

A Level 0 Task

PST	Topic	Task
Ivan	Cell phone costs	A student is in need of a new cell phone. He is offered two phones of similar quality and features. One is priced at $250 and the second is priced at $300. If both are offered on 24-month payment plans with interest rates compounded monthly of 6% for the first phone and 4% for the second phone, which phone is the better deal overall?

In this task, Ivan *did not acknowledge a social justice issue*. There was no mention of the student's disenfranchised position. Furthermore, it is possible that individuals of various social standing, middle or lower class, might be interested in securing the best phone deal for their budget (although Ivan's point is well taken that those with greater means would likely be unwilling to pay higher interest rates). Ivan did not broach a critical issue; he simply asked his students to compare phone expenses. By the preponderance of the evidence, I classified Ivan's word problem as a level 0 task.

Summary. Most PSTs (8 of the 10) provided tasks at levels 2 or 3 on the Social Justice Consciousness Framework. That is, PSTs at least acknowledged the disparate experiences of the disenfranchised members of students' communities. Most identified that minimum wage, or limited healthcare or post-education opportunities, or domestic violence, or racism likely affect their disadvantaged students' communities. Although most PSTs shed light on their social justice issues, some of these (i.e., Keenan, Carmel, Brian, Henry, and David, and Angela) fell short of assisting students in questioning the described issues. In contrast, other PSTs, such as Eli, Javi, and Faith, pressed students to provide some critical analysis of their social justice issue by requiring students to consider the fairness of the disparate experiences and experiences of disadvantage of their students and their community members. It was unsurprising that no PST provided a level 4 or level 5 task, as they were not provided examples of such tasks in their learning segment.

Task topics. In this section, I discuss the nature of the PSTs tasks, by describing the variety of social justice issues addresses, and the prevalence of some issues. PST topics varied, with most of them explicitly relating to either students' lower income status. For instance, four PSTs created scenarios relating to social class (i.e., limited health care coverage, un-livable wages, or limited access to post-secondary education). Some PSTs' topics related to other issues. For instance, only Carmel created a task on the gender wage gap. Keenan and Javi were the only two PSTs to explicitly include in their tasks race-based issues, namely racial profiling and the minority-White incarceration gap, respectively.

PST Reflections

PSTs expressed a variety of beliefs about teaching and critical mathematics tasks. Most beliefs centered on the value or appropriateness of critical mathematics tasks.

The value of tasks. PSTs expressed beliefs of the value of tasks to students and to teachers.

To students. PSTs believed students can derive various benefits from completing their (or a) critical mathematics task. The most frequently expressed PST beliefs about the benefits to students related to an increased awareness of social justice issues and to the inspiration to become agents of change. With the exception of Brian and Ivan, PSTs (8 of 10) indicated that they believed that students will become more knowledgeable of their own or others' experiences of disenfranchisement. Half of these eight PSTs (i.e., Carmel, Faith, Eli, and Henry) also reported that students might develop critical agency. PSTs expressed beliefs about other benefits to students, including mathematics knowledge, opportunities to see themselves in tasks, emotional and psychological support for students, skills for completing schoolwork, and opportunities for critical self-reflection. Keenan believed that students would gain a greater understanding of unjust institutions. Keenan wrote, "They can all be made aware of the imbalances that are present within our judicial/prison systems." Faith believed critical mathematics tasks may shed light on structural barriers that block access to resources. According to Faith, "Students would benefit from learning that the issue of poverty is not necessarily from parents not working hard, but may be from factors that they cannot control."

Brian believed that his students will not "benefit very much from this problem." He did not explain this belief. Ivan failed to note how critical mathematics tasks may (or may not) benefit students. Interestingly, both Brian and Ivan's tasks received the lowest rankings of all the tasks on the Social Justice Consciousness scale.

Some PSTs expressed beliefs about the steps they could take to increase the value of critical mathematics tasks to students. Faith wrote that she believed that knowledge of students

would better prepare her to create a task for them. Both Ivan and David wrote that they would choose topics that are meaningful to students. David also expressed a belief that he should be more knowledgeable of the subject matter in critical mathematics tasks. He wrote, "Because of the topic I picked, lack of health insurance, it was hard to create a problem that would thoroughly explain and help the student see the problem." Angela believed that her task would require the benefit of multiple lenses before it could be administered it to students. She wrote, "I think that this word problem is still too controversial to be used in a classroom. I think that it needs more editing from different perspectives." That Ivan and Javi attempted to empathize with students indicates beliefs about the role empathy plays in creating critical mathematics tasks. Ivan wrote that he tried to view his problem "from the perspective of a low-income student." Javi attempted to empathize with African American students, whose disparate experiences are foreign to him. According to Javi, "My biggest difficulty when trying to create this culturally responsive word problem was about how I put myself into the students' shoes." This evidence indicates that Ivan and Javi believed that the value of their task would be raised from their efforts to understand the students' disadvantages from their [students'] vantage points.

To teachers. Angela was the only PST who wrote that she, as a future teacher, derived benefits from creating a critical mathematics task. The process grew her awareness of "white cultural bias" in curricular materials. According to Angela, in creating her task, she became more aware of the absence of racial minority representation (and issues) in her high school curriculum. She wrote, "I rarely, if ever, had word problems that talked about other cultures or the problems that these cultures may be facing." Angela concluded that curricular tasks should reflect the diversity of experiences students bring to the classroom.

The appropriateness of tasks. Most PSTs expressed beliefs that social justice issues embedded in critical mathematics tasks are inappropriate for students. Only a few contended that middle school-aged students are ready to grapple with social justice issues in tasks.

Age-appropriateness. Two PSTs expressed beliefs that the subject matters in critical mathematics tasks are appropriate for students. For instance, Keenan wrote that middle school-aged students are "mature enough to have discussions on social justice issues." However, he added, teachers must present students age-appropriate social justice contexts. Javi believed that middle school students' discomfort from grappling with a "disheartening" social justice issue will spark critical discourse. He wrote, "Students would be led by this discontent and discuss potential reasons or problems that occur."

Faith and Brian, expressed beliefs about the age-inappropriateness of critical mathematics tasks for students. According to Faith, "Mature students at the [CI site] may be able handle this word problem. A lighter topic for a word problem would be more ideal for middle school students." Brian wrote, "Health insurance should not be something that students discuss."

Topic appropriateness. Eli's, Carmel's, Henry's, Faith's, and Angela's uneasiness about the appropriateness of critical mathematics tasks stemmed from the sensitivity of social justice topics. These PSTs respectively described the subject matter in their tasks as "uncomfortable," "off-putting", potentially "offensive," "sensitive," and "controversial." PSTs feared that the tasks would elicit negative emotions from students as they grapple with the harsh realities of their existence. In contrast to Javi who believed student discomfort would spark critical discourse, Eli claimed that students will disengage from learning if forced to think about "uncomfortable" realities. Eli wrote, "It brings up issues that a lot of people may not want to think about. People don't like to feel uncomfortable." Brian expressed that he "hate[d]" his task and under no

circumstances would he administer it to students, in part, because of his beliefs that students should not be encumbered by thinking about certain social justice topics, such as access to health care. According to Carmel, it was the seeming permeability of her topic, the gender wage gap that would prevent her from giving her female students her task. Carmel expressed,

> I am concerned that it would be off-putting to the girls and give the impression that no matter how hard they work they will be expected to earn less than their male counterpart. All of the statistics that I had gathered though had the same issue in which it highlights the issue, but makes it sound as if that is just a fact than something that can change.

Angela stated her task was "still too controversial to be used in a classroom."

Four PSTs believed that there was a risk of stereotyping students in the creation of critical mathematics tasks. PSTs were not required to discuss their fears of stereotyping in the reflections. The emergence of these fears shed light on PSTs' beliefs about the appropriateness of these tasks and PST beliefs about their readiness to create critical mathematics task for students. Eli wrote that one challenge he faced involved "phrasing the problem to avoid any kind of stereotyping. We obviously want to avoid negative stereotypes like the ones present in a couple of the word problems shown in class." Henry had difficulty discerning if he had unintentionally incorporated stereotypes into his task. He wrote, "I thought for a while about different problems but couldn't tell if they were offensive in any way or stereotypical of any group of people." David reported that he struggled to include just enough student details to accurately reflect students' experiences of disadvantage, but no so many as to stereotype students. David expressed, "I don't want students to feel like I'm crossing the line by putting too much background information because that could lead to stereotyping." Angela wrote, "I don't want the students to think that I believe in stereotypes." These PSTs feared that they would

project negative generalizations of the disenfranchised onto students with disadvantages, which is why they believed their tasks potentially were inappropriate for students.

PSTs described the actions they took (or would take) to make tasks with potentially stereotypical details more appropriate for students. Henry wrote that he could avert the issue of stereotyping and of raising sensitive subjects by focusing on "communal differences." According to Henry, a communal difference word problem would be "low risk in terms of being socially acceptable." David was careful to include just the right amount of details to avoid stereotyping students. Also, David wrote, "I picked names that I feel like are mostly culturally neutral." Like David, Angela made her cultural actors racially ambiguous. She wrote, "I tried to keep the people in the problem racially neutral." Eli offered no suggestions on this matter.

Conclusions

In their mathematics tasks, most PSTs at least acknowledged the experiences of disadvantage of disenfranchised students. More PST tasks included explicit reference to social class than other topics, such as race or gender. PSTs expressed beliefs that awareness and agency are potential outcomes from the use of critical mathematics tasks. According to most PSTs, the uncomfortable nature of critical mathematics tasks made them inappropriate, in general, and for middle school-aged students, in particular.

Discussion

Avoidance as a Response

Gau's (2005) teachers similarly were resistant to broaching social justice topics, such as racism. In Gau's study, one teacher did not want to "bring up anything too controversial" (p. 38). A teacher claimed that a credit card topic would be more appropriate "because it's not quite as controversial" (p. 38). Moreover, the PSTs in Kelley and Brooks' (2009) study expressed

reluctance to discuss "iffy," "scary," or "heavy" topics with their students (p. 208). Given these findings, it was unsurprising that PSTs believed the subject matter in their critical mathematics tasks was inappropriate for students. Still, I anticipated less discomfort because PSTs had the benefit of the CI experience, had opportunities to discuss critical issues in class, used real mathematics data on social justice issues, and based their task scenarios on real issues that likely are relevant to the lower income and minority middle school-aged students or their community members. To the latter point, PSTs were asked to include a social justice issue *the students at the CI site or member of their community might be facing*. Therefore, the chosen concerns are issues that the students likely think about, whether or not they [issues] are deemed too harsh for those of their age. Even if these issues more directly affect their parents, the disenfranchised students, such as lower income and minority students, are still indirectly impacted by them. Additionally, the students likely will be directly impacted by these social justice issues in roughly six years when they are adults. PSTs' beliefs about the inappropriateness of social justice issues in critical mathematics tasks indicate that PSTs are resistant to ideological change (Rodriguez, 2005). That is, the tenets of a liberatory education conflict with their pre-existing (and tightly held) beliefs about traditional mathematics education and, as some researchers have found (Bartell, 2006; Pajares, 1992; Rodriguez, 2005), they [PSTs] were unwilling to adopt new ideas into their existing schema.

It bears repeating that PSTs believed that the middle school students at the CI site were too young to grapple with social justice issues. PSTs may have desired to shield students from topics they perceived as difficult to explain or difficult to address. Kelley and Brandes (2001) found that when teachers perceive students as highly impressionable, they avoid mentioning uncomfortable issues and are purposeful in not exposing students to their own perceptions.

However, Jackson (2006) contended, "The rhetoric of 'vulnerability' and 'protection' [associated with innocence] is not necessarily helpful to children or young people" (p. 251) because PSTs may use them as an excuse to not expose children to their or others' harsh realities. Furthermore, Freire (2000) suggested that teachers should engage young children in critical reflection, even if they are unprepared for critical agency. Middle schools have already set a precedent of exposing students to "sensitive" topics by exposing them to sex education. This suggests that middle school-age students might be ready to wrestle with complex issues such as those in PSTs' critical mathematics tasks.

An alternate interpretation for PSTs' beliefs about the inappropriateness of critical mathematics tasks (despite the acknowledgement of the benefits of such tasks) is that they are uncomfortable about grappling with social justice issues they [PSTs] rarely face. In fact, Bickmore (1999) argued that PST expressed beliefs about the inappropriateness of social justice tasks can be understood as "a cover for educators' own fears of handling potentially controversial topics" (p. 48). This largely middle class, European American group of PSTs, as most PSTs are (Feistritzer, 2011) may not have been without health care, or struggled to make ends meet, or been targeted due to their racial background. Put simply, they may have had few direct experiences with these issues. Although PSTs are becoming experts in the teaching of mathematics, they may be novices in thinking about and discussing social justice issues. For this reason, avoidance is an unsurprising response for PSTs in administering social justice tasks. In contrast, their future students may be well prepared to discuss complex social justice issues and unlikely to "withdraw" from critical mathematics discourse. In this sense, the students may be the experts in discussions for which PSTs are too immature or "uncomfortable."

Explicit Mention of Race

PSTs were allowed to choose social justice issues that they perceived would affect their students or members of their students' communities. Given the class assignment for the creation of their critical mathematics tasks to compare the experiences of groups from different races, it is noteworthy that most PSTs *explicitly* created tasks relating to social class, not race. It is possible that students' lower socioeconomic status, which was consistent across race, struck PSTs the most. It is also possible that PSTs abandoned efforts to create tasks about minority students to avoid stereotyping them. Due to this decision, PSTs may have found themselves limited to a financial focus, rather than social justice topics of particular interest to certain cultural groups. While it is the case that PSTs' social class, for the most part[8], differed from that of their lower income students, it is also true that, in most cases, PSTs' race differed from that of their (largely) African American students. Therefore, it is curious that more PSTs did not explicitly focus on racial issues in their critical mathematics tasks.

The current discourse in the U.S. on race and racism sheds some light on the reluctance to name racial and social justice issues that pertain to people of color. Recently, according to Senator Dick Durbin of Illinois, the U.S. President, Donald Trump, stated he did not want immigrants from "s***hole" African and some Latin@ countries (O'Keefe & Gearan, 2018). Instead, he expressed a desire for immigrants from Norway. Days later, he told reporters, "I am the least racist person you have ever interviewed" (Griffiths, 2018). Trump's refusal to acknowledge the racist nature of his first statements suggests that it is taboo to talk about race and racism in America. However, critical race theorists have argued that to successfully instruct

[8] The coordinator at the CI site shared the racial and socioeconomic demographics of students. Also, students shared their socioeconomic standings and their cultural backgrounds in a class activity.

students of color, teachers cannot afford to ignore their racial disparate experiences (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002; Martin, 2006; Matsuda, Lawrence, Delgado, & Crenshaw, 1993). Race and racism—and the voices of racial minorities—must be central to these discussions. Moreover, critical theorists, such as Freire (2000) and Gutstein (2003), contend that teachers, as social justice advocates, must provide students the knowledge and tools to join the struggle to disrupt unfair systems. Through their curricular materials, such as critical mathematics tasks, teachers must speak truth to power.

Contradictory Beliefs

PSTs expressed multiple conflicting beliefs. For instance, some believed critical mathematics tasks were inappropriate, but they also believe they hold awareness and agency value. PSTs believed tasks should be meaningful, but not the meaningful tasks about students' harsh realities. They feared incorporating students' cultural details into tasks, potentially leading to stereotyping, but they also believed students should be able to "see themselves" in tasks. According to Pajares (1992), teacher beliefs dictate practice. From this investigation, it is unclear which beliefs will influence PST decisions to incorporate social justice issues into mathematics task.

Stand-Alone Critical Tasks

Brian expressed a noteworthy belief that stand-alone critical mathematics tasks are insufficient for the instruction of mathematics concepts and critical issues:

> Making this question was also hard because I felt like I couldn't address the social issue that I researched. Because of the topic I picked, lack of health insurance, it was hard to create a problem that would thoroughly explain and help the student see the problem.

To engage students in meaningful learning about a social justice issue, teachers may have to plan a full lesson or unit on the issue. Furthermore, it might be necessary for teachers to plan to teach multiple units on social justice issues to establish a classroom culture in which it is acceptable to engage in critical discourse.

Classifying Tasks

Finally, my Social Justice Consciousness instrument provided a gauge of PST willingness or ability to create tasks that acknowledge the disparate experiences and experiences of disadvantage of disenfranchised students or their community members. It was helpful for comparing tasks, but also for identifying possible resources that might aid PSTs in demonstrating actions that reflect higher levels of critical consciousness. For instance, PSTs at level 0 might require multicultural education classes to inform them of others' experiences. Those at levels 1 and 2 might require classes that highlight the struggles of disenfranchised people, such as Raza studies courses (Cammarota & Romero, 2014) or other courses that investigate the works of critical scholars such as Freire. PSTs at level 3 might need to talk to social activists to learn of their role in effecting change for those in the local community. PSTs at level 4 might require knowledge of how to contact lawmakers to change policies the affect disenfranchised people.

Limitations

There are some limitations to this investigation. The learning segment for this investigation lasted three weeks. Because we were trying to cover a wide range of topics related to culturally responsive teaching, we had limited time to discuss critical mathematics tasks. Also, because of the "sensitive" nature of PSTs' mathematics tasks, PSTs were prohibited from directly asking their middle school students about social justice issues pertinent to their

experience[9]. Therefore, it is unclear if PSTs' tasks were truly reflective of student circumstances. Ideally, students at the CI site would have described to PSTs the acts of social injustice that they or their community members have experienced.

Implications

The study has implications for mathematics teacher education programs. Prospective teachers are likely ill prepared for instructing students from marginalized groups because their programs fail to provide them opportunities to become critical educators (Cochran-Smith, 2004; McLaren, 2003). The NCTM (1989, 2014) recommended that students be provided tasks that reflect what one might experience in life. These tasks must run the gamut of student experiences and must include tasks with "sensitive" content that, as Brian expressed, teachers "hope that students never have the burden of worrying about." Mathematics teacher education programs must grow critical educators by providing PSTs support for learning about the struggles of their disenfranchised students and their people. Teacher education programs must also show PSTs how to arm students with mathematics skills and knowledge to analyze and confront oppressive systems. Mathematics teachers are uniquely positioned to aid students in their quest for social justice because they can direct students to turn a critical eye towards numeric data regarding their undemocratic participation in our social systems (Frankenstein, 1990; Gutstein, 2003, 2005; Tate, 1995). They can teach students how to understand and critique this data and to use it to develop arguments for challenging power structures, effecting change in their immediate and global communities.

[9] The coordinator at the CI site indicated to me that she was uncomfortable with PSTs asking students about the social justice issues they faced, which is why PSTs instead created tasks about issues they perceived students experienced.

Once teacher education programs commit to growing critical educators, they must create a safe space for learning about disenfranchised students and people. Mathematics teacher education programs must provide PSTs both in- and out-of class opportunities to develop their sociocultural consciousness. In class, PSTs must have critical mathematics educators who can provide insight into the research on marginalized students' perceptions and experiences. This will require the purposeful recruitment and hiring of critical teacher educators who have their fingers on the pulse of disenfranchised communities. Critical mathematics educators may share their own disparate experiences, act as a sounding board for PSTs' reservations about critical pedagogy, provide a lens for PSTs' critical mathematics tasks, and help PSTs process what they have learned in their CI experience.

It is also important that majority PSTs have minority PSTs in their mathematics education courses. Researchers have argued that the growing minority student population requires a proportionate minority teacher population with similar life experiences (Achinstein & Aguirre, 2008; Gandara & Maxwell-Jolley, 2000; Valencia, 2002; Villegas & Irvine, 2010; Valencia, 2002). Another benefit from increased minority representation in teacher education programs is that majority PSTs can benefit from the perspectives of their minority critical friends. According to Costa and Kallick (1993), a critical friend is:

> a trusted person who asks provocative questions, provides data to be examined through another lens, and offers critiques of a person's work as a friend. A critical friend takes the time to fully understand the context of the work presented and the outcomes that the person or group is working toward. The friend is an advocate for the success of that work. (p. 50)

These minority undergraduate students are of the same generation as their peers and, in this sense, are of equal standing. As such, majority PSTs may be more willing to learn from those perceived as equal to themselves. Also, as experts, critical minority PSTs might provide insight into the perspective of a minority K–12 student based on what minority PSTs personally experienced in their own education. In this investigation, the African American student provided necessary insight into the experiences of disenfranchisement of students such as those at the CI site. Therefore, similarly positioned minority PSTs may give voice to current minority students because they may be able to empathize with them. In this in-class community of practice with insiders and outsiders to disenfranchised students' communities, topics such as race and racism (including stereotyping) can be broached. Open and honest dialog may help PSTs develop sociocultural consciousness for critical mathematics instruction.

Outside the classroom, teacher education programs can provide PSTs opportunities to discuss social justice issues with a community critical friend in a marginalized community. Ukpokodu (2004) found that PSTs' cultural diversity knowledge base grew as a result of shadowing students—accompanying them at school and at their personal and cultural events. According to Ukpokodu (2004),

> These contexts serve as authentic meeting places that naturally lend to communication exchange, opportunities for conversations, talking, inquiry, and authentically learning about the cultural partner and gathering pertinent data. (p. 21)

Therefore, it is possible that critical knowledge of students can be gained through shadowing disenfranchised students to political events. Programs can require PSTs to attend events, rallies, and marches on issues of oppressed people. PSTs can interview attendees to gain their perspectives of the political struggle.

As teacher education programs embark on a journey to create more critical educators, research opportunities will arise for mathematics education scholars. According to Gutstein (2006), more studies are necessary on PST adoption of critical pedagogy. The research community must know more about preservice teacher attempts to create critical mathematics tasks and the struggles they faced in constructing their curricular products. Also, further research is necessary on the spaces mathematics educators use for molding critical educators, as well as on the structured professional development they utilize, including their critical activities, such as shadowing students. Moreover, more must be known about the age-appropriateness for social justice topics. That is, when are students prepared to wrestle with topics such as racism or sexism? Finally, the mathematics education community needs additional research on criteria for critical mathematics tasks. In this investigation, PSTs created critical tasks for students but did not have an opportunity to administer the tasks. What might happen if PSTs could administer their tasks? More must be known if higher-level social justice consciousness tasks, in fact, do lead to greater critical agency when tasks are applied in classrooms.

References

Achinstein, B., & Aguirre, J. (2008). Cultural match or cultural suspect: How new teachers of color negotiate socio-cultural challenges in the classroom. *Teachers College Record, 110*, 1505–1540.

Ayers, W. (1998). Foreword: Popular education—Teaching for social justice. In: W. Ayers, J. A. Hunt, & T. Quinn (Eds.), *Teaching for social justice* (pp. xvii–xxvi). New York, NY: Teachers College Press.

Babies in the river. (n.d.). Retrieved from https://www.uua.org/re/tapestry/youth/call/workshop1/171686.shtml

Bartell, T. R. (2006). Striving for equity in mathematics education: Learning to teach mathematics for social justice. In S. Albatorre, J. L. Cortina, M. Saíz, & A Méndez (Eds.), *Proceedings of the 28th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Universidad Pedagógica Nacional, Mérida, México.

Bell, D. (1980). Brown v. Board and the interest-convergence dilemma. *Harvard Law Review*, *93*, 518–584. doi: 10.2307/1340546

Bickmore, K. (1999). Elementary curriculum about conflict resolution: Can children handle global politics? *Theory and Research in Social Education, 27*, 45–69. doi: 10.1080/00933104.1999.10505869

Bourdieu, P. (1973). Cultural reproduction and social reproduction. In R. Brown (Ed.), *Knowledge, education, and cultural change* (pp. 71–112). London, England: Tavistock.

Bowles, S., & Gintis, S. (1976). *Schooling in capitalist America: Education and the contradictions of economic live*. New York, NY: Basic Books.

Brown, K. (2004). Assessing preservice leaders' beliefs, attitudes, and values regarding issues of diversity, social justice, and equity: A review of existing measures. *Equity & Excellence in Education, 37*, 332–342. doi: 10.1080/10665680490518948

Commarota, J., & Romero, A. (2014). *Raza studies: The public option for educational revolution.* Tucson, AZ: University of Arizona Press.

Cochran-Smith, M. (2004). *Walking the road: Race, diversity, and social justice in teacher education.* New York, NY: Teachers College Press.

Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (3rd ed.). Thousand Oaks, CA: Sage. doi: 10.4135/9781452230153

Costa, A. L., & Kallick, B. (1993). Through the lens of a critical friend. *Educational Leadership, 51(2),* 49–51.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Delgado, R. (Ed.). (1995). *Critical race theory: The cutting edge*. Philadelphia, PA: Temple University Press.

Dewey, J. (1906). *The child and the curriculum*. Chicago, IL: University of Chicago Press.

Dewey, J. (1966). *Lectures in the philosophy of education: 1899*. Edited by R. D. Archambault (Ed.). New York, NY: Random House.

Edmundson, P. J. (1990). A normative look at the curriculum in teacher education. *Phi Delta Kappan*, 71, 717–722.

Feistritzer, C. E. (2011). *Profile of teachers in the U.S. 2011*. Washington, DC: The National Center for Education Information.

Frankenstein, M. (1990). Incorporating race, gender, and class into a critical mathematics literacy curriculum. *Journal of Negro Education, 59*, 336–347. doi: 10.2307/2295568

Freire, P. (2000). *Pedagogy of the oppressed: 30th anniversary edition*. New York, NY: Continuum.

Freire, P., & Macedo, D. P. (1987). *Literacy: Reading the word & the world*. South Hadley, MA: Bergin & Garvey Publishers.

Gandara, P. & Maxwell-Jolley, J. (2000). *Preparing teachers for diversity: A dilemma of quality and quantity*. Santa Cruz, CA: The Center for the Future of Teaching & Learning.

Gau, T. R. (2005). *Learning to teach mathematics for social justice* (Unpublished doctoral dissertation). University of Wisconsin-Madison, Madison, WI.

Gay, G. (2000). *Culturally responsive teaching: Theory, practice, and research.* New York, NY: Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Giroux, H., & McLaren, P. (1986). Teacher education and the politics of engagement. *Harvard Educational Review, 56*, 213–239. doi:10.17763/haer.56.3.trr1473235232320

Golgowski, N. (2012). *If eight slaves picked 56 oranges: Georgia school under fire for racist, violent math homework*. Retrieved from http://www.dailymail.co.uk/news/article-2083734/If-slaves-pick-56-oranges--Georgia-school-racist-violent-math-homework.html

Goodlad, J. I. (1990). Studying the education of educators: From conception to findings. *Phi Delta Kappan*, 71, 698–701.

Gordon, B. (1995). Knowledge construction, competing critical theories, and education. In J. A. Banks & C. A. McGee-Banks (Eds.), *Handbook of research on multicultural education* (pp. 184–199). New York, NY: Macmillan.

Griffiths, E. (2018, January 14). Trump: "I am the least racist person you have ever interviewed." Retrieved from http://www.politico.com/story/2018/01/14/Trump-least-racist-person-340602

Gutierrez, R. (2002). Enabling the practice of mathematics teachers in context: Toward a new equity research agenda. *Mathematical Thinking and Learning, 4*(2/3), 145-187. doi: 10.1207/S15327833MTL04023_4

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, latino school. *Journal for Research in Mathematics Education, 34*(1), 37–73. doi: 10.2307/30034699

Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York, NY: Routledge.

Hollingsworth, S. (1989). Prior beliefs and cognitive change in learning to teach. *American Educational Research Journal, 26*, 160–189. doi: 10.3102/00028312026002160

Jackson, L. (2006). Childhood and youth. In H. G. Cocks & M. Houlbrook (Eds.), *Palgrave advances in the modern history of sexuality* (pp. 231–255). Basingstoke, England: Palgrave Macmillan. doi: 10.1057/9780230501805_11

Jennings, M., & Lynn, M. (2005). The house that race built: Critical pedagogy, African-American education, and the re-conceptualization of a critical race pedagogy. *Educational Foundations, 19*(3/4), 15–32.

Kea, C., Campbell-Whatley, G. D., & Richards, H. V. (2006). *Becoming culturally responsive educators: Rethinking teacher education pedagogy* (practitioner brief series). Tempe, AZ: National Center for Culturally Responsive Educational Systems.

Kelly, D. M., & Brandes, G. M. (2001). Shifting out of "neutral": Beginning teachers' struggles with teaching for social justice. *Canadian Journal of Education, 26*, 437–454. doi: 10.2307/1602176

Kelley, D. M., & Brooks, M. (2009). How young is too young? Exploring beginning teachers' assumptions about young children and teaching for social justice. *Equity & Excellence in Education, 42*, 202–216. doi: 10.1080/10665680902739683

Ladson-Billing, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*, 465–491. doi: 10.3102/00028312032003465

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American students* (2nd ed.). San Francisco, CA: Jossey-Bass.

Ladson-Billing, G., & Tate, W. (1995). Towards a critical race theory of education. *Teachers College Record*, 97, 47–69.

Mahan, J. M., & Rains, F. V. (1990). Inservice teachers expand their cultural knowledge and approaches through practica in American Indian communities. *Journal of American Indian Education, 29*(2), 11–23.

Martin, D. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking & Learning, 8*, 197–229. doi: 10.1207/s15327833mtl0803_2

Matsuda, M., Lawrence, C., Delgado, R., & Crenshaw, K. (Eds.). (1993). *Words that wound: Critical race theory, assaultive speech, and the first amendment*. Boulder, CO: Westview Press.

McLaren, P. (2003). Critical pedagogy: A look at the major concepts. In A. Darder, M. Baltodano and R. Torres (Eds.), *The critical pedagogy reader* (pp. 69-96). New York, NY: Routledge Falmer.

Moses, R. P., Kami, M., Swap, S. M. & Howard, J. (1989). The Algebra Project: Organizing in the spirit of Ella. *Harvard Educational Review, 59*, 423–443. doi: 10.17763/haer.59.4.27402485mqv20582

Murrell, P. C., Jr. (1997). Digging again the family wells: A Freirian literacy framework as emancipatory pedagogy for African American children. In P. Freire, (Ed.), *Mentoring the mentor: A critical dialogue with Paulo Freire* (pp. 19–58). New York, NY: Peter Lang Publishing.

Nasir, N. S. (2000). Points ain't everything: Emergent goals and average and percent understandings in the play of basketball among African American students. *Anthropology & Education Quarterly, 31*, 283–305. doi:10.1525/aeq.2000.31.3.283

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (2014). *Principles to action: Insuring mathematics success for all.* Reston, VA: Author.

Nieto, J. (2006). The cultural plunge: Cultural immersion as a means of promoting self awareness and cultural sensitivity among student teachers. *Teacher Education Quarterly, 33*(1), 75–84.

Oakes, J. (1995). Two cities' tracking and within school segregation. *Teachers College Record, 96*, 681–690.

O'Keefe, E. & Gearan, A. (2018, January 13). *Trump, condemned for 'shithole' countries remark, denies comment but acknowledges 'tough' language*. Retrieved from https://www.washingtonpost.com/politics/trump-acknowledges-tough-language-but-appears-to-deny-shithole-remark/2018/01/12/c7131dae-f796-11e7-beb6-c8d48830c54d_story.html?utm_term=.93e890cbfbb9

Pajares, M. F. (1992). Teachers' beliefs and educaitonal research: Cleaning up a messy construct. *Review of Educational Research, 6*, 307–332. doi: 10.3102/00346543062003307

Parker, L., & Lynn, M. (2002). What's race got to do with it? Critical race theory's conflicts with and connections to qualitative research methodology and epistemology. *Qualitative Inquiry, 8*, 7–22. doi: 10.1177/107780040200800102

Peterson, B. (2005). Teaching math across the curriculum. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers* (pp. 9–15). Milwaukee, WI: Rethinking Schools.

Pohan, C. (1996). Preservice teachers' beliefs about diversity: Uncovering factors leading to multicultural responsiveness. *Equity & Excellence in Education, 29*, 62–67. doi: 10.1080/1066568960290310

Price, J., & Ball, D. (1998). Challenges of liberatory pedagogy in mathematics and teacher education. *Theory into Practice, 37*, 256–264. doi: 10.1080/00405849809543814

Rittle-Johnson, B., & Alibali, M. W. (1999). Conceptual and procedural knowledge of mathematics: Does one lead to the other? *Journal of Educational Psychology, 91*, 175–189. doi: 10.1037/0022-0663.91.1.175

Rodriguez, A. J. (2005). Teachers' resistance to ideological and pedagogical change: In A. J. Rodriguez, & R. S. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 1–16). Mahwah, NJ: Lawrence Erlbaum.

Rokeach, M. (1968). *Beliefs, attitudes, and values*. San Francisco, CA: Jossey-Bass.

Ryan, B., & Simpson, M. D. (2016). *Physical appearance categorization activity.* Retrieved from http://breakingprejudice.org/teaching/group-activities/physical-appearance-categorization-activity/

Schoenfeld, A. H. (2004). The math wars. *Educational Policy, 18*, 253–286. doi: 10.1177/0895904803260042

Skovsmose, O. (1994). *Towards a philosophy of critical mathematics education.* Dordrecht, The Netherlands: Kluwer. doi: 10.1007/978-94-017-3556-8

Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practise. *Mathematics Teaching in the Middle School, 3,* 344–350.

Strategies for Promoting Culturally Responsive Classrooms in Alexandria City Public Schools. (n.d.). Retrieved from http://www.acps.k12.va.us/equity/strategies.pdf

Style, E. (1998). Curriculum as window and mirror. In C. Nelson & K. Wilson (Eds.), *Seeding the process of multicultural education* (pp. 149–156). Plymouth: Minnesota Inclusiveness Program.

Tate, W. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*, 166–173. doi:10.1080/00405849509543676

Ten quick ways to analyze children's books for racism and sexism (n.d). Retrieved from http://cmascanada.ca/wp-content/uploads/2011/11/article-10-ways-to-analyze-childrens-books-for-sexism-and-racism.pdf

Ukpokodu, O. N. (2004). The impact of shadowing culturally different students on preservice teachers' disposition towards diversity. *Multicultural Education, 12*(2), 19–28.

Valencia, R.R. (2002). The plight of Chicano students: An overview of schooling conditions and outcomes. In R. R. Valencia (Ed.), *Chicano school failure and success, second edition* (pp. 3-51). New York, NY: Routledge-Falmer.

Villegas, A. M., & Irvine, J. J. (2010). Diversifying the teaching force: An examination of major arguments. *Urban Review, 42*, 175–192. doi: 10.1007/s11256-010-0150-1

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. Albany, NY: State University of New York Press.

CHAPTER IV: PRESERVICE TEACHERS' BELIEFS ABOUT CULTURALLY DIVERSE STUDENTS, AND THE MICRO-TRANSFORMATIONS IN THESE BELIEFS OVER THE COURSE OF A CULTURAL IMMERSION EXPERIENCE

Abstract

Teachers with positive beliefs of lower income and minority students are more likely than those with low perceptions of them to be committed to providing these students a high quality education. In this investigation, I documented the beliefs of secondary mathematics PSTs who were exposed to a cultural learning segment on the instruction of lower income and minority students, and were engaged in cultural immersion experiences in a program with lower income students, many of whom were also African American. All of the PSTs experienced micro-transformations in their beliefs about lower income and African American students and their experiences. PSTs with past encounters with lower income or minority students experienced micro-transformations earlier than other PSTs. The findings have implications for mathematics education research and teacher education programs.

Introduction

Preservice teacher [PST] beliefs about cultural diversity may dictate the learning opportunities they provide their future culturally different students (Gay, 2000, 2002; Sheets, 2003). Dewey (1933) asserted that belief

> covers all the matters of which we have no sure knowledge and yet which we are sufficiently confident of to act upon and also the matters that we now accept as certainly true, as knowledge, but which nevertheless may be questioned in the future. (p. 6)

According to Zheng (2009), beliefs are "psychologically held understandings, premises, or propositions felt to be true; as a result, beliefs are the permeable and dynamic structures that act

as a filter through which new knowledge and experience are screened for meaning" (p. 74). PSTs' beliefs about cultural diversity are based on their own experiences, their personal encounters with people, places, and things (Nespor, 1987). PST beliefs are also based on others' experiences; they may come from various sources, such as family members and friends, literature, or various forms of communicative multimedia. PST beliefs about cultural diversity are not necessarily true. However, the belief holder embraces the "truth" strongly enough to act upon it as if it were fact-based, using this perception as a lens for judging and instructing ethnically diverse or ethnically different students (Pajares, 1992).

Teacher Beliefs Dictate Actions?

Because PST beliefs spur their future pedagogical actions (Pajares, 1992), it is important to consider the beliefs of PSTs—those who will instruct an increasingly diversified student body (Brand & Glasson, 2004). Researchers have found that the mostly European American, female, monolingual, middle class body of PSTs (Cozart, Cudahy, Ndunda, & VanSickle, 2003; Feistritzer, 2011; U. S. Department of Education, 2009) hold negative beliefs of students of different race, language, or social class (Bell, Horn, & Roxas, 2007; Kumar & Hamer, 2012; Sleeter, 2001a, 2001b; Terrill & Mark, 2000). Oates (2003) discovered that European American and African American teachers held neutral views of European American students. African American teachers also held neutral views of African American students, while European American teachers were prone to negative views of these students. Some teachers have characterized African American students as less studious and less prepared for class than other students (Gross, 1993). European American PSTs have characterized African American students in urban schools as less well behaved, less motivated, and less academically prepared than suburban students (Terrill & Mack, 2000) or as lazy or violent (Shultz, Neyhart, & Reck, 1996).

Teachers can influence minority students' performance by actions—intentional or unintentional—that are dictated by their negative beliefs about African American students (Berry, 2004; Jussium, Eccles, & Madon, 1996; Oakes, 1995). In mathematics classes, in particular, teachers' negative perceptions of African American students may influence these students' mathematics performance. Jussium et al. (1996) discovered that teacher expectations and perceptions had a significant effect on 6th grade students' grades and their achievement on a standardized mathematics assessment. Researchers have found that mathematics teachers with negative beliefs about African American students have dissuaded them from participating in class (Martin, 2006). African American students may be susceptible to low teacher expectations and, consequently, low placement in mathematic classes (Oakes, 1995). In these low-track classes, students receive an education that depresses their academic performance (Heubert & Hauser, 1999; Oakes, 1995). Students are exposed to a less rigorous mathematics curriculum (Oakes, 2005) and are taught by less capable and less credentialed teachers (Hallinan, 1987) than those in higher track mathematics classes.

Mathematically successful African American students have attributed their achievement to teachers with positive beliefs about them and their abilities (Berry, Thunder, & McClain, 2011; Jett, 2011; McGee & Martin, 2011). High achieving African American mathematics students have reported that their teachers cared about African American students, had high expectations of them, motivated them to excel in mathematics, and were excellent communicators of mathematics. One of Berry et al.'s (2011) students stated that his 4th grade mathematics teacher challenged him intellectually. This teacher "pushed [him] to the limit" (p. 17) by providing him "hard work." When the mathematics concepts were challenging, this teacher provided support for learning. Jett's (2011) student, Roger, stated that his African

American male professor eased his understanding of complex mathematics. Taken together, this research indicates the mathematics success that can be gained as a result of teachers holding positive beliefs about their African American students' cultural and mathematics identities.

Teacher Education Programs: Sites for Changing PST Beliefs

Pajares (1993) contended, "when beliefs are left unattended, no instruction is likely to have much effect. Students [PSTs] simply incorporate new ideas into old frameworks" (p. 47). Teacher education programs are sites for challenging PST notions of ethnic minorities. And they have a responsibility to equip PSTs with the knowledge, disposition, and tools to give all students, including culturally different students, an equitable education (Gay, 2002). This responsibility of teacher education programs is particularly important given that PST have had few cross-cultural interactions prior to entering the program (Hollins & Guzman, 2005; Kolano & King, 2015). Kahn, Lindstrom, and Murray (2014) suggested that teacher education programs help shape PSTs' beliefs about diversity in a variety of ways by providing them opportunities (a) to take multicultural courses (Walker-Dalhouse & Dalhouse, 2006), (b) to do cross-cultural fieldwork (Akiba, 2011; Kyles & Olafson, 2008), and (c) to critically reflect on their diversity training and experiences (Gay & Kirkland, 2003; Milner, 2006). The authors also stated that PSTs' cross-cultural relationships (Dedeoglu & Lamme, 2011) are powerful determinants of their ability to embrace new beliefs about diversity.

Multicultural education courses. Some researchers have found that multicultural education courses may shift PSTs' beliefs about diversity (Amatea, Cholewa, & Mixon, 2012; Middleton, 2002). Garmon (2004) found that PSTs who are open and self-aware, and possessing sociopolitical consciousness are more apt to benefit from diversity classes than other students.

Milner (2005) concluded that shifts in PST beliefs about diversity were linked to the interaction between PSTs, their course participation, and cross-cultural people and contexts.

Cross-cultural fieldwork. Delpit (1995) and Gay (2002) contended that PSTs should have experiences with culturally different students and community stakeholders to prepare them to instruct in diverse classrooms. Leland and Harste (2005) discovered that field experiences with culturally different students can shift PST beliefs about these students. Nieto (2006) found that direct interaction with culturally different people enhanced PST understanding of minority experiences, helped PSTs develop positive attitudes towards minorities, and diminished PST fear of such students and their community members. Ukpokodu's (2004) PSTs shadowed ethnic minority students to grow their knowledge of them. From this experience, most of the PSTs reported feeling more comfortable about teaching ethnically diverse students. They all reported that they were able to adopt positive views of students and more deeply understand students' in- and out-of-school experiences. Moreover, all of the PSTs reported that the cross-cultural experiences allowed them to challenge and change previously held negative, misinformed beliefs about culturally different students. One PST reported,

> I know that families of culturally different students do value education and want the best for their children. I have also come to understand that circumstances may prevent parents of my culturally different students from active involvement in their education. (Ukpokodu, 2004, p. 25)

Cross-cultural relationships. Researchers have found that meaningful relationships with cultural others may shift PSTs' views of minority students (Dedeoglu & Lamme, 2011; Kahn, Lindstom, & Murray, 2014). The PSTs in Kahn, Lindstrom, and Murray's (2014) study reported that meaningful cross-cultural relationships contributed the greatest to their development of

cultural competence[10]. PSTs ranked cross-cultural relationships as more important to their cultural competency than cross-cultural experiences, multicultural education, and self-reflection. Dedeoglu and Lamme (2011) discovered that PSTs reporting that they had multiple cross-cultural relationships were much more inclined to value diversity than PSTs reporting fewer cross-cultural relationships.

Critical reflection. According to some scholars, (i.e., Cornbleth, 2008; Howard & Aleman, 2008), PSTs need opportunities to reflect on experiences that disrupt previously held beliefs about diverse students. Doyle (1997) found that PSTs who engaged in field experiences with minority students and were given opportunities to analyze and reflect on these experiences changed their beliefs. Ukpokodu's (2004) PSTs wrote reflection papers about their experiences shadowing culturally different students. They reported that critical reflection allowed them to think more profoundly about what is necessary for teaching ethnically different students and what it would take to teach in a diverse setting. Kyles and Olafson (2008) found that reflective writing prepared PSTs from diverse schools more than those from monocultural schools to confront their beliefs about minority students. LePage et al. (2005) stated,

> Through reflective practice, teachers can move beyond the trial-and error stage quickly…. Teachers who have reflective dispositions are less likely to blame children or parents for lack of progress. They are more likely to engage in critical self-assessment in order to change their strategies. (p. 354)

[10] Kahn, Lindstrom, and Murray (2014) defined a cultural competent teacher as having a cultural diversity knowledge base and knowledge of culturally responsive teaching (Gay 2000), as possessing a sociocultural consciousness (Howard, 2003), and as capable of appropriately responding to cultural diverse people and contexts (Diller & Moule, 2005).

Lepage et al. described practicing teachers; however, it is possible that critical reflection may also enable a positive shift in PST beliefs about diverse students.

Rationale

The research community has learned that majority, middle class PSTs enter their teacher education programs having few cross-cultural interactions (Hollins & Guzman, 2005; Kolano & King, 2015). Moreover, we know that while participating in teacher education programs, PSTs hold negative beliefs about minority students (Bell, Horn, & Roxas, 2007; Kumar & Hamer, 2012; Shultz, Neyhart, & Reck, 1996; Sleeter, 2001a, 2001b, Terrill & Mark, 2000). Fortunately, researchers have also found that PST beliefs can shift with the proper instruction (Amatea, Cholewa, & Mixon, 2012; Middleton, 2002), exposure to cultural others (Dedeoglu & Lamme, 2011; Kahn, Lindstom, & Murray, 2014), and reflection opportunities (Doyle, 1997; Ukpokodu, 2004). McMunn-Dooley (2008) claimed that major shifts or transformations in PSTs' beliefs are difficult to capture, which is why she focused her research on capturing micro-transformations. In her investigation of teachers participating in a literacy methods course on culturally responsive teaching, McMunn-Dooley documented "slight shifts toward new, broadened conceptions" (McMunn-Dooley, 2008, p. 65) of multicultural literacy pedagogy.

In her review of the literature, McMunn-Dooley (2008) noted that there is limited empirical evidence of micro-transformations. McMunn-Dooley (2008) documented teachers' micro-transformations, but not the timing of these type of shifts. The research community requires a more in depth understanding of PSTs' micro-transformations, specifically noting the timing of these micro-shifts. I aimed to uncover this key transition in PST beliefs, or micro-transformation. The following research questions were addressed:

1. What beliefs were evident in PST reflections?

2. How were those beliefs transformed as they accumulated more hours working with lower income and minority students at the cultural immersion site?

Theoretical Framings

In their Conceptual Change Theory, Posner, Strike, Hewson, and Gertzog (1982) bridged notions from Kuhn (1970) with those of Piaget (1977). Kuhn (1970) described the process by which a new scientific paradigm is adopted by a group of scientists. According to Kuhn, scientists perceive a lack of usefulness of an existing paradigm, pursue a conflicting paradigm to make sense of a phenomenon, and form consensus around the newly derived paradigm. Posner, Strike, Hewson, and Gertzog (1982) applied Kuhn's theory to learning. They contended that learning occurs when the individual becomes discontent with previously held ideas, is faced with new ideas that are incompatible with the original ones, grapples with the reasonableness of conflicting ideas, and arrives at a conclusion that is acceptable to the learner. They also added two forms of learning, assimilation and accommodation, to Kuhn's framework. These learning types had been previously identified by Piaget (1977). According to Piaget, some learners assimilate or merge a new idea into an existing set of notions that resemble the new conception. In comparison, with accommodation, a new idea is incompatible with originally held conceptions; therefore, learners grapple with its truth-value and usefulness. To accommodate the new conception, the learner must rearrange or replace what was originally accepted. Duit and Treagust (2003) found that learners have difficulty accommodating new ideas. Furthermore, it is challenging to capture moments in which conceptual change due to accommodation occurs. For example, how can a researcher document a PST's shift from deficit to affirming attitudes—reflections of beliefs— towards diverse students? How can a researcher document the PST shift

from sociocultural consciousness to sociocultural dysconsciousness? McMunn-Dooley (2008, p. 56) stated,

> Theoretically, transformation would be an all-or-nothing venture. In other words, when a teacher transforms his or her perspective, then his or her conceptions would all likely change as well. Teachers are then supposed to use these understandings as they fashion their literacy instruction to meet the needs of diverse student populations.

McMunn-Dooley also noted that major shifts in teacher beliefs may be difficult to capture. However, it is possible to document "micro-transformations" (Alexander, 1998), smaller conceptual shifts that lead to the accommodation of an ideology that celebrates diversity. McMunn-Dooley (2008) described micro-transformations as a broadening of conceptions.

Methods

In the fall semester of 2016, PSTs participated in a learning segment on culturally responsive teaching (see Appendices F, G, H, I, J, and K) that was embedded in a semester-long secondary mathematics education course. The 3-week learning segment met twice a week for 1 hour and 35 minute-sessions at a large Midwestern university. For roughly 12 weeks of the 16-week semester course (including the time PSTs were engaged in the 3-week learning segment), the PSTs simultaneously experienced a cultural immersion (CI) in an informal after-school education setting with lower income students who largely also were African American (see Figure 1).

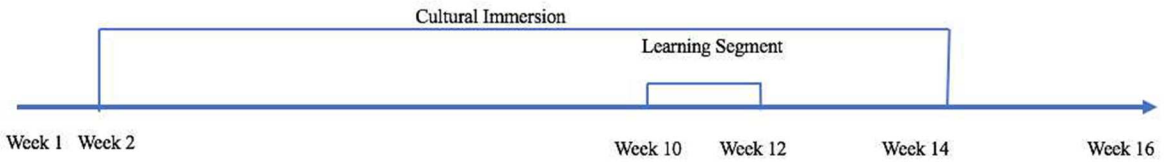

Figure 1. Timeline for cultural immersion and learning segment.

PSTs constructed three tasks for the learning segment: tasks with their own cultural details (culturally responsive to PST tasks), tasks with interviewed students' cultural details (culturally responsive to student tasks), and task with social justice issues (critical mathematics tasks). Figure 2 shows the topics covered in the learning segment, as well as the tasks PSTs constructed.

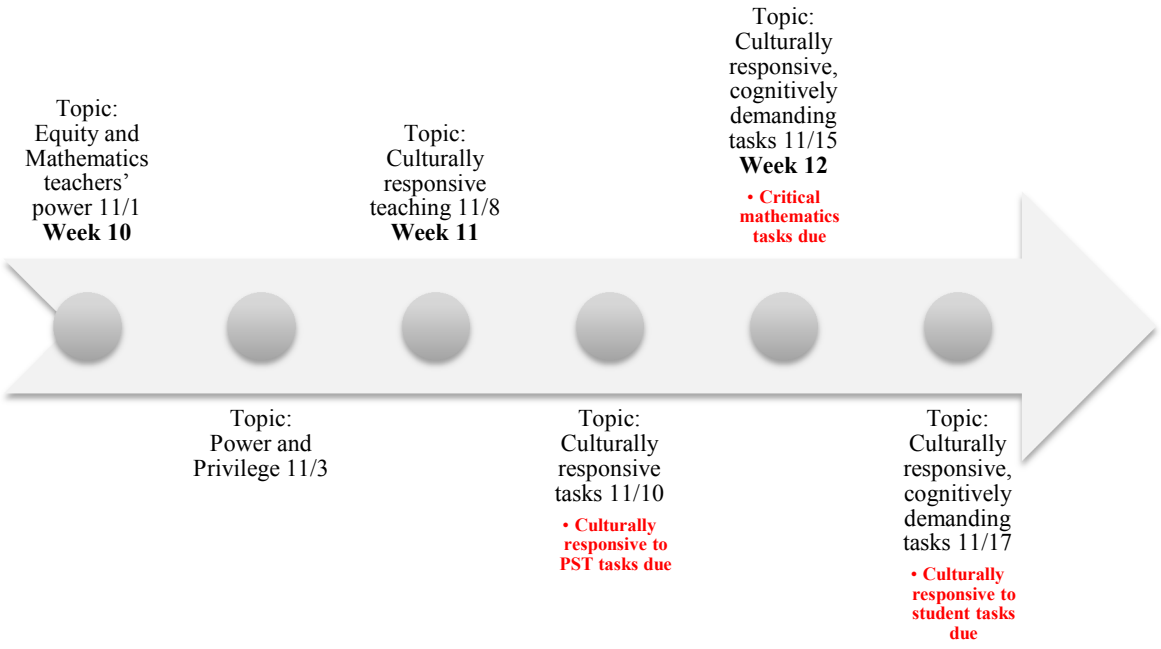

Figure 2. Learning segment topics and culturally responsive and critical mathematics tasks.

I used case study methodology to examine PST beliefs about their lower income and minority students. Case study applies three principles of qualitative research: to describe, to understand, and to explain (Yin, 1994). A case study is a close examination of the contextual dynamics of an actor or set of actors. The researcher attempts to provide readers details of the case that will help them more fully understand what the researcher has observed and is analyzing. "Thick description" (Geertz, 1973) is used to give the reader a clear picture of the participants and environment in which the study occurs. The case study researcher also helps the

reader understand the case by asking "why" and "how" (Yin, 2003) questions to understand the social dynamics of interactions. Little regard is given to generalizing beyond the case itself. Stake noted (1995), "We take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what is does" (p. 8).

A case study may consist of a single case or of multiple cases. A single case study is useful for shedding light on an occurrence or phenomenon that previously was obscured. In a multiple case study, the idea or concept binding the cases, the "quintain" (Stake, 2006), is of primary interest, while each single case is of secondary interest. In this study, the quintain is PST shifts in their beliefs about teaching lower income and minority students. I will investigate each case as an illustration of this concept that binds the cases.

Setting

Participants. The PSTs consisted of four individuals: a European American male (Micah), a European American female (Faith), an African American male (Keenan), and a Jewish, European American female (Carmel). Although other PSTs submitted critical reflections through their writing on their cultural immersion experiences (see Appendix M), I chose Micah, Keenan, and Carmel because they had the most complete data for this study. That is, they provided written class assignments and written CI reflections, and they allowed me to interview them after the learning segment (see Appendix N). I chose Faith because she was the only PST who consistently exhibited positive views of the students at the CI site and her CI reflections indicated that she had experienced a micro-transformation over the course of the cultural immersion.

Before the methods class began, PSTs had completed at least 45 hours of coursework (roughly three full-time semesters at the university). I recruited PSTs from this class because

they were interacting with lower income and minority students (i.e., African American and Latin@ students) and because they were required to engage in critical reflection through written assignments on issues relating to African American and Latin@ students and on their [PST] experiences when interacting with such students.

Learning segment. During the learning segment, PSTs read literature on the teaching of culturally diverse students, especially African American and Latin@ students. Readings included the National Council of Teachers of Mathematics' (2000) Equity Principle, as well as other literature (see Table 1) on teacher identity, the instruction of ethnic minority students, and the role mathematics plays in accessing post-secondary educational and occupation opportunities. PSTs engaged in class discourse on the readings and class activities. In addition, they reflected on CI experiences in journal entries. I co-led classroom discussions along with the primary instructor, a European American male.

Table 1

Class Themes, Readings, Activities, and Homework

Days	Intended Themes	Readings	In-class Activities	Homework
Day 1	(In)Equity in mathematics classes and its consequences -Tracking by race and socioeconomic status -The link between access to higher mathematics and access to post-secondary education and good jobs The power mathematics educators wield	Moses, Kami, McAllister-Swam, & Howard (1989) Oakes (1995) National Council of Teachers of Mathematics (2000)	Small and whole group discussion of the readings	Discuss the extent to which you, a future mathematics teacher, will be in a position of power in school. In your own words, define equity. Assume you have a class of African American and Latin@ students, such as those at [the CI site]. Your students are not performing as well as those from other racial groups. Who is responsible for their performance?
Day 2	Acknowledging biases/preconceived notions Acknowledging own position in society, particularly in relation to others'	None	Physical Appearance Categorization Activity (Ryan & Simpson, 2016) Position of Privilege or Power Activity (created by Trask)	To what extent do you believe you are in a position of power? Are you in the same position of power as [the students at the CI site]? How do similarities or differences in position of power between teacher and student influence instruction or learning?
Day 3	Culturally responsive teaching	Gay (2002) Kea, Campbell-Watley, & Richards (2006) *Strategies for Promoting Culturally Responsive Classrooms* (n.d.)	Video interview about culturally responsive teaching (https://www.youtube.com/watch?v=eSwr6vsrqb0) Small and whole group discussion on characteristics of culturally responsive teacher PST to PST Cultural Information Interview	Please create a mathematics task that reflects your own experience. Create a list of information (or questions one might ask you) that would be helpful to create this culturally-responsive-to-you task. Please research a social justice issue you perceive a [student at the CI site] or the student's family member may be facing (e.g., racism, sexism, homelessness, poverty, food desert, joblessness, domestic violence, ageism, lack of health care/health care coverage). Look for statistics that illustrate this issue. In particular, please find statistics that show how the issue affects your student's group and other racial groups. Please bring this information to class.
Day 4	Culturally responsive tasks	Kea, Campbell-Watley, & Richards (n.d.) Ten quick ways to analyze children's books for racism (n.d.) Gutstein (2003) Ladson-Billings (2009) Nasir (2000) Style (1998) Tate (1995)	Whole group discussion on the readings Analysis of the cultural responsiveness of some mathematics tasks Analysis of a critical mathematics task Videos on African American secondary students discussing perspectives of culturally responsive teaching and tasks Examination of a rubric with cultural aspects of a task based on Gay's (2002)	Use the information you gathered about the issue you perceive your [student at the CI site] or a family member faces to create a culturally and critically responsive word problem. Please reflect on the difficulties you had in making this problem (and in making it significant to this group of people). In what ways might your student benefit from your culturally and critically responsive word problem? In what ways might students from other groups benefit from your word problems?
Day 5	Cognitively demanding tasks	National Council of Teachers of Mathematics (2000) Smith & Stein (1998)	Video of Trask interviewing African American secondary students using the Cultural Information Interview Protocol (see Appendix O) Analysis of the cognitive demand of tasks in Smith and Stein's (1998) article	Using the Cultural Information Interview Protocol, complete your interview with an African American or Latin@ [student at the CI site]. Use information from this interview to create a culturally-responsive-to-student mathematics task. Describe the type of student who should receive high cognitive demand tasks.

(Table Continues)

Days	Intended Themes	Readings	In-class Activities	Homework
				Describe the type of student who should receive low cognitive demand tasks.
Day 6	Cognitively demanding and culturally responsive tasks	None	Whole group discussion of the cognitive demand and cultural responsiveness of a reform-oriented word problem	None

Note. CI=Cultural immersion.

Cultural immersion. PSTs experienced cultural immersion with ethnic minority students as a result of course participation. Mahan and Rains (1990) and Nieto (2006) discovered that teachers' understandings of ethnic minorities' personal and cultural experiences and backgrounds increased from direct contact with members of these groups. Also, Nieto (2006) found that cultural immersion eased teachers' fears of ethnic minorities.

At the CI site, PSTs spent 20 hours experiencing cultural immersion with lower income and ethnic minority students, such as African American and Latin@ students. PSTs submitted 3 reflection papers in total after volunteering 7, 14, and 20 hours. At the beginning of the semester, the primary mathematics educator expressed to the PSTs that he preferred that they spread their 20 hours evenly over the course of 12 weeks. However, he allowed PSTs to allocate their cultural immersion time; PSTs decided the amount of sessions and amount of hours per session they would volunteer. The cultural immersion occurred in an after-school program at a local junior high school where PSTs tutored students in mathematics and other subjects, monitored students, and interacted with them through play during recess periods. There was a mismatch between the grade level PSTs aspired to teach (high school) and the grade level of students at the CI site (middle school). Moreover, PST responsibilities at the site did not always involve mathematics. However, at the beginning of the semester, the primary secondary mathematics educators had expressed to me that one of his goals for the class was to provide PSTs direct contact with culturally different students so they can reflect on what it might mean to teach cultural others.

Data sources. I used the reflection data from four PSTs from the secondary mathematics education course. Data consisted of PSTs' written reflections on their CI experiences, post-cultural learning segment interviews about their critical CI reflections, and their written assignments on culturally responsive teaching, including a reflection on power and privilege. Table 2 outlines the CI reflections PSTs submitted for analysis.

Table 2

PST CI Reflections

PST	Preflection[11]	Reflection 1 (7 hours)	Reflection 2 (14 hours)	Reflection 3 (20 hours)
Keenan	X	X		X
Carmel	X	X	X	X
Micah		X	X	X
Faith	X	X	X	X

Analyses

Villegas and Lucas (2002) developed a framework (see Figure 3) for understanding the difference between teachers who have a sociocultural dysconsciousness and those who have a sociocultural consciousness.

[11] Preflection include PSTs' anticipations of what they will experience at the CI site.

Sociocultural dysconsciousness →	Sociocultural consciousness
Worldview: Unreflective way of thinking that takes one's worldview as universal; lack of awareness that one's experiences in life, as mediated by factors such as social class, race/ethnicity, and gender, influence how one comes to see the world.	Worldview: Heightened awareness that there are multiple perspectives on the world and that person's worldview reflects his/her location in the social order relative to such factors such as class, race/ethnicity, and gender; clear insight into one's perspective and how it is shaped by one's biography.
Power differentials: Unawareness of power differentials in society and how existing differences in power are structured into the standard practices of various institutions—including the education system; uncritical belief in the neutrality of school practices; unquestioned adherence to a meritocratic view of American society, which supports justification of existing inequities.	Power differentials: Profound understanding that power is differentially distributed in society and that social institutions, including the educational system, are typically organized to advantage the more powerful; critical of existing inequalities.

Figure 3. Gaining sociocultural consciousness framework. Reprinted from *Educating Culturally Responsive Teachers: A Coherent Approach* (p. 33), by A. M. Villegas, 2002, New York, NY: State University of New York Press. Copyright 2002 by State University of New York. Reprinted with permission.

Socioculturally dysconscious PSTs are ignorant (perhaps purposefully) of the ways powerful institutions privilege the knowledge, behaviors, and norms of dominant groups. For example, PSTs who have sociocultural dysconsiousness might be reluctant to question self-serving school policies. They might refuse to acknowledge that race and class may dictate student experiences. Instead, PSTs who have sociocultural dysconsciousness might express beliefs that schools are meritocratic, and they might propose that lower income and minority students underperform in school because of their poor effort or low intelligence. In contrast, PSTs with sociocultural consciousness might reject this ideology and express beliefs that lower income and minority students have greater difficulty advancing in school due to their social status or race. These PSTs might express beliefs that the knowledge of European American middle-class students is privileged in standard curricular materials. Furthermore, they might express beliefs that lower

income and minority students' access to high quality mathematics education is blocked by oppressive class- and race-based policies.

Villegas and Lucas (2002) also articulated differences between teachers with deficit and affirming attitudes towards students (see Figure 4).

Deficit perspective	Affirming perspective
Attitude toward the dominant culture: The culture (e.g., ways of thinking, talking, behaving) of the white middle class is inherently superior and, therefore, the legitimate standard for U.S. society and its institutions.	*Attitude toward the dominant culture:* The culture of the white middle class is valid, as are the cultures of other groups. The greater status of this dominant culture derives from the power of the white middle class, not from an inherent superiority.
Attitude toward cultural diversity: Ways of thinking, talking, and behaving that differ from the dominant cultural norms are inherently inferior. Cultural differences are problems.	*Attitude toward cultural diversity:* Ways of thinking, talking, and behaving that differ from the dominant cultural norm are valid (not inherently inferior or deficient). Cultural differences are to be respected and affirmed.
Attitude toward culturally different students: Student who don't conform to the dominant culture are "deficient" and in need of "fixing." Emphasis is placed on what students are lacking	*Attitude toward culturally different students:* All students—not just those who conform to the dominant cultural norms—have experiences, knowledge, and skills that can be used as resources to help them learn even more.

Figure 4. Developing an affirming attitude toward student from culturally diverse backgrounds. Reprinted from *Educating Culturally Responsive Teachers: A Coherent Approach* (p. 36), by A. M. Villegas, 2002, New York, NY: State University of New York Press. Copyright 2002 by State University of New York. Reprinted with permission.

According to Villegas and Lucas (2002) teachers with deficit attitudes towards lower income and minority students—socially dysconscious teachers—hold beliefs that students who are nonconforming to Eurocentric norms and behavior are lacking or broken and need to be fixed. In contrast, teachers with affirming attitudes towards these students believe that they, like middle class majority students, bring experiential, cultural, and educational assets to class. Furthermore,

these teachers with affirming attitudes towards lower income and minority students believe all students are capable of learning, not just those with behaviors, experiences, or norms that mirror that of the dominant culture.

In this investigation, I used Villegas and Lucas' framework to identify micro-transformations in PSTs' beliefs about the role power plays in lower income and minority students' experiences (a social justice awareness micro-transformation). Moreover, I used the researchers' framework to identify micro-transformation in PSTs' attitudes (an attitudinal micro-transformation), which are based on their beliefs (Hogg, & Vaughan, 2005) about students.

Findings

In the section that follows, I give profiles of PSTs based on information they provided from their post-learning segment interviews to give the reader some understanding of PSTs' backgrounds, experiences, or beliefs. I did not gather the same information from the PSTs, as interview questions were constructed to obtain a better understanding of each particular PST's attempts to create critical mathematics and culturally responsive tasks. I asked PSTs open-ended questions and sometimes they volunteered information—although not always the same information—about their backgrounds, experiences, or beliefs. Faith did not agree to be interviewed; therefore, I was unable to provide a profile for her.

Next, each set of PST reflections, as well as their preflections, is immediately followed by an analysis of the micro-transformations the PST experienced over the course of the cultural immersion. I acknowledge that a micro-transformation may have occurred before PSTs wrote their reflection. However, because I am relying solely on the reflections that occurred after 7, 14, and 20 hours, these were used as markers for micro-transformations in PST beliefs.

Keenan's Profile

Keenan is an African American who grew up in a predominantly African American community. He noted, "I grew up in a school that was all black. About the only time I really saw white people, it was like the police. If I saw Asians, it was at the beauty supply house. And if I saw Arabics, it was at the gas station." Roughly half of his teachers were African American, the other half were "white, Hispanic, and probably one Asian in [his] entire life." In contrast, all of his grammar school and high school peers were African American. Keenan experienced culture shock upon taking classes in his mathematics teacher education program. "Now I rarely see black people, like in class, especially in my major. [Recently], my abstract Algebra class had two black people. But I was shocked to see that because that has never happened." Keenan felt isolated, both in his program and at home with family members and friends. Keenan expressed,

> Coming here, I always feel like I'm on an island. Like in class, just being the only black person there, I feel like I'm on an island. Or even at home, 'cause most of the people I know are not educated. My sister was the first one to graduate college in my family. So there I feel like I'm on an island. Some of the stuff I can't really talk about because they can't relate, and so either way it goes…It's only a few people who make me not feel like I'm on an island.

Keenan noticed that his high school had not prepared him for college when he participated in college mathematics classes. His European American peers seemed to have vastly different knowledge than he possessed.

> All of my peers [mathematics majors] were taking Calc I. I'm like, 'Dang, how do you know all this stuff?' And it's because they had it in their high school….I never got the

> chance to learn Calculus or more upper level math at my high school….The highest we went up to [that was offered] was just the Algebras and Geometry.

According to Keenan, the cultural learning segment had supported prior beliefs. In particular, Keenan believed, "It's important to get to know the students. It's important to be aware of what kind of baggage you bring into the class." When asked what he meant by "baggage," Keenan replied, "Some of the stuff I bring in that I may not see as a big deal but is harmful, may be offensive to a student." He expressed that culturally responsive tasks are valuable because they "would catch [his] attention."

Keenan's Written Reflection and Other Information Related to His Beliefs

Preflection. Before he had a chance to volunteer, Keenan expressed that he was "excited" to interact with students at the CI site. Keenan revealed in his post-cultural learning segment interview that all of his classmates in grammar school were African American and of lower socioeconomic status. Keenan imagined that the students at the CI site would have similar cultural and social class backgrounds to the students in his former grammar school, who he contrasted with the students he interacted with in local Midwestern schools.

> Since coming to college, I have had the opportunity to familiarize myself with children of pretty much every culture found in American schools. It has been great to learn how children of different cultures respond to different teaching styles and I do believe that I have gained valuable teaching tools and have learned how to build relationships with students who are very different from myself, which is great! However, there is a sense of satisfaction and comfort that comes from teaching children that have backgrounds similar to my own and I am extremely excited to do exactly that.

Keenan wrote of a desire to be a role model for the students at the CI site just as his teachers had been for him and his peers. He wanted to show these lower income students, particularly the African American male students, that they could attain academic success as he had.

> I know how important representation is for members of marginalized groups and being the person that shows students, especially the black males, that people who look, dress, speak, and behave like they do are perfectly capable of doing more than what the media portrays.

Reflection 1. In his first reflection, Keenan squarely acknowledged that students had not yet developed the skills and obtained the tools necessary to excel in an academic environment. In particular, he mentioned that students lacked motivation, had limited attention for homework tasks, or had behavioral or learning impairments. However, Keenan perceived that he was responsible for helping students attain their highest level of understanding. He stated he must shelve his own feelings of frustration and work harder to improve students' academic standing.

> Undoubtedly, there have been times where I have gotten frustrated with my lack of progress with the students. Still though, after putting aside my frustrations and working more diligently with the students, I have been able to actually have some kind of influence over these students for the better.

Keenan allocated much of his first reflection to a 2-phase plan he executed to maintain order to facilitate student learning: (a) "getting student conduct under control" and (b) "instruction." At first, he took an authoritarian approach, yelling at students and engaging in multiple power struggles. He discovered, "A power struggle with a stubborn child whom you are not allowed to chastise is a recipe for a headache, and that is exactly what I got." When his tactics were unsuccessful, Keenan devised a new plan, which entailed being positive and polite

to students. To his dismay, this approach also was unfruitful. Keenan then engaged in critical reflection on his attempts and on what might work on students whose behavior likely mirrored his own as a child of their age. The next time he volunteered, Keenan abandoned all efforts to provide students at the CI site academic assistance, focusing instead on getting to know students on a personal level. Keenan noted, "After hearing the students' backgrounds, it became a lot easier to empathize with them and remain patient with them when they began misbehaving. It also became substantially easier to get them to *stop* [Keenan's emphasis] misbehaving."

Keenan drew multiple conclusions from his critical reflection on his experiences with the students at the CI site. First, he must be adaptive; his plans for students likely will change and he must be willing to adjust his plans for the betterment of the students. Second, student-teacher relationships are essential to maintaining order in the classroom for learning. Keenan mentioned that one must "gain their [students'] respect" to ease learning. Keenan coupled this with gaining student favor. In this sense, Keenan seemed to take less of an authoritarian approach and seemed willing to be attempting to work with students, establishing rules and boundaries and classroom norms with them to work toward their best interests.

Reflection 3. In his final reflection, Keenan again devoted much of his reflection to describing his struggle to coerce students to improve their academic outcomes. Keenan did not demonize student behavior but rather remarked about the "mystery" of the inconsistency of student behavior and his need for a myriad of strategies to convince students to act in ways that allow them to learn.

> Among the challenges that I have faced at the CI site, classroom management has definitely been one of the most pressing. The students can be extremely difficult to get through to, and even once I finally do get through to them, the next day is as if I have to

> completely start from scratch. Every day with these students is a mystery. Some days the students are angels and other days they make me want to pull my hair out. Through certain practices such as disciplining the students on a consistent [basis] and explaining to them the seriousness of their misbehavior, I have been able to reduce the number of bad days that I have with the students and increase the number of days where students are behaving in a way that is more conducive to a learning environment.

By his admission, Keenan's efforts were frustrating and exhausting. However, Keenan believed in the inherent goodness of students and in their ability to learn, which is why he recommitted to helping them at the close of each volunteer day.

> Following the days where student behavior was not up to the standards that we hold them to, there would be a sense of discouragement. It was difficult to gauge whether I would ever be successful in properly swaying the students to do what was in their best interests. It was also difficult to combat the sense of frustration that the students would provoke. I'd be lying if I said that there were not days where I'd leave in a fit because of the way the students behaved. This is where patience comes in handy. Being able to reset at the end of the day and look at the following day as a completely new day was an extremely valuable ability that proved to be extremely important to my survival at the [CI site].

Keenan ended his last reflection with the same affirming attitudes towards the students at the CI site. For instance, Keenan wrote of how fortunate he felt to work with "students of such character," as his experiences with these students have prepared him for his future teaching career.

Summary of beliefs and micro-transformations. For the most part, Keenan held positive views of these students from culturally diverse backgrounds positive. He may have felt this way because he saw himself reflected in students of similar cultural and social class backgrounds. Keenan believed the students could behave in ways conducive to what he perceived as a positive learning environment. Because of his convictions, Keenan constantly worked to create and revise plans to help them excel in school despite their resistance. Keenan characterized students in positive ways and held himself responsible for convincing them to invest in their education. He developed relationships with students and found that the bonds eased his ability to convince students to work with him to establish and enforce classroom environment rules.

Keenan wrote of one micro-transformation relating to his treatment of the students. When he first volunteered at the CI site, Keenan held a deficit perspective of student behavior. More specifically, he assumed that the lower income and minority students at the CI site should behave in ways that mirrored typical Eurocentric classroom settings. He also saw himself as the authority who should forcibly (through yelling and arguing) enforce the rules of the program. Keenan's first reflection (after 7 hours) revealed an attitudinal micro-transformation relating to the treatment of African American students (see Figure 5).

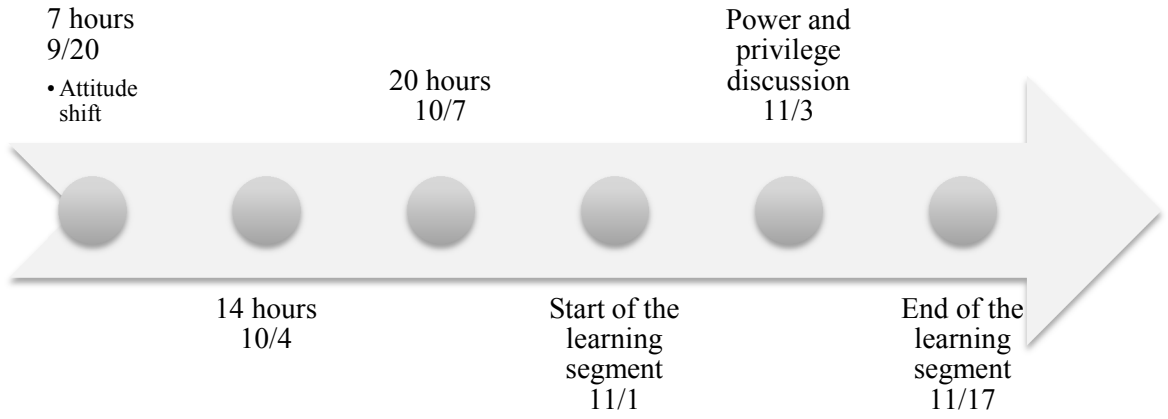

Figure 5. Keenan's micro-transformation.

After critical reflection, Keenan treated students with the respect he would have wanted at their age. His development of relationships and his growing cultural diversity knowledge base made it possible for the students to respect him, in return, and grant him favor.

Keenan wrote little about his awareness of the social or social justice issues faced by the students at the CI site; therefore, a determination could not be made about micro-transformations in Keenan's sociocultural consciousness. In his preflection, Keenan wrote of the disparate experiences of low-income and minority students and of inaccurate media portrayals of marginalized people, particularly African American males. Besides this, there is no written evidence in Keenan's reflections about his understandings of students' encounters with social justice issues.

Carmel's Profile

Carmel is a Jewish, European American who grew up in a community that was "all white, all Catholic," and "almost everybody was Polish." Carmel reported that most people do not perceive her as a cultural minority. However, when her cultural identity is revealed, she has observed that she "will definitely see a distinction with some people on how they treat [her] after that." According to Carmel, discussions about culture and cultural difference, such as those in the cultural learning segment, were not new to her because her family often discusses how to present themselves as "the token Jew[s]." Carmel reported that her family strategizes on how they can give others "a sense of what Judaism is" and on how to present themselves in ways that will encourage others to develop positive associations between them and their faith.

Carmel claimed that the use of culture in instruction could result in enhanced student learning. She anticipated that she might teach in a "majority Christian environment; [therefore] using a culturally responsive task relating to Judiaism might give more culture, a little more diversity to the classroom environment." In addition, as a result of her experiences as a camp director, Carmel determined that there is a social element to learning, including the learning of mathematics. Carmel stated, "Teaching mathematics doesn't require having culture, but school isn't about teaching mathematics only. We're leaning a lot more than just math. We're learning how to cooperate with our peers; how to engage in discussions; how to relate to each other. There's a lot more social learning that's happening and I think culturally responsive tasks kind of help with that, as well as helping to learn the math."

Carmel's Written Reflection and Other Information Related to Her Beliefs

Preflection. Before she had begun volunteering, Carmel percieved that her time at the CI site would be enjoyable. She anticipated that she would have fun with the students at the CI site

just as she has had when working with children at a past summer program. Carmel primarily focused on what she could give students at the CI site, as opposed to how they could enhance her understandings. Carmel wrote that students at the CI site would benefit from her mathematics contributions. She did not mention how their understandings of mathematics or their world views might also change how she views mathematics education, in terms of its social or cultural components.

Reflection 1. Carmel's beliefs about her CI experience had soured by the time she wrote her first reflection. She devoted much of her reflection to describing the "misbehavior" of students at the CI site and their unwillingness to participate in their own education. For instance, Carmel wrote that on one of her volunteer days, most of the students in her room refused to do their homework and were "disruptive and disrespectful." According to Carmel the students needed to be controlled because they lacked discipline and respect for volunteers and staff. Carmel's criticisms also extended to staff at the CI site. Carmel complained that the staff fell short of strongly admonishing students and correcting improper behavior.

> At my most recent visit to the [CI site], there were only 6 students in the entire room. Two of those students were working, while the other four were shouting, running, cursing, fighting, and making inappropriate jokes. The staff in the room had visibly given up on trying to control or discipline the students. When I tried to intervene, the staff did not back me up, and the students decided that they did not have to listen to me, especially since [the program coordinator] was out of town.

Carmel offered her own suggestions for gaining control of similarly behaving students in a classroom setting. According to Carmel, students, such as the largely lower income and African American students at the CI site, need a strict authoritarian teacher who will set high

behavior standards early and maintain them throughout the school year. Carmel associated students' ability to learn and student respect of their teacher with the teachers' ability to maintain order in the classroom.

> This experience has shown me how important it is to get a handle on the classroom from the very beginning and maintain a strict atmosphere rather than try to rein it back in later. As a teacher, we have to set expectations and enforce them consistently and gain the respect of the students to have any response from them. When a single student is not disciplined for misbehavior, students will take it as weakness and follow that student's behavior. Educators must be responsive to keep control over the classroom and promote a safe and positive learning environment. It is very hard to gain that respect when you are only a face that students see once a week.

Carmel argued that teachers must "gain the respect of the students." However, what Carmel called "respect" sounded more like fear as she followed this claim with an example of how a teacher must make an example of poorly behaving students early in the school year to control them and their peers. By Carmel's logic, if the teacher fails to rule the class with an iron fist, students will take the teacher's inaction as "weakness." Carmel claimed that this approach to discipline is necessary to create a safe and positive learning environment. Yet, she was making these claims from a teacher perspective without the benefit of a student perception.

Reflection 2. Midway through her volunteer assignment (by Reflection 2), Carmel had softened somewhat in her perspective of students, as she realized that there are reasons students struggle to complete their work. Carmel discovered that students lacked clarity about what they must do to successfully complete homework tasks. Additionally, she found that students may have needed to respond to stimuli in the immediate environment before they could focus on their

homework tasks. She discovered that if she allowed distracted students to briefly respond to the surrounding activity, she could persuade them to focus on their homework task.

> Most of the time, the students do not know how to get started with the assignment and seem to not understand what is needed of them to succeed. The students need to be guided through the homework and activities. When they are working, the students get very distracted and need to constantly be reminded that they actually are working. They all seem to feed off of each other's energy and then get distracted and involved in what each other is doing. I have learned to let them go a little and respond to what is happening around them before I bring them back in because it will let them give a little bit of their energy and focus a bit more.

Reflection 3. Finally, in her third refection, Carmel reported that she had discovered that there are non-academic factors, such as hunger, that may influence learning. From her observations of students who were hungry "all the time," Carmel concluded that hunger may overwhelm students, and their desire for food may take precedence over their desire to complete their schoolwork.

> The students I had spoken to who went [to the STEM program offered at the CI site] said either that they were interested in the program and that it sounded cool, or, more often, that they were going for the free food. Food seems to be something that the students have on their minds all the time. They are always asking for a snack and complaining that they are hungry. When people are hungry, they are focused on that rather than things like school work, so I have been questioning if that is one of the reasons why they are so unfocused, because they are hungry. I was once around when the students were allowed to have a second snack because they said they were all so hungry and the snack was

cheese, crackers, and a piece of fruit. It did not seem like a lot of food, but enough for a snack.

In her post-cultural learning segment interview, Carmel articulated her understanding of the role non-school factors play in students' school performance. Carmel also stated that she would have to remember not to take student disengagement personally but to instead look for out-of-classroom factors that may influence achievement before judging student behavior.

T: Your [CI] reflections suggest you had an epiphany about the role of hunger in student participation in school or school related activities.

C: It was shocking seeing how they are always like, "Oh, well, I'm hungry. I don't want to do this. I just want food. Can we have another snack?" Just all the time, they were asking, "Can we have more snack?" Whenever they were doing well, the [workers at the CI site] tried to give them more food. So, I was kind of wondering like why is there always this question about food? Are they just always hungry? Or is it because they're growing? Or are they really getting enough food elsewhere. It was just weird for me to see that that's what's on their mind. They don't really want to do their work. They're like, "Oh, can we get more snack?"

T: In what ways does that influence your perception of how factors outside of school could influence what happens in your classroom? Like students' willingness…what looks like their willingness to learn and things like that?

C: Well, I mean, of course, if you have something like a basic need like hunger, and are not satisfied, you're not going to be able to focus nearly as well. You kind of need to satisfy that stuff, make sure the kids have something to eat, have

something to drink. That way they can focus on learning and focus on the material and try to concentrate more.

T: Do you think that your experience made you more willing to look for those types of things when you become a teacher?

C: Yeah. I think it kind of works as a reminder to myself. I know that there are these outside things that are interacting with how they are learning, but you don't always realize it. Sometimes you take it a little more personally or take it as just the students don't want to be here, but it kind of acts as a reminder. You have to keep thinking you don't know what's going on outside. You need to figure that out before you judge the student.

That she gave little thought, prior to volunteering, to the plight of lower income students is evidenced in her post-cultural learning segment utterances: "It was just weird for me to see that that's what's on their mind." "It was shocking seeing how they are always like, 'Oh well, I'm hungry. I don't want to do this. I just want food.'" "I was just wondering like why is there always this question about food?" These utterances suggest that Carmel's awakening seemed to result from her direct experiences with the lower income and minority students at the CI site.

Summary of beliefs and micro-transformations. There was evidence in Carmel's written reflections of multiple micro-transformations in her attitudes towards or beliefs about students from culturally diverse backgrounds. Before she volunteered at the CI site, Carmel held expectations that she would have positive interactions with the students, just as she had with those at a past summer camp with middle school-aged students. However, by the time she wrote Reflection 1, she perceived the students at the CI site negatively, focusing almost primarily on their "misbehavior." Her deficit perspective of student behavior was further revealed when she

expressed a need to control students (or fix them) by creating an environment that forced them conform to Eurocentric behavioral norms typically found in schools, and by creating an environment in which respect for the teacher is demanded, but not necessarily earned. By Reflection 2 (after 14 hours), Carmel's experienced an attitudinal micro-transformation, as views of students had shifted again and were more positive (see Figure 6).

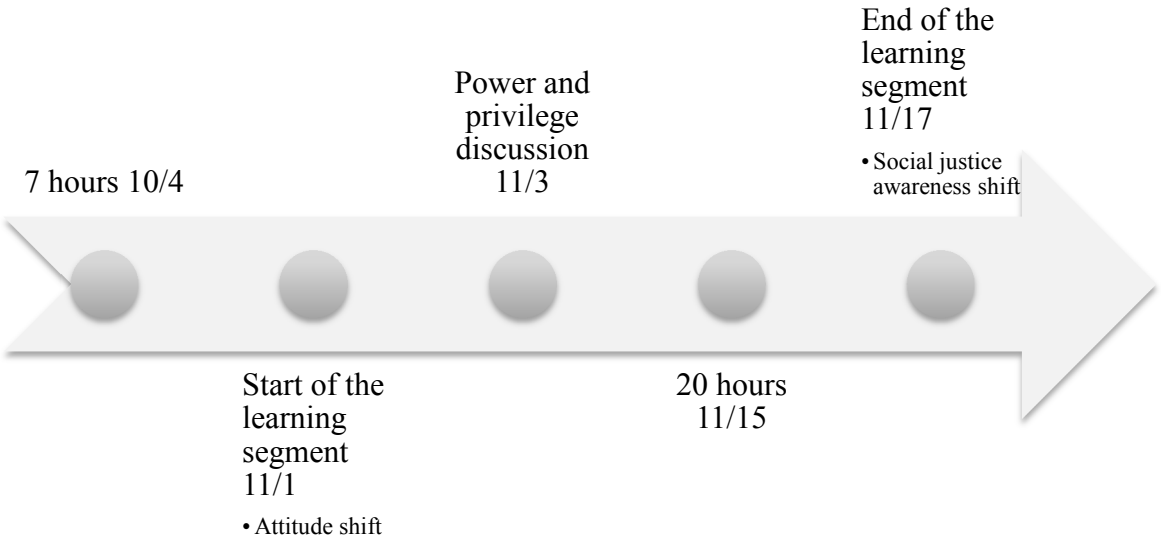

Figure 6. Carmel's micro-transformation.

She became more forgiving of their behavior and offered rationales for their struggle to complete their work. By the final reflection (after 20 hours), Carmel had pinpointed a particular non-school, social justice factor, namely access to adequate amounts of food that impeded students at the CI site from excelling in school. According to Carmel, she will have to take these out-of-school factors into consideration before judging students.

Carmel's enlightenment on students' lack of access to adequate amounts of food (after 20 hours) also marked a social justice awareness micro-transformation. She wrote that she now

understands that lower income people experience the world differently than the more fortunate. She also became aware, through her critical reflection, of how lower income students' disparate experiences may influence their performance in school.

Micah's Profile

Micah is a European American who came from a "very small, predominantly white town, a conservative white town." With one exception, Micah did not discuss his cultural background. When asked about cultural activities in which he participates, he mentioned camping. Micah was hesitant to admit that his favorite activity was, for the most part, shared by others with the same ethnic background. According to Micah, "Like I said, I come from a predominantly white town, so when I go to the camp grounds, it's mostly white people." When I pressed Micah on whether or not he had observed people of color camping, he replied, "Um, yeah. Sure, sure."

Micah stated that topics of race should not be broached in education contexts, as "People can say the wrong things. Not that they would necessarily mean to but it could happen." In addition, Micah claimed that students' disparate experiences should not be placed in tasks because students will be ashamed of their experiences of disenfranchisement. He also believed that teachers should not place cultural referents in tasks because they might stereotype students. He offered the following alternative to including culturally relevant names in students' tasks: "I think that we can make it general and maybe just think of a name that is neutral or a cultural name that could be both."

Micah brought up his political beliefs more than the other PSTs. On the one hand, he described himself as "open minded" and willing to learn from people from other cultural groups. On the other hand, he was critical of those who did not share his perspectives. As part of the

learning segment, I showed a video of African American secondary students expressing their beliefs about their classroom experiences. To this Micah responded,

> I will never forget when you showed us the video, when they said mathematics is a white thing. That really bothered me. I could see from their point of view why that could be thought of as such, but I don't think it is that way.

Micah argued that close-minded people are "quick to point fingers and not look at the other side." Unsolicited, he explained this comment: "They are way too quick to be like, 'Trump is a racist.' No, he's not. He's not a racist guy." Micah adopted a color-blind mentality, noting,

> If you look at the news, everybody is so quick to point out color. You don't have to say a white person killed a black person or a black person killed a white person. Somebody got killed. Somebody died. That's not okay.

Finally, Micah seemed willing to embrace formerly lower income individuals who advanced themselves through hard work, but was critical of those unable to pull themselves up by their bootstraps:

> I'm not happy there's poor people, but at the same time, those poor people have to want to do something for themselves. They can't just expect something to happen. I'm not sure if the opportunities would present themselves if they would take them because it literally has to do with what they want to do. If they want to do it, they will do it. If not, they're just going to keep taking all the handouts. That's not okay.

Micah's Written Reflection and Other Information Related to His Beliefs

Preflection. I could not get a sense of Micah's earliest feelings about volunteering because he failed to provide a preflection.

Reflection 1. Like Carmel, in his first reflection, Micah voiced his concerns about the "bad" behavior of students at the CI site. Student infractions included disrespect of staff and fellow students and unauthorized use of cellphones and computers. Micah also complained that the structure of the classroom was not conducive to a positive learning environment, as, from his perspective, overly large groups of students were in close proximity to each other.

Micah negatively characterized the students' behavior, writing that their actions were purposely destructive to themselves, their fellow students, and staff. Micah revealed possible authoritarian views when he complained that the undisciplined students refused to respect "powers of authority." According to Micah, although students knew or could understand the rules, they willfully defied authority figures at the CI site.

> Many times students blantangly disrespect [an African American teacher volunteer], [a male, European American staff member], and [me]. Some students do not listen to simple directions, and often look for opportunities to be a "class clown" and disrespectful. Profanity is frequently used by the students, and they often get away with it. Sometimes, the students have even made racial comments. Overall, students have a hard time listening and following instructions, as well as listening to powers of authority.

In one of his class assignments, Micah wrote about what he meant by the "racial comments" he percieved he and the male, European American staff member experienced by students. Micah also voiced feelings of discomfort and powerlessness in these instances. His reflection was absent of mention of the African American students' perceptions or feelings or of the fact that student views were substantiated by multiple people who look like them and share their experiences.

> Unfortunately, multiple times that I have volunteered, racial issues have been brought up by the students. For example, one time, [the male, European American staff member] grabbed something from a student, and they proceeded to say, "Ewe white germs." Another time, I was discussing hairstyle with a student, and I mentioned that he and I have different types of hair. He called what I said racist. The other students around me also started agreeing that it was racist just because the first student had said it. I explained it was not racist, but that it was just true. Because of these examples, I feel that in some ways I do not have power. I do not like the fact that the kids are quick to make something a racial issue, especially when the staff is not racist or does not act in such a way. It is very uncomfortable, and I feel that it could limit the effectiveness of my authority.

Micah attempted to end his first reflection on a positive note but returned to his beliefs about a need for disciplining the minority students at the CI site with "difficult backgrounds."

> In the end, I really enjoy tutoring at the [CI site]. I believe it is hard to discipline these students because they have more difficult backgrounds. However, I think they do need to be disciplined more. I believe that respecting the student makes them respect the authority figure more, but sometimes, I feel they demand too much respect.

Micah fell short of describing student-derived and teacher-derived respect.

Reflection 2. Micah's second reflection marked a shift in his perceptions of the students at the CI site. In much of this reflection, Micah wrote of the role caring played in his developing positive relationship with students. Micah reported that his relationship with students had improved because he (a) welcomed students by greeting them when he arrived at the CI site and by inquiring about their wellbeing, (b) participated in activities of interest to them, such as

playing basketball, football, and dodge ball, (c) acknowledged their assets and potential, and (d) established expectations for students about homework, disposition, and other concerns. As a result of his efforts, students rewarded him by listening to him and being more respectful. He noted, "When students recognize the care and effort put forth by an individual, they tend to be more respectful towards you."

In the post-cultural learning segment interview, I asked Micah about his evolved perception of the students at the CI site.

T: In your [CI] reflections you seemed initially concerned with student behavior and then you switched to focusing on your own behavior. What triggered that transition?

M: It took me by surprise and these students were cussing and being really disrespectful, kind of, just outright, would blatantly do it. Do it just to be class clown kind of a thing. But as soon, as soon as I made an effort to really get to know somebody and listen to what they were saying, they were more real with me and not disrespectful. I feel like those kids, coming from their socioeconomic status and all that, as long as you are upfront with them and real with them, they are going to be real with you.

In the post-cultural learning segment interview, Micah also described current cross-cultural relationships that had influenced his ability to positively interact with students at the CI site. Micah briefly mentioned that his girl friend was of Middle Eastern descent. He also reported that his time with his African American roommate had made him more open to positive communications with the students at the CI site. Micah, who had never had extended interaction with an African American, was purposeful in learning about his roommate and sought out

activities they could share, such as basketball. Micah argued that by seeking common grounds in a friendly way, bridges between cultures can be constructed and greater knowledge of individuals' cultures can be gained.

T: Was that [the time with his roommate] the first time you've spent an extended amount of time with an African American?

M: It is.

T: Does that experience influence your perspectives?

M: Yes, definitely, because it's opened up my eyes a lot. I've never considered myself racist or anything like that, but I've never had that much of an interaction with a black person before, 'cause like I said, I came from a small white town. I have learned a lot about how he specifically lives. He has informed me more of black culture. And yeah. It's different. It's different than white's.

T: What type of things has he informed you about?

M: Basketball is a big black culture thing. It really is. The sport is dominated by African Americans. So, I instantly, even as I got back from Spring break, I told him I really want to kind of get into basketball. I've never been big into basketball. I was like, "I want you to help me." Connection! Right there, between us. And like I said it doesn't matter, our skin color. It doesn't matter.

Micah also observed "growth in [himself] as an individual." He wrote that he was more comfortable interacting with culturally different students. He also expressed that as a teacher he will not allow racial and cultural differences to hinder him from providing all students quality education.

In Micah's third reflection, he expressed anger about cultural suppression and racial discrimination. He wrote, "I'm going to be very honest in this last reflection. I hate racial tension. No person is better than the next because of skin color." According to Micah, notions of "white supremacy" are alive and well, and minorities are expected to assimilate into European American society: "When people come to America, they are expected to learn English, and often times expected to celebrate holidays like Christmas." Micah wrote that the use of minorities' cultural traditions or language, such as Ebonics, is rejected. Micah was protective of minority students and argued that, "Teachers cannot be distracted by silly differences like this. They need to adapt, and look for opportunities to have learning experiences with their students."

Micah closed his reflections expressing how he enjoyed his time at the CI site working with culturally different students. As a result of his time there, he felt more prepared to work with culturally different students, especially now that he knows he can develop meaningful relationships that will facilitate the learning process.

Summary of beliefs and micro-transformations. Like Carmel, Micah experienced multiple micro-transformations involving his attitudes towards students from culturally diverse backgrounds. Initially, he held deficit perspectives of student behavior. Micah was critical of the students at the CI site, characterizing them as having "difficult backgrounds" and as being willfully disobedient, incapable of following "simple directions." In fact, most of his first reflection was dedicated solely to attributing students' lack of participation in the learning process to what he perceived as their poor behavior. In particular, he complained that he unable to control the lower income and minority students because they behaved in ways outside the norms of the traditional Eurocentric classroom. By the time he wrote his second reflection (after

14 hours), his views of students had shifted and he experienced and attitudinal micro-transformation (see Figure 7).

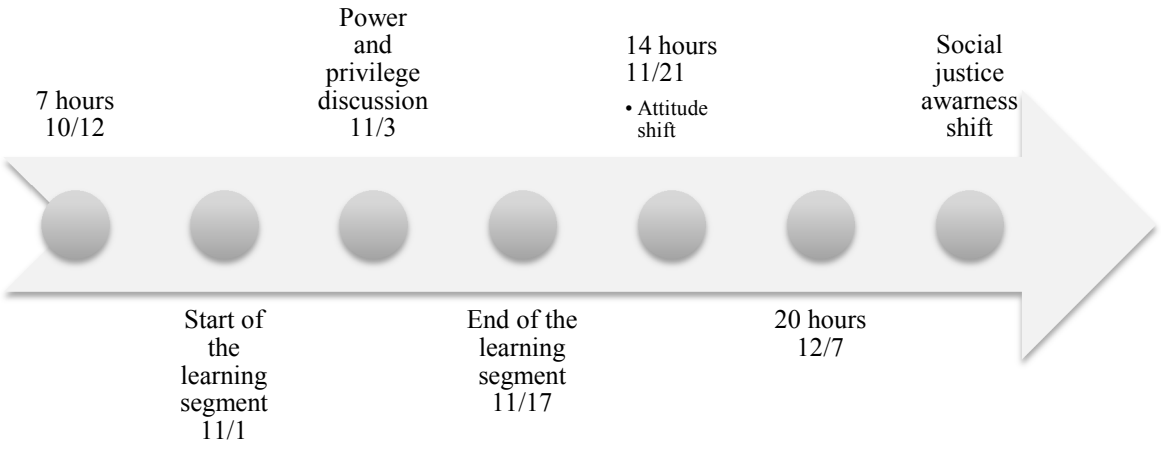

Figure 7. Micah's micro-transformations.

Micah's new, positive, caring approach to interacting with students resulted in them being more receptive and responsive to him. Micah identified his personal micro-transformation, noting that he had observed, "growth in me as an individual." Micah ended his reflections on a positive note. He wrote that his cross-cultural relationships with culturally different students and his experiences better prepared him for future interactions with similar future students.

Micah's third reflection (after 20 hours) provided evidence that he experienced a social justice awareness micro-transformation. In his first reflection, Micah, a European American male, expressed feeling of victimization from being called a racist because of a comment he made about an African American student's hair. By his third reflection, Micah wrote of the victimization, through racism and cultural suppression, of minority students. Micah showed

frustration that the African American students at the CI site would likely be victims of discrimination in schools due to their racial backgrounds. He argued that teachers should be able to put aside "silly differences" and seek to raise their culturally different students' achievement.

Faith's Written Reflection and Other Information Related to Her Beliefs

Preflection. Faith initially had apprehensions about volunteering at the CI site due to past experiences she had while volunteering tutoring middle school-age homeless students. Her experiences with these students helped her understand potential resistance she might face from students at the CI site regarding the completion of homework tasks. Faith hoped for the best and looked forward to the challenges she perceived she might face.

> While I am excited, I am also very nervous. In previous tutoring experiences, I have worked with students who were generally affluent and were generally respectful. While I do expect that the students at the [CI site] will show me the same level of respect, I am nervous that some students will not comply. When volunteering in a homeless shelter in middle school, I had many of the children who were in middle school swearing at me and threatening to become violent simply because they did not want to do their homework. While most of these conflicts were resolved and I overall enjoyed my time, it was terrifying at times. In most of my experiences when working with students or athletes, I have generally not had hard moments like I had in the homeless shelter. I go into the experience at the [CI site] aware that uncomfortable situations may happen, I will go into every day positively and ready for working with the students.

It is unclear whether Faith compared the homeless shelter students (but not the student athletes) to students at the CI site because of their age, race, or their socioeconomic status. Although she projected the disconcerting experiences she had with the homeless students onto the CI students,

she was still hopeful that her time at the CI site would be positive. Faith accepted the challenges she would face at the CI site because they would prepare her for future teaching. She looked forward to effecting change in the academics of the students at the CI site.

Reflection 1. For Faith, positive connections with students are essential to teacher-student relations and to student-curriculum interactions. In Reflection 1, Faith wrote of how she invested herself in students' education, patiently instructing them and finding ways to connect their education to prior knowledge and experience. She believed that students can learn and was willing to work with students until they had some mastery of what they were attempting to comprehend.

> While working with a specific student, Shantrell, I worked to show the connection between multiplication and addition. When working on a problem, I discovered that this student does not understand basic multiplication or division….I used her prior knowledge of addition in order to connect to multiplication in order to show how mathematical ideas interconnect and build on one another to produce a coherent whole. I also used objects to show the multiplication and addition….When the student struggled with the idea of fractions, I helped her convert fractions into decimals and then into the form of money…. I always need to be thinking of different ways and connections for my students to understand the material I am teaching.

Faith also invested in a student who other volunteers and staff members had difficulty instructing. The student was grateful for Faith's patience and commitment. She noted that each of her future students is worthy of her "full effort."

> During one of my days volunteering, I worked with [a] student for the majority of the time. He is a student that struggles with spelling and reading comprehension. While

> interacting this student, he thanked me for being so patient with him. He stated that most of the other workers and volunteers normally get frustrated with him or leave before he really understands what is going on. As a future teacher, I learned that patience and building confidence in a student is worth my time. My future students deserve my full effort.

Reflection 2. Faith's Reflection 2 reveals that she purposefully sought personal and cultural details that are relevant and meaningful to students at the CI site to assist them in learning. She "connect[ed]" with students by engaging them in discourse, paying close attention to their accounts of their experiences within and outside of school. That Faith valued knowledge of students is further evidenced by her intentionally engaging students in personal conversation during their leisure time. Faith could have spent this time talking with staff at the CI site or using her cellular phone to text or email her friends. Instead, Faith reported that, "During the students' free time, I attempted to talk to the students about topics that they seemed interested in."

In her second reflection, Faith engaged in some critical reflection on how her whiteness had eased her access to a higher quality education than the low-income and minority students at the CI site. In a class reflection (not a CI reflection) on a discussion about power and privilege, Faith wrote,

> As a white individual, our society treats me differently than those of minority. While I wish our country did not act this way, white privilege exists and is going strong. I come from an area that was very affluent and allowed me to get a great education.

In her Reflection 2, she wrote of how her direct experiences with students at the CI site had further expanded her understanding of their access to opportunities. Moreover, Faith, articulated

her beliefs about teacher responsibility to provide equitable education for lower income and minority students.

> This experience at this point has clear connections to what has been discussed in our class. I, as a white, affluent, educated individual, have been given different opportunities and have a higher position of power in comparison to the students at [the cultural immersion site]. In order to bridge this gap, I needed to work on connecting with the students on their level while instilling confidence in them in relation to their ability in completing academic work successfully. The students at the [CI site] come from diverse backgrounds and the [program] gives these students a chance to expand on their academic knowledge and how to interact successfully with others. While the students getting more time to work with [their primary teachers] at school may not reflect equal treatment, it reflects equitable treatment that gives all students the chance to succeed. Education needs to be equitable, not equal. As a teacher, I need to be aware of this. My future students may need different things in order to succeed at the same level.

The only time Faith commented on atypical student behavior occurred in Reflection 2. In this reflection, Faith noted that student use of technology at the CI site is, at time, less than ideal. She used her observations to develop expectations for future students.

> Technology continues to be a large issue in the boys and girls classroom. The students often are mistreating their technology physically, are on YouTube watching inappropriate videos, or are distracted by something else their friend shows them. Phones are often out and students are texting, calling, and watching videos that do not appear to be educational. When in a classroom using one to one technology or any technology at all, I will need to set clear boundaries with my students and their use of technology in my

classroom. I need to set clear rules and consequences from the beginning of the school year so that the students know exactly what is expected of them.

Reflection 3. In her final reflection, Faith again noted that her personal relationships with students allowed her to "get to know the students on another level." Faith illustrated this point when she recounted what she learned from a Latin@ student about the student's cultural experiences. In particular, Faith learned of the student's holidays, traditions, cultural actors, and cultural artifacts. "I got the chance to learn about a different culture. I learned about different aspects of Hispanic culture. I learned about different foods her family makes, trips to Mexico, and her future quinceañera[12]." From her conversation with this student she originally perceived as being different than her as a child, Faith discovered she could project herself onto the student's experiences. Faith observed, "While our stories were different, I could see myself in her shoes as she spoke." Therefore, from this conversation, Faith discovered through her positive interaction with this minority student that she could relate to minority students' experience. Faith concluded from this exchange, "I will be able to connect with different students when I take the time to talk with them and really listen."

From her personal and cultural conversations with minority students, Faith became confident that she could positively interact with students of diverse backgrounds. She also argued that knowledge of students' cultures can only strengthen her ability to teach: "From the interviews, I can see how getting to know my students more could help me provide students with culturally responsive problems and a more equitable educational experience." "When trying to connect with my future students, learning about their cultures can only help me become a better

[12] A quinceañera is a Spanish celebration of a young lady's 15th birthday. It marks her entrance into womanhood (Quinceanera celebration, n.d.).

teacher. In my first classroom, I think I may do a survey that would contain similar questions [to those in the interview protocol] so that I can learn a few details about my students quickly and efficiently." Faith's positive perspectives of students and their experiences enabled her to view minority students' contributions in a positive light and plan to incorporate their cultural experiences into her curriculum.

Throughout her reflections, Faith stated that she was grateful for the opportunity to work with students [at the CI site]. She wrote, "My experience as a volunteer at the CI site was positive and strengthened my aspiration to become a teacher….While I may have been volunteering to help the students, their energy and vibrant personalities helped me. When interacting with the students, I am reminded constantly that working with students is what makes me happy. I looked forward to each day spent at the CI site….I am thankful for the opportunity I had to volunteer at the CI site and interact with such a great diverse groups of students."

Summary of beliefs and micro-transformations. Faith's reflections indicated that she consistently had positive attitudes towards students from culturally diverse backgrounds. Although she had some reservations before she began volunteering, she still perceived that her time at the CI site would be positive. Faith's positive views of students at the CI site were echoed throughout her first, second, and third journal reflections. Faith rarely mentioned poorly behaving students in her reflections. An exception was when she discussed their improper use of technology. Instead, her reflections primarily entailed her commitment to students' academic achievement, the relationships she built with students, and what she learned from students and how she might apply these discoveries to creating a welcoming, culturally responsive learning environment.

By the second reflection (after 14 hours), Faith experienced a noteworthy social justice awareness micro-transformation, which, according to her occurred from our in-class discourse on power and equity (see Figure 8).

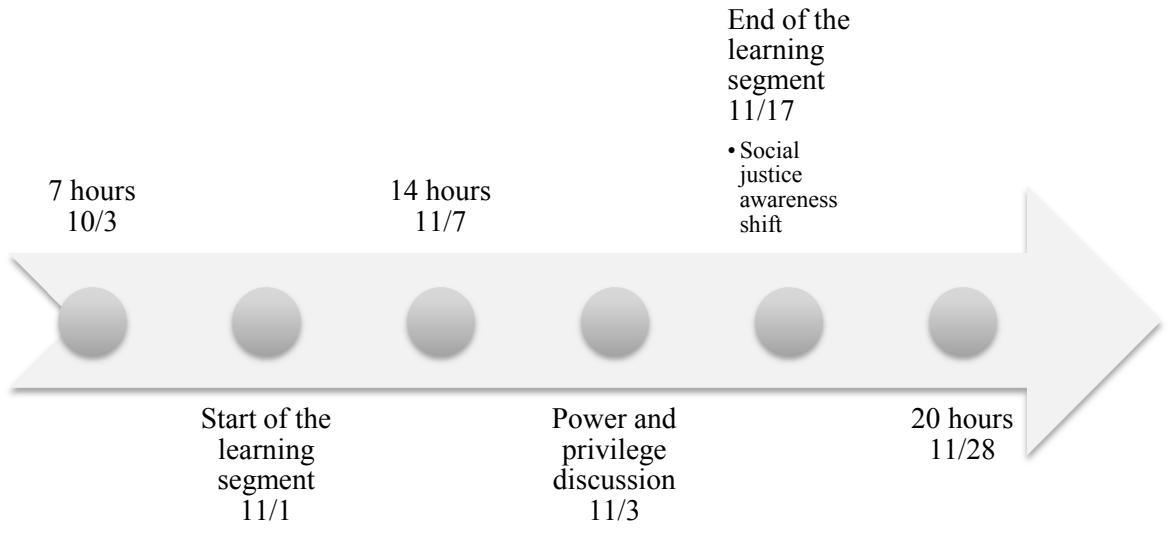

Figure 8. Faith's micro-transformation.

As a result of this conversation, and possibly also critical reflection on her interactions and conversations with students at the CI site, Faith identified that her membership in the dominant group had afforded her privileges that her students were blocked from accessing due to their cultural and social class backgrounds. Her realization may have contributed to her views on equity in mathematics education, namely that greater school resources should be provided to students of lessor means.

Emergent beliefs and the timing of micro-transformations. An overview of the expression of PST beliefs from their written reflections, as well as micro-transformations of these beliefs, is provided in Table 3. These details will be discussed in greater detail below.

Table 3

PST Beliefs and Micro-transformations in Beliefs

PSTs	Preflection	Reflection 1 (after 7 hours)	Reflection 2 (after 14 hours)	Reflection 3 (after 20 hours)
Keenan	"Excited" to teach CI students with racial and cultural background similar to his own	***Yelled at students and engaged with them in "power struggles" (attitudinal micro-transformation)*** Developed plans to increase his knowledge of students	Missing	Developed and revised plans to create environment conducive to students' learning.
Carmel	Looked forward to having fun with students	Described students as "disruptive and disrespectful" Wrote that students needed to be controlled	**No mention of student misbehavior** **Stated reasons for student struggle with homework *(attitudinal micro-transformation)***	No mention of student misbehavior **Identified that hunger may influence student engagement *(social justice awareness micro-transformation)***
Micah	Missing	Described students as "disrespectful" and "class clown[s]" and as having "difficult backgrounds" Wrote that students need to be controlled Claimed he was a victim (that students harassed him)	**No mention of student misbehavior** **Wrote of caring for students and building relationships with them *(attitudinal micro-transformation)***	No mention of student misbehavior **Identified racism may influence African Americans experiences *(social justice awareness micro-transformation)*** Wrote he enjoyed his time with CI students
Faith	Anticipated going "into every day positively and ready for working with the students"	Worked patiently with students struggling to complete homework tasks	Briefly mentioned inappropriate cell phone use Sought personal and cultural knowledge of students **Wrote of her access to advantages as a member of the dominant culture, namely, "I as an affluent, educated individual, have been given different opportunities…than the students at the [CI site]. *(Social justice awareness micro-transformation)***	Gained cultural knowledge of student Empathized with student Wrote she appreciated the opportunity to work with "such a great diverse group of students"

Before they had volunteered, PSTs held affirming beliefs about students and anticipated enjoying their time volunteering at the CI site. Keenan wrote he was "excited" to teach CI students with racial and cultural backgrounds similar to his own. According to Carmel, she anticipated having fun with students. Faith predicted she would go "into every day positively and ready for working with the students."

By the first reflections or after 7 volunteer hours, PSTs expressed deficit perceptions of students. Carmel described students as "disruptive" and "disrespectful." Micah also described students as "disrespectful, " and he complained that students were "class clowns." Both Carmel and Micah expressed in their first reflection a belief that their role as teachers was to control students. Carmel wrote, "Educators must be responsive to keep control over the classroom and promote a safe and positive learning environment." Micah claimed students should respect him, and his direction, because he was one of the "powers of authority." Specifically, student behavior needed to mirror what PSTs were accustomed to seeing in school classrooms they had attended. According to Carmel, atypical school behavior included "shouting, running, cursing, fighting, and making inappropriate jokes." Micah wrote that students shouldn't use profanity or make racial comments.

Kennan reported in his first reflection and third reflections that he had tried multiple approaches to controlling student behavior, including yelling or being polite. Keenan decided after 7 hours—and Micah after 14 hours—of volunteering that that building relationships with the students was a more productive route for managing behavior. Keenan abandoned all efforts to force instruction upon students for having meaningful conversations about their experiences. He noted, "After hearing the students' backgrounds it became a lot easier to empathize with them and remain patient with them when they began misbehaving." Micah engaged in activities

meaningful to students, such as basketball, and made a concerted effort to listen to students. Micah wrote, "As soon as I made an effort to really get to know somebody and listen to what they were saying, they were more real with me and not disrespectful." As a result of forming positive relationships with students, the PSTs reported deficit perspectives of students less often.

In Keenan's preflection, he indicated an awareness of the different ways lower income and minorities experience the world. In contrast, none of the non-African American PSTs mentioned social justice issues in their preflections. However, by her 14-hour reflection, Faith wrote of her societal position as a European American and the privileges she is afforded. According to Faith, "I as an affluent, educated individual, have been given different opportunities…than the students at the [CI site]. Faith attributed her social justice awareness to critical conversions we had in class. Carmel and Micah reported greater social justice awareness by their 20-hour reflection. Carmel acknowledged that hunger may diminish student desire to learn, and Micah acknowledged the reality of racial oppression the students experience in school settings and in other environments. Carmel's micro-transformation came from critical reflections on students' repeated requests for food. Micah reported that he become more aware of African American experiences through conversations with his African American roommate.

Conclusions

All of the PSTs experienced either an attitudinal or social justice awareness micro-transformation (see Figure 9).

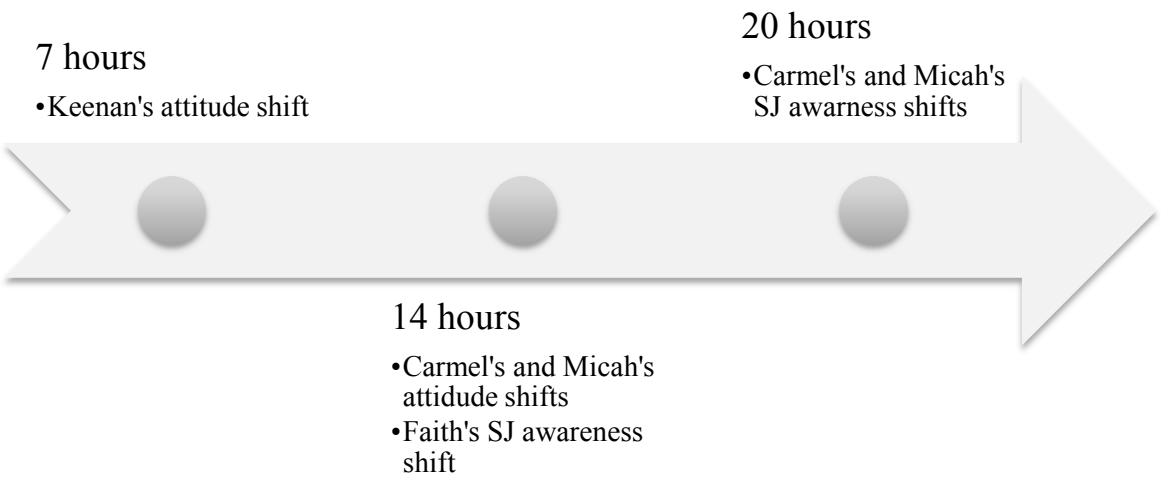

Figure 9. An overview of PST shifts. *Note.* SJ=Social justice.

Faith, who did not indicate an attitudinal micro-transformation in any of her reflections, indicated a social justice awareness micro-transformation after 14 hours of volunteering. Keenan, who did not indicate a social justice awareness micro-transformation, indicated an attitudinal micro-transformation after 7 hours of volunteering. It took Carmel and Micah the same amount of volunteer hours to report attitudinal (after 14 hours) and social justice awareness (after 20 hours) micro-transformations. Carmel and Micah experienced their attitudinal micro-transformations later than Keenan did and they both experienced social justice awareness micro-transformations after Faith.

Discussion

Considering the gatekeeper role mathematics plays in student access to post secondary educational and occupational opportunities (Moses & Cobb, 2001), it was important to consider the preparation of future mathematics teachers. In this investigation, I focused on mathematics

PST preparation to instruct lower income and minority students because there is an increased likelihood that PSTs will teach culturally different students, as the U.S. study body is becoming increasingly diverse (Brand & Glasson, 2004). Another reason for my focus is that lower income and minority mathematics students are susceptible to low teacher expectations (Oakes, 1995), which ultimately result in a poorer mathematics education outcomes for the students (Heubert & Hauser, 1999; Oakes, 1995).

In some, but not all, ways, my findings were consistent with existing research. Researchers have found that PSTs enter teacher education programs with few cross-cultural interactions (Hollins & Guzman, 2005; Kolano & King, 2015). Both Micah and Carmel's post-cultural learning segment interviews revealed that they too had few direct interactions with cultural others prior to their teacher preparation. Faith's past experience with homeless students was atypical for PSTs and may have enabled her to focus her reflections on the assets of the lower income and minority students.

That both Micah and Carmel described student behavior in deficit terms is evidenced by the fact that they dedicated much of their first reflections to describing various infractions students committed during the program. Such deficit beliefs of PSTs about lower income and minority students have been expressed in other studies (Bell, Horn, & Roxas, 2007; Kumar & Hamer, 2012; Sleeter, 2001a, 2001b, Terrill & Mark, 2000). However, like Ukpokodu's (2004) PSTs, by the end of the CI experience, Micah and Carmel referred to negative student behavior less often and shifted their focus away from a need to control students. By both of their last reflections, neither wrote of student (mis)behavior. Instead they focused on their understanding of students' behaviors or of the disparate experiences of lower income or minority students.

Oates (2003) found that African American teachers held positive perceptions of African American students. However, Keenan did not consistently indicate affirming attitudes towards the lower income and African American students at the CI site. Like Carmel and Micah, Keenan initially attempted to force the students to conform to the Eurocentric norms often found in traditional schools. It is curious that Keenan yelled at the students. In my observations at the CI site, I noticed that it was common for program assistants to raise their voices at the students. Keenan may have made a similar observation and adopted this approach to addressing the lower income and minority students. He might have used a different initial approach had he observed different leadership behavior. That is, I wonder if the existing environmental norms dictated Keenan's approach or if he held deficit attitudes toward students from his cultural and socioeconomic background prior to volunteering at the CI site. It is evident that Keenan was convinced that the students would respond to different tactics, as Keenan had revised his initial approach to interacting with the students before he wrote his first reflection.

All of the PSTs experiencing attitudinal micro-transformations provided these reports around the time that they had gained a greater knowledge of students' backgrounds and needs. Carmel identified that she needed to allow students to briefly respond to each other to later focus them on homework tasks. Micah determined that he needed to show students he cared about them to truly gain their respect and favor. Finally, Keenan identified that building relationships and knowing his students resulted in a communal effort to work towards maintaining a positive learning environment. Such positive outcomes are aligned with findings on teachers with affirming attitudes towards African American students (Berry, Thunder, & McClain, 2011; Jett, 2011; McGee & Martin, 2011).

There were various possible sources responsible for PSTs' social justice awareness micro-transformations. Micah's may have come from conversations with his girlfriend or African American roommate. Faith wrote that her increased awareness came from in-class discourse. Carmel wrote that her own observations caused her to engage in critical reflection on the plight of her lower income students. Therefore, it is possible that cross-cultural relationships (Dedeoglu & Lamme, 2011), or course activities (Walker-Dalhouse & Dalhouse, 2006), or critical reflection (Milner, 2006) may shifts in PST beliefs. However, it may be difficult to identify which combination of teacher education components truly influenced these shifts.

Finally, the timing of the attitudinal and social justice awareness micro-transformations might have significance. The two PSTs with few interactions with lower income or minority students experienced a shift in beliefs later than Faith, who had worked with homeless students. Furthermore, both non-African American PSTs who experienced an attitudinal micro-transformation did so after the African American had reported a shift in his attitude towards students. It is possible that those having past experiences with lower income and minority students are more prone to earlier, positive shifts in their beliefs about them. This is an area for further research.

Limitations

This study has some limitations. The mathematics PSTs in this investigation were allowed to reflect on any CI experience they chose meaningful, and their responsibilities at the CI site did not have to pertain to the teaching of mathematics. As a consequence, many of the PST did not write about their growth as a future mathematics teacher. Still, I obtained rich, PST-determined data on their beliefs about lower income and minority students and their instruction. For future investigations, I will cater the instructions to obtaining PST beliefs about the

mathematics instruction of lower income and minority students, especially considering that in a similar setting they will have opportunities to teach mathematics.

Implications

Teacher education programs must provide PSTs more opportunities to interact with disenfranchised students. After 14 hours of interactions, all of the PSTs had more positive attitudes, and therefore also beliefs, about the lower income and minority students at the CI site. Furthermore, those with past experiences with lower income or minority students had more positive attitudes towards these students than the other PSTs. Therefore, teacher education program must provide PSTs more opportunities to learn about cultural others to improve their attitudes towards them. Also, because multiple cultural training experiences may have contributed to PST micro-transformations, teacher education programs must continue to provide a variety of preparation options for PSTs to gain knowledge about lower income and minority students and their instruction.

The research community must seek to determine the amount of CI time it takes to shift PST beliefs about lower income and minority students. I was limited by the 7-, 14-, and 20-hour restraints placed on PST reflections. Researchers might find that it takes less than 7 hours of cultural immersion to experience a micro-transformation. They might also discover ideal circumstances for micro-transformations.

Finally, more must be known about the permanency of micro-transformations. That is, to what extent do PSTs retain beliefs they have expressed while in their teacher education programs? What happens to these beliefs once PSTs enter their official teaching setting? And how do multiple micro-transformations lead to larger transformations?

References

Akiba, M. (2011). Identifying program characteristics for preparing pre-service teachers for diversity. *Teachers College Record, 113*, 658–697.

Alexander, P. (1998). Positioning conceptual change within a model of domain literacy. In B. Guzzetti & C. Hynd (Eds.), *Perspectives on conceptual change: Multiple ways to understand knowing and learning in a complex world* (pp. 55–76). Mahwah, NJ: Erlbaum.

Amatea, E., Cholewa, B., & Mixon, K. (2012). Influencing teachers' attitudes about working with low-income and/or ethnic minority families. *Urban Education, 47*, 801-834. doi: 10.1177/0042085912436846

Bell, C. A., Horn, B. R., & Roxas, K. C. (2007). We know it's service, but what are they learning? Preservice teachers' understanding of diversity. *Equity & Excellence, 40*, 123–133. doi: 10.1080/10665680701218467

Berry III, R. Q. (2004). The Equity Principle through the voices of African American males. *Mathematics Teaching in Middle School, 10*, 100–103.

Berry III, R. Q., Thunder, K., & McClain, O. L. (2011). Counter narratives: Examining the mathematics and racial identities of black boys who are successful with school matheamtics. *Journal of African American Males in Education, 2*(1), 10–23.

Brand, B. R., & Glasson, G. E. (2004). Crossing cultural borders into science teaching: Early life experiences, racial and ethnic identities, and beliefs about diversity. *Journal of Research in Science Teaching, 41*, 119–141. doi: 10.1002/tea.10131

Cornbleth, C. (2008). *Diversity and the new teacher: Learning from experience in urban schools*. New York, NY: Teachers College Press.

Cozart, A. C., Cudahy, D., Ndunda, M., & Sickle, M. (2003). The challenges of co-teaching within a multicultural context. *Multicultural Education, 10*(3), 43–45.

Dedeoglu, H., & Lamme, L. (2011). Selected demographics, attitudes, and beliefs about diversity of preservice teachers. *Education & Urban Society, 43*(4), 468–485. doi: 10.1177/0013124510380718

Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York, NY: The New Press.

Dewey, J. (1933). *How we think*. Boston, MA: D. C. Heath.

Diller, J., & Moule, J. (2005). *Cultural competence: A primer for educators*. Belmont, CA: Thomson/Wadsworth.

Doyle, M. (1997). Beyond life history as a student: Preservice teachers' beliefs about teaching and learning. *College Student Journal, 31*, 519–553.

Duit, R., & Treagust, D. F. (2003). Conceptual change: A powerful framework for improving science teaching and learning. *International Journal of Science Education, 25*, 671–688. doi: 10.1080/09500690305016

Feistritzer, C. E. (2011). *Profile of teachers in the U.S. 2011*. Washington, DC: The National Center for Education Information.

Garmon, M. A. (2004). Changing preservice teachers' attitudes and beliefs about diversity: What are the critical factors? *Journal of Teacher Education, 55*, 201–213. doi: 10.1177/0022487104263080

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice.* New York, NY: Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Gay, G., & Kirkland, K. (2003). Developing cultural critical consciousness and self-reflection in preservice teacher education. *Theory into Practice, 42*, 181–187. doi: 10.1207/s15430421tip4203_3

Geertz, C. (1973). *The Interpretation of Cultures: Selected Essays*. New York, NY: Basic Books.

Glock, S. (2017). Pre-service teachers' responses to students' misbehavior in the classroom depends on students' ethnicity: A pilot study. *Journal of Classroom Interaction, 52*(2), 4–15.

Gross, S. (1993). Early mathematics performance and achievement: Results of a study within a large suburban school system. *Journal of Negro Education, 62*, 269–287. doi: 10.2307/2295465

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*, 37–53. doi:10.2307/30034699

Hallinan, M. (1987). Ability grouping and sex differences in mathematics achievement, *Sociology of Education*, *60*, 63–72. doi: 10.2307/2112582

Heubert, J. P., & Hauser, R. M. (1999). *High stakes: Testing for tracking, promotion, and graduation.* Washington, DC: National Academy Press.

Hogg, M., & Vaughan, G. (2005). *Social Psychology (4th edition)*. London, England: Prentice-Hall.

Hollins, E. R., & Guzman, M. E. (2005). Research on preparing teachers for diverse population. In M. Cochran-Smith & K. M. Zeichner (Eds.), *Studying teacher education: The report of the AERA panel on research and teacher education* (pp. 477–548). Mahwah, NJ: Lawrence Erlbaum.

Howard, T. C. (2003). Culturally relevant pedagogy: Ingredients for critical teacher reflection. *Theory into Practice*, 42(3), 195—202. doi: 10.1207/s15430421tip4203_5

Howard, T. C., & Aleman, G. R. (2008). Teacher capacity for diverse learners. In M. Cochran-Smith, S. Feiman-Nemser, & D. J. McIntyre (Eds.), *Handbook of Research on Teacher Education* (3rd ed.) (pp. 157–174). New York, NY: Routledge.

Jett, C. C. (2011). "I once was lost, but now am found": The mathematics journey of an African American male mathematics doctoral student. *Journal of Black Studies, 42*(7), 1125–1147. doi: 10.1177/0021934711404236

Jussium, L., Eccles, J., & Madon, S. (1996). Social perceptions, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. *Advances in Experimental Social Psychology, 28*, 281–287. doi: 10.1016/S0065-2601(08)60240-3

Kahn, L. G., Lindstrom, L., & Murray, C. (2014). Factors contributing to preservice teachers' beliefs about diversity. *Teacher Education Quarterly, 41*(4), 53–70.

Kea, C., Campbell-Whatley, G. D., & Richards, H. V. (2006). *Becoming culturally responsive educators: Rethinking teacher education pedagogy* (practitioner brief series). Tempe, AZ: National Center for Culturally Responsive Educational Systems.

Kolano, L. Q., & King, E. T. (2015). Preservice teachers' perceived beliefs towards English language learners: Can a single course change attitudes? *Issues in Teacher Education, 24*(2), 3–21.

Kyles, C. R., & Olafson, L. (2008). Uncovering preservice teachers' beliefs about diversity through reflective writing. *Urban Education, 43*, 500–518. doi: 10.1177/0042085907304963

Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago, IL: University of Chicago Press.

Kumar, R. & Hamer, L. (2012). Preservice teachers' attitudes and beliefs toward student diversity and proposed instructional practices: A sequential design study. *Journal of Teacher Education*, 64, 162–177. doi: 10.1177/0022487112466899

Kyles, C., & Olafson, L. (2008). Uncovering preservice teachers' beliefs about diversity through reflective writing. *Urban Education, 43*, 500–518. doi: 10.1177/0042085907304963

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American students* (2nd ed.). San Francisco, CA: Jossey-Bass.

Leland, C. & Harste, J. (2005). Doing what we want to become: Preparing new urban teachers. *Urban Education, 40*(1), 60–77. doi: 10.1177/0042085904270374

LePage, P., Darling-Hammond, L., Akar, H., Gutierrez, C., Jenkins-Gunn, E., & Rosebrock, K. (2005). Classroom management. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 327–357). San Francisco, CA: Jossey-Bass.

Mahan, J. M., & Rains, F. V. (1990). Inservice teachers expand their cultural knowledge and approaches through practica in American Indian communities. *Journal of American Indian Education, 29*(2), 11–23.

Martin, D. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking & Learning, 8*, 197–229. doi: 10.1207/s15327833mtl0803_2

McGee, E., & Martin, D. B. (2011). From the hood to being hooded: A case study of a black male PhD. *Journal of African American Males in Education, 2*(1), 46–65.

McMunn-Dooley, C. (2008). Multicultural literacy teacher education: Seeking micro-transformations. *Literacy Research and Instruction, 47*, 55–75. doi: 10.1080/19388070701878808

Middleton, V. A. (2002). Increasing preservice teachers' diversity belief and commitment. *Urban Revie*w, 34, 343–361.

Milner (2005) Stability and change in US prospective teachers' beliefs and decisions about diversity and learning to teach. *Teaching & Teacher* Education, 21, 767–786. doi: 10.1016/j.tate.2005.05.010

Milner, R. H. (2006). Preservice teachers' learning about cultural and racial diversity: Implications for urban education. *Urban Education, 41*, 343–375. doi: 10.1177/0042085906289709

Moses, R. P., & Cobb, C.E. (2001). *Radical equations: Math literacy and civil rights*. Boston, MA: Beacon Press.

Moses, R. P., Kami, M., Swap, S. M. & Howard, J. (1989). The Algebra Project: Organizing in the spirit of Ella. *Harvard Educational Review, 59*, 423–443. doi: 10.17763/haer.59.4.27402485mqv20582

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Curriculum Studies, 19*, 317–328. doi: 10.1080/0022027870190403

Nieto, J. (2006). The cultural plunge: Cultural immersion as a means of promoting self awareness and cultural sensitivity among student teachers. *Teacher Education Quarterly, 33*(1), 75–84.

Oakes, J. (1995). Two cities' tracking and within school segregation. *Teachers College Record, 96*, 681–690.

Oakes, J. (2005). *Keeping track: How school structure inequality*. New Haven, CT: Yale University Press.

Oates, G. (2003). Teacher-student racial congruence, teacher-perceptions, and test performance. *Social Science Quarterly, 84*, 508–525.

Pajares, M. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307–332. doi: 10.3102/00346543062003307

Pajares, F. (1993). Preservice teachers' beliefs: A focus for teacher education. *Action in Teacher Education, 15*(2), 45–54. doi: 10.1080/01626620.1993.10734409

Piaget, J. (1977). *Behavior and evolution* (D. Nicholson-Smith, Trans.). New York, NY: Pantheon Books.

Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education, 66*, 211–227. doi: 10.1002/sce.3730660207

Ryan, B., & Simpson, M. D. (2016). *Physical appearance categorization activity.* Retrieved from http://breakingprejudice.org/teaching/group-activities/physical-appearance-categorization-activity/

Sheets, R. (2003). Competency vs. good intentions: Diversity ideologies and teacher potential. *International Journal of Qualitative Studies in Education, 16*, 111-120

Shultz, E. L., Neyhart, K., & Reck, U. M. (1996). Swimming against the tide: A study of prospective teachers' attitudes regarding cultural diversity and urban teaching. *Western Journal of Black Studies, 20*, 1–8.

Sleeter, C. E. (2001a). Epistemological diversity in research on preservice teacher preparation for historically underserved children. *Review of Research in Education, 25*, 209–250. doi: 10.1177/0022487101052002002

Sleeter, C. E. (2001b). Preparing teachers for culturally diverse school: Research and the overwhelming presence of whiteness. *Journal of Teacher Education, 52*, 94–106. doi: 10.1177/0022487101052002002

Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practise. *Mathematics Teaching in the Middle School, 3,* 344–350.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: SAGE Publications.

Stake, R. E. (2006). *Multiple case study analysis*. New York, NY: Guilford Press.

Strategies for Promoting Culturally Responsive Classrooms in Alexandria City Public Schools. (n.d.). Retrieved from http://www.acps.k12.va.us/equity/strategies.pdf

Style, E. (1998). Curriculum as window and mirror. In C. Nelson & K. Wilson (Eds.), *Seeding the process of multicultural education* (pp. 149–156). Plymouth: Minnesota Inclusiveness Program.

Tate, W. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*, 166–173. doi:10.1080/00405849509543676

Ten quick ways to analyze children's books for racism and sexism (n.d). Retrieved from http://cmascanada.ca/wp-content/uploads/2011/11/article-10-ways-to-analyze-childrens-books-for-sexism-and-racism.pdf

Terrill, M., & Mark, D. (2000). Preservice teachers expectations for schools with children of color and second language learners. *Journal of Teacher Education, 51*, 149–155. doi: 10.1177/002248710005100209

Ukpokodu, O. N. (2004). The impact of shadowing culturally different students on preservice teachers' dispositions toward diversity. *Multicultural Education, 12*(2), 19–28.

U. S. Department of Education. (2009). *Digest of education statistics*, 2009. Washington, D. C.: National Center for Education Statistics.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. Albany, NY: State University of New York Press.

Walker-Dalhouse, D., & Dalhouse, A. (2006). Investigating White preservice teachers' beliefs about teaching in culturally diverse classrooms. *Negro Educational Review*, 57(1/2), 69–84.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Newbury Park, CA: Sage Publications.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

Zheng, H. (2009). A review of research on EFL Pre-service teachers' beliefs and practices. *Journal of Cambridge Studies, 4*(1), 73–81.

CHAPTER V: DISCUSSION AND RECOMMENDATIONS

There were multiple goals for this investigation. For Article 2, I examined PSTs' attempts at creating mathematics tasks for African American and Latin@ students who they had interviewed and who they encountered repeatedly in a cultural immersion experience. Specifically, I sought to answer the following questions:

1. To what extent can PSTs incorporate personal and cultural assets when developing mathematics learning tasks for themselves and for their students?
2. In what ways are cultural elements integrated into PSTs' mathematics tasks?
3. What challenges do PSTs face when constructing culturally responsive mathematics tasks?

The purpose of my investigation for Article 2 was to describe PST attempts to construct critical mathematics tasks for lower income or minority students who they repeatedly encountered in a cultural immersion experience. I looked at PST's tasks and considered their potential for developing students' critical consciousness, according to Villegas and Lucas' (2002) Gaining Sociocultural Consciousness rubric and Freire's (2000) critical consciousness and critical agency ideas. Also, I investigated PST beliefs about the value and appropriateness of these tasks for minority or lower income students and for students in other groups. For Article 2, I addressed the following research questions:

1. To what extent do PST-created critical mathematics tasks have the potential to foster the development of critical consciousness of disenfranchised students, such as lower income and minority students, for whom they were developed? What type of social justice topics do PSTs include in their tasks?

2. What do PSTs report about the appropriateness and value of critical mathematics tasks?

For Article 3, a final goal was to investigate shifts, or micro-transformations, in PSTs' beliefs about students resulting from repeated encounters with them at a cultural immersion site. My investigation was guided by the following research questions.

1. What beliefs were evident in PST reflections?
2. How were those beliefs transformed as they accumulate more hours at the cultural immersion site?

In my last chapter, I shed light on connections across the three articles. Also, I discuss my findings, and the limitations and implications of the study. Finally, I discuss the direction of future research.

Discussion of the Study

Creating Culturally Responsive Tasks

In preparation for creating tasks with cultural referents to their students, I asked PSTs to create culturally responsive tasks for themselves. Inadvertently, these tasks served as a baseline for determining whether PSTs could incorporate cultural details into tasks. I discovered that PSTs could identify and incorporate their own cultural details into tasks; furthermore, most incorporated these cultural details into the primary mathematics activities. Thus, by having cultural actors perform authentic cultural primary activities in their tasks, they made meaningful connections (Turner et al., 2012) in tasks created for themselves. For the tasks they created for students, PSTs identified and incorporated students' personal or cultural details into tasks; however, they made emergent connections (Turner et al., 2012) in student tasks, as they had difficulty creating authentically cultural primary mathematics activities inclusive of students'

cultural details. In particular, PSTs created tasks in which cultural actors performed activities that were inauthentic to students' cultural experiences. In fact, PSTs were less likely to incorporate students' cultural details into primary activities in tasks for students than in tasks for themselves. There are several possible reasons for PSTs' struggles. First, PSTs reported having limited knowledge of students. PSTs may have needed additional time for developing relationships with students, or multiple opportunities to conduct interviews of students to gather or clarify the details in or significance of students' cultural contexts, or additional preparation for interviewing students. Second, PSTs reported having limited experience creating high quality mathematics problems. As a result, they incorporated into student tasks mathematics contexts with which they were familiar. Therefore, PSTs may have required additional opportunities to construct mathematics tasks so they have multiple models for the creation of tasks for students.

All of the PSTs distorted students' narratives by either adding details not provided in student interviews or by omitting relevant student-derived details. According to Critical Race Theory (Ladson-Bilings & Tate, 1995), these PSTs choices are unacceptable in the creation of tasks for minority students. By filtering task details through their own lenses, PSTs diminished minority student voices, ignoring their understandings of their lived experiences. By placing student details in inauthentic contexts, PSTs ran the risk of creating mathematics activities their students cannot relate to or understand (Hefflin & Barksdale-Ladd, 2001).

Creating Critical Mathematics Tasks

Most PSTs acknowledged the experiences of disenfranchisement of the lower income and minority students at the CI site. In their tasks, more PSTs gave explicit reference to social class disparities than to other topics, such as race or gender. According to critical race theorists (Ladson-Billings & Tate, 1995; Parker & Lynn, 2002; Martin, 2006; Matsuda, Lawrence,

Delgado, Crenshaw, 1993), race and racism must be held central in the instruction of racial minority students. Freire (2000) and Gutstein (2003) argued that teachers must be willing to broach social justice topics that are relevant to their students' experiences.

Most PSTs believed critical mathematics tasks are inappropriate for students, particularly for younger students, such as those at the CI site. Thus, PSTs were resistant to ideological change (Rodriquez, 2005). They were unconvinced that liberatory education had a place in what they perceived as a traditional mathematics classroom. As in other investigations (Gau, 2005; Kelley & Brooks, 2009), these (future) teachers expressed a desire to avoid the controversial topics in critical mathematics tasks. PSTs claimed that students should not be forced to grapple with sensitive issues. However, this approach may be harmful to students, as they likely will be given few (or no) opportunities to confront their harsh realities (Jackson, 2006) and to seek solutions for change (Freire, 2000). Undergirding PST reservations to present social justice tasks might be their fears about addressing issues of which they are ignorant or rarely face. That is, PSTs fear making themselves uncomfortable in discussions of social justice issues.

PST future behavior is based on their beliefs (Pajares, 1992). However, it remains unclear what actions PSTs might take in their future classes, as they expressed multiple conflicting beliefs in their written reflections. PSTs believed critical mathematics tasks are inappropriate for students, but have critical consciousness and agency value. They also believed tasks should be meaningful, but should be absent of meaningful controversial details, especially if these details could result in PSTs stereotyping students. This tension is an area for further research.

A few other points are worth mentioning. A PST identified that the tasks PSTs created in class should not serve as stand-alone activities. These tasks should be placed in a larger unit on social justice and teachers might expose students to multiple units on social justice to establish

an atmosphere that acknowledges the variety of experiences students bring to class. Second, my instrument to classify tasks may be helpful in identifying support for PSTs according to performance at each task level.

Interacting with Cultural Others

In some ways, the PSTs in this investigation had similar profiles to those in other studies, in that some had few cross-cultural interactions (Hollins & Guzman, 2005; Kolano & King, 2015). Also, some held negative beliefs about lower income and minority students (Bell, Horn, & Roxas, 2007; Kumar & Hamer, 2012; Sleeter, 2001a, 2001b; Terrill & Mark, 2000); however, by the end of the cultural immersion, all PSTs expressed positive beliefs towards students. Hence, those starting with negative attitudes towards students' experienced micro-transformations over the course of volunteering with students. PSTs' attitudinal micro-transformations occurred around the time they became more knowledgeable of students' experiences and needs.

The non-African American PSTs all experienced social justice micro-transformations. All expressed an increased awareness of the social justice issues the lower income and minority students or their community members face. PSTs attributed their social justice micro-transformations to various sources, including cross-cultural relationships (Dedeoglu &Lamme, 2011), critical reflection (Milner, 2006), or course activities (Walker-Dalhouse & Dalhouse, 2006).

The timeline of PSTs' micro-transformations may be important. All PSTs experiences their micro-transformations before their 20-hours reflection. Every PST who experienced an attitudinal shift experienced their micro-transformation before their 14-hour reflection. For the two PSTs experiencing both attitudinal and social justice awareness micro-transformations,

attitudinal shifts occurred prior to social justice awareness shifts. PSTs with few interactions with lower income or minority students experienced social justice awareness shifts later than the PST who with had tutored homeless middle school students, and they experienced attitudinal shifts later than the African American PST. Thus, it is possible that repeated interactions with lower income and minority students in multiple cultural contexts might be associated with the timing of PST micro-transformations.

Limitations

The investigation had some limitations. For the culturally responsive tasks, PSTs were not provided additional opportunities to gather details related to students' cultural contexts for the creation of culturally responsive tasks. And for the critical mathematics tasks, PSTs could not ask students about social justice issues they or their community members face. However, lower income and minority student voice should be central to the development of tasks for them. In the future, I would choose a cultural immersion site whose program coordinator feels comfortable with allowing PSTs to do follow-up interviews of students for their cultural details, or with allowing PSTs to present students their cultural tasks to determine the accuracy of portrayals of student contexts and significance in tasks, or with allowing PSTs to survey students for social justice issues pertinent to their experiences. As in Gau's (2005) study, I would ask the coordinator to identify students who might be willing to share their experiences with PSTs. It is possible that PSTs might be willing to create and administer critical mathematics tasks after obtaining intimate details from students with whom they have developed personal relationships.

Also, the cultural segment lasted for only three weeks. In this limited time, a variety of topics relating to culturally responsive teaching were explored, but none with great depth. PSTs may have needed additional time to reflect on the tenets of culturally responsive teaching and

they may have needed additional training on the practical application of culturally responsive tasks. Furthermore, they may have needed additional time engaged in critical discourse about the instruction of cultural others with their community of practice in their mathematics education courses.

Finally, PSTs needed structured activities that would grow their knowledge of minority students. In the future, I will require PSTs to reflect on their beliefs about the mathematics education of minority students. PSTs will have to think about their time tutoring mathematics and ideally, they will be at a cultural immersion site that allows them to interact with and instruct minority students at the same grade level they aspire to teach.

Implications

The research in this dissertation has moved the field in our understandings of the preparation of mathematics teachers for culturally responsive instruction. In this section, I outline what we knew, now know as a result of this investigation, and have yet to discover about the preparation of culturally responsive mathematics teachers, as well as the role teacher education programs play in preparing teachers for increasingly diverse classrooms (Major & Brock, 2003).

First, from past research, we knew that some PSTs and teachers could create mathematics tasks using cultural details (Herron and Barta, 2009; Rubel & Chu, 2012; Turner et al., 2012). Upon examination of the culturally responsive tasks PSTs created for themselves, I discovered that most of my PSTs also could appropriately incorporate cultural details into the cultural backdrop and primary mathematics activities of tasks. However, we now know that PSTs struggle to appropriately assign significance to students' cultural contexts, as PSTs were more likely to draw meaningful connections in tasks for themselves and emergent connections in tasks created for students. Therefore, teacher education programs still need to support PSTs to grow

relationships with students or to develop their interview skills of students for drawing meaningful cultural details from them. Furthermore, we still need to know how to assist PSTs in creating culturally significant tasks once they have obtained cultural details from students. Considering that there is limited research on PST creation of cultural tasks, the research community must continue to document the process of creating culturally responsive tasks and further determine if the use of culturally responsive mathematics tasks lead to academic gains for minority students.

Second, Gau (2005) found that teachers could incorporate social justice issues into mathematics tasks. She also discovered teachers were uncomfortable with the "controversial" nature of the topics included in critical mathematics tasks. This investigation focused on PST beliefs about critical mathematics tasks. I discovered that PSTs have the same reservations about creating critical mathematics tasks for students as the teachers in Gau's (2005) study. From my investigation, we now have a clearer picture of the tensions between PST beliefs about the benefits and value of critical mathematics tasks to students. We have yet to learn if PSTs will allow their reservations about critical mathematics tasks to outweigh the benefits of these tasks to disenfranchised students. This is an area for further research.

In my interviews of Keenan and Micah, they reported that they were more open to learning about culturally responsive teaching primarily because they had developed relationships with me, an aspiring critical educator, and with critical friends who were their peers in the classroom. These, relationships, or friendships, may be central to productive discourse about the instruction of minority students. Teacher education programs must provide PSTs a safe space for discussing these PSTs' reservations about critical mathematics task with critical mathematics educators and critical friends. Critical educators can scaffold PST understandings of culturally

responsive teaching. Critical community members and critical minority PSTs who can empathize with students are critical friends who can serve as a sounding board for PSTs. They can provide PSTs perspective and place minority students' experiences in the appropriate historical, social, or sociopolitical context.

Third, we have learned from past research that PSTs beliefs about diverse students may shift from cultural training. We now have an indication of when belief shifts may occur, as PSTs experienced attitudinal micro-transformations by their 14-hour reflection and social justice awareness micro-transformations by their 20-hour reflection. Although we have greater clarity on the timing of micro-transformations, we require a more nuanced understanding of the events leading to or responsible for the micro-transformation. For a future investigation, I will ask PST to report times they noticed attitudinal and social justice awareness micro-transformations and to describe the cross-cultural relationships or fieldwork, course activities, or critical reflections they perceived contributed to their belief shifts.

Finally, past researchers (e.g. Gay, 2002, 2010; Villegas & Lucas, 2002) have provided broad frameworks that can be used for the construction of culturally responsive tasks. In this investigation, I applied these frameworks both for the differentiation of mathematics tasks and for identifying support for PSTs according to the level of their tasks. Repeated use, and possibly adaptation, of my instruments may allow the research community to arrive at clearer criteria for culturally responsive and critical mathematics tasks.

Personal Reflections and a Challenge to the Mathematics Education Community

I had apprehensions about co-teaching the cultural learning segment. As I mentioned in Chapter 1, I grew up in a predominantly European American community where I was marginalized due to my racial and social class backgrounds. My initial perception of the PSTs

was that they would trivialize culturally responsive teaching and be resistant to learning from me because they did not understand my experiences or appreciate how my background differed from their own. I also feared that they might refuse to meaningfully reflect on their beliefs about the lower income and minority students with whom they interacted. I was also concerned about what sort of beliefs the PSTs' held and how those beliefs might be evident in the culturally responsive and critical mathematics tasks they wrote for these students.

During the learning segment, It seemed that the PSTs, too, were uncomfortable. I perceived that PSTs who normally would make eye contact with me, looked away. Those who were vocal during the first 9 weeks of the class seemed to be uncharacteristically silent. I would learn from their written assignments on our readings and in-class discussions and their written journal reflections on their experiences at the CI site that they were, in fact, uneasy about writing their tasks and about engaging with cultural others. In short, we, the PSTs and me, had entered an uncomfortable space.

Fortunately, we grew from our interactions. I learned about PSTs from talking to them about their interests and aspirations when I visited the CI site. I became less fearful of them as I developed relationships with them, and my new bonds facilitated my understanding of some of their fears of teaching cultural others. PSTs' journals indicate that their knowledge of culturally different students grew from the relationships they built with students. Some PSTs' understanding of their students was also influenced by discussions we had in class on readings related to culturally responsive teaching. In some ways, we took steps towards addressing our fears for the betterment of the instruction of lower income and minority students.

I am more fearful that the mathematics education community will miss out on the brilliance of lower income and minority students than I am of making future teachers (and

possibly also the teacher educator) uncomfortable through requiring them to learn about culturally responsive teaching. Some lower income and minority student may be "successful" in learning mathematics using Eurocentric tasks. However, we have yet to fully discover how well these students might perform and what new contributions they might provide if given opportunities to learn with tasks they can relate to and understand. Moses and Cobb (2001) used culturally responsive mathematics curriculum to assist minority students in the learning of mathematics. They were committed to helping students learn in meaningful ways because they were convinced that mathematics, in general, and algebra, in particular, is "the gatekeeper for citizenship" (Moses & Cobb, p. 14), because those without mathematical competence are blocked from accessing educational and occupational opportunities. I agree with this philosophy and reiterate that it is critically important that along with increasing lower income and minority students' access to mathematics, we must also allow them reach their fullest mathematical potentials. I contend that this goal can be achieved through the use of culturally responsive and critical mathematics tasks.

Future Directions

I would like to investigate whether or how PSTs use what they have learned in their cultural training in their future classes. To do so, I would interview the PSTs who participated in the investigations in this work when they have their own set of students to document shifts in their beliefs, since their cultural immersion, regarding minority students and their ability to learn mathematics. I would also examine tasks those teachers use with their own students to determine the extent to which those tasks are culturally relevant to the students. Finally, I am interested in learning if PSTs how PSTs' reservations about critical mathematics tasks have influenced their decisions to incorporate them in the curriculum.

References

Bell, C. A., Horn, B. R., & Roxas, K. C. (2007). We know it's service, but what are they learning? Preservice teachers' understanding of diversity. *Equity & Excellence, 40*, 123–133. doi: 10.1080/10665680701218467

Dedeoglu, H., & Lamme, L. (2011). Selected demographics, attitudes, and beliefs about diversity of preservice teachers. *Education & Urban Society, 43*(4), 468–485. doi: 10.1177/0013124510380718

Freire, P. (2000). *Pedagogy of the oppressed: 30th anniversary edition*. New York, NY: Continuum.

Gau, T. R. (2005). *Learning to teach mathematics for social justice* (Unpublished doctoral dissertation). University of Wisconsin-Madison, Madison, WI.

Gay, G. (2000). *Culturally responsive teaching: Theory, practice, and research.* New York, NY: Teachers College Press.

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). New York, NY: Teachers College Press.

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*, 37–53. doi:10.2307/30034699

Hefflin, B. R., & Barksdale-Ladd, M. A. (2001). African American children's literature that helps students find themselves: Selection guidelines for grades K-3. *The Reading Teacher, 54*, 810–819.

Herron, J., & Barta, J. (2009). Culturally relevant word problems in second grade: What are the effects? *The Journal of Mathematics and Culture, 4*(1), 23–49.

Hollins, E. R., & Guzman, M. E. (2005). Research on preparing teachers for diverse population. In M. Cochran-Smith & K. M. Zeichner (Eds.), *Studying teacher education: The report of the AERA panel on research and teacher education* (pp. 477–548). Mahwah, NJ: Lawrence Erlbaum.

Jackson, L. (2006). Childhood and youth. In H. G. Cocks & M. Houlbrook (Eds.), *Palgrave advances in the modern history of sexuality* (pp. 231–255). Basingstoke, England: Palgrave Macmillan. doi: 10.1057/9780230501805_11

Kelley, D. M., & Brooks, M. (2009). How young is too young? Exploring beginning teachers' assumptions about young children and teaching for social justice. *Equity & Excellence in Education, 42*, 202–216. doi: 10.1080/10665680902739683

Kolano, L. Q., & King, E. T. (2015). Preservice teachers' perceived beliefs towards English language learners: Can a single course change attitudes? *Issues in Teacher Education, 24*(2), 3–21.

Kumar, R. & Hamer, L. (2012). Preservice teachers' attitudes and beliefs toward student diversity and proposed instructional practices: A sequential design study. *Journal of Teacher Education*, 64, 162–177. doi: 10.1177/0022487112466899

Ladson-Billings, G., & Tate, W. F. (1995). Toward a critical race theory of education. *Teachers College Record, 97*, 47–68.

Major, E., & Brock, C. (2003). Fostering positive dispositions toward diversity: Dialogical explorations of a moral dilemma. *Teacher Education Quarterly, 30*(4) 7–26.

Martin, D. (2006). Mathematics learning and participation as racialized forms of experience. *Mathematical Thinking & Learning, 8*, 197–229. doi: 10.1207/s15327833mtl0803_2

Matsuda, M., Lawrence, C., Delgado, R., & Crenshaw, K. (Eds.). (1993). *Words that wound: Critical race theory, assaultive speech, and the first amendment*. Boulder, CO: Westview Press.

Milner, R. H. (2006). Preservice teachers' learning about cultural and racial diversity: Implications for urban education. *Urban Education, 41*, 343–375. doi: 10.1177/0042085906289709

Moses, R. P., & Cobb, C.E. (2001). *Radical equations: Math literacy and civil rights*. Boston, MA: Beacon Press.

Pajares, M. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*, 307–332. doi: 10.3102/00346543062003307

Parker, L., & Lynn, M. (2002). What's race got to do with it? Critical race theory's conflicts with and connections to qualitative research methodology and epistemology. *Qualitative Inquiry, 8*, 7–22.

Rodriguez, A. J. (2005). Teachers' resistance to ideological and pedagogical change: In A. J. Rodriguez, & R. S. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 1–16). Mahwah, NJ: Lawrence Erlbaum.

Rubel, L. H., & Chu, H. (2012). Reinscribing urban: Teaching high school mathematics in low income, urban communities of color. *Journal of Mathematics Teacher Education, 15*, 39–52. doi: 10.1007/s10857-011-9200-1

Sleeter, C. E. (2001a). Epistemological diversity in research on preservice teacher preparation for historically underserved children. *Review of Research in Education, 25*, 209–250.

Sleeter, C. E. (2001b). Preparing teachers for culturally diverse school: Research and the overwhelming presence of whiteness. *Journal of Teacher Education, 52*, 94–106.

Terrill, M., & Mark, D. (2000). Preservice teachers expectations for schools with children of color and second language learners. *Journal of Teacher Education, 51*, 149–155. doi: 10.1177/002248710005100209

Turner, E. E. Drake, C., McDuffie, A. R., Aguire, J., Bartell, T. G., Foote, M. Q. (2012). Promoting equity in mathematics teacher preparation: A framework for advancing teacher learning of children's mutiple mathematics knowledge bases. *Journal of Mathematics Teacher Education, 15*, 67–82. doi: 10.1007/s10857-011-9196-6

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A coherent approach*. Albany, NY: State University of New York Press.

Walker-Dalhouse, D., & Dalhouse, A. (2006). Investigating White preservice teachers' beliefs about teaching in culturally diverse classrooms. *Negro Educational Review*, 57(1/2), 69–84.

APPENDIX A: SECONDARY STUDENT RECRUITMENT AND ASSENT LETTER

Hello! My name is Tisa Trask and I am a graduate student at Illinois State University. I am conducting a research study on mathematics teacher preparation to instruct students from diverse backgrounds. I am asking you to be a part of this study because I think your beliefs about what it takes to teach students of your ethnic background are important so that future teachers can help minority students learn mathematics.

You don't have to be a part of the study if you don't want to. If you decide to participate in the study, which will be held in the fall semester of 2016, you will be asked to be a part of 3 focus group interviews and one learning activity on culturally responsive teaching and tasks. I will videotape each session, which will last about an hour, so I can show them, in their entirety, to college students who want to become mathematics teachers. To hide your identity, I will blur your face in the videos before I show them to future teachers. In the sessions, I will ask you questions about your beliefs about culturally responsive teaching and tasks. Some students may not want to talk about these topics. You do not have to answer any question you don't want to. You can stop being in this study at any time. No one will be mad at you. If you quit the study, you can still participate in the ACT class.

There are some good things that might happen if you participate in the study. For instance, you will have a chance to reflect on your mathematics instruction as an ethnic minority student. We might also find out information that will help other ethnic minority mathematics students some day.

I will work hard to keep your participation confidential. In the focus group and instruction sessions, I will assign you a fake name, which I will also use in any future publication or presentation so no one will know you were a part of this study. Please do not repeat what is said in the sessions so that no one outside the focus group knows how those involved in the study responded to questions or activities. Although I will make every effort to hide your identity, it is possible that someone might recognize you by what they see or hear on the video, for example, by your clothes or voice.

You can ask me (tmtrask@ilstu.edu) or my advisor, Dr. Tami Martin (tsmartin@ilstu.edu), who will also see the videos and help me with this study, questions about this study at any time. If you have questions about your rights as a participant in this study, or if you feel this study puts you at risk, please contact Illinois State University Research Ethics & Compliance Office at (309)438-2529 or rec@ilstu.edu.

□ I **WANT** to be in this study.

_____ _____

PRINT your name Date

_____ _____

SIGN your name Date

□ I **DO NOT** WANT to be in this study.

_____ _____

PRINT your name Date

SIGN your name

Date[13]

IRB Protocol Number: 884673–1

APPENDIX B: SECONDARY STUDENT PARENT RECRUITMENT LETTER

Hello!

I, Tisa Trask, a PhD student at Illinois State University, am conducting a research study on future mathematics teacher preparation for the instruction of diverse students. I am very interested in what your child believes about what it takes to teach ethnic minority students.

I am asking you to allow your child to participate in the study by allowing me to videotape your child's involvement in four sessions during the Fall semester of 2016. There are three focus group interviews on culturally responsive teaching and mathematics assignments and there is one session in which your child will participate in a culturally responsive learning activity and a discussion about the activity afterwards. Each session will last about one hour. I will be using the videos of all four sessions to help future mathematics teachers to learn about your child's perspectives on culturally responsive teaching and about how mathematics teachers can develop culturally responsive lessons for diverse students. There is a small risk that your child will be identifiable from the videos. I will be intentional about minimizing the chance that anyone knows that your child is a part of my study. I will mask your child's identity by blurring his/her face in the videos before they are presented to the future teachers. Also, I will assign your child a fake name so that he/she cannot be identified by name.

Your child's participation in this study is voluntary, meaning he/she does not have to participate in this research if he/she is unwilling. If, at any time, your child decides not to participate or to withdraw from the study, there will be no penalty or loss of benefits associated with the ACT class in which your child is participating.

I am doing this research for my dissertation. I am conducting this research under the supervision of Dr. Tami Martin. The project has been approved by the Institutional Review Board of ISU (IRB# 884673-1). Dr. Martin will also have access to the data to assist with the analysis.

Your child may benefit from participating in this study in several ways. One possible benefit is that your child will have an opportunity to reflect on issues related to his/her mathematics instruction as an ethnic minority student. There are minimal risks from participating in this study. Your child may experience some feelings of self-consciousness as he/she gives responses during the focus groups or the learning activity. If this research is published or used in presentations, your child's identity will be masked using a pseudonym, or fake name, and by blurring his/her face.

If you consent to allow your child to participate in the study, an assent form will be given to your child that explains what is involved in the study and asks your child if he/she is willing to participate in the study.

If you have questions regarding the research, please contact me, Tisa Trask, at tmtrask@ilstu.edu or Tami Martin at tsmartin@ilstu.edu If you have questions regarding your child's rights as a subject/participant in this study, or if you feel this investigation places your child at risk, you can contact Illinois State University Research Ethics & Compliance Office at (309)438-2529 or rec@ilstu.edu.

Sincerely,

Tisa Trask	Dr. Tami S. Martin
Ph.D. Student	Mathematics Professor

APPENDIX C: CULTURAL IMMERSION STUDENT RECRUITMENT AND ASSENT LETTER

Dear Student,

Hi! My name is Tisa Trask. I am a graduate student at Illinois State University. I am doing a study on how mathematics teachers are prepared to teach students with different cultural backgrounds. I am interested in learning how mathematics teachers create word problems for specific students. As a class assignment, a preservice mathematics teacher will interview you on your culture (the music you and your family listen to, the holidays your family celebrates, the people you, your family, and friends admire, the foods your family eats, the activities your family participates in…) so they can create a word problem that represents your experiences and that of other students from your culture. The interview will be audio taped, will last up to 30 minutes, and will take place in the Fall semester of 2016. Your preservice teacher will use the information you give to create a word problem for you and other students from your culture. I am asking that you allow me to collect the audiotaped interview from your preservice teacher so that I can include it in my study.

You don't have to be a part of the study if you don't want to. No one will be mad at you. You can, at any time, decide that you do not want me to use the audiotaped interview information you give the preservice teacher. Whether or not you decide to be in the study, you can still participate at the program.

There are some good things that might happen if you participate in the study. For instance, you will have a chance to think about how you would like to see your culture included in

mathematics problems. We might also find out information that will help other mathematics students from your culture some day.

I will keep the information you give for the interview private. By this, I mean that I will not include your name in any paper I write or in any presentation I give in the future. Also, all interviews will be written out, so no one can find out you gave a particular response.

If you have questions about the study, please contact me, Tisa Trask, at tmtrask@ilstu.edu or my advisor, Tami Martin at tsmartin@ilstu.edu, who will also see your information and will help me in this study. If you have questions about to your rights and what you should expect while in the study, have your parents contact Illinois State University Research Ethics & Compliance Office at (309)438-2529 or rec@ilstu.edu.

□ I **WANT** to be in this study.

_____ _____

PRINT your name Date

_____ _____

SIGN your name Date

□ I **DO NOT** WANT to be in this study.

_____ _____

PRINT your name Date

_____ _____

SIGN your name Date[14]

IRB Protocol Number: 884673–1

Please check your selected response of consent and sign the form at the bottom.

_____I DO give permission for the researchers (Tisa Trask and Tami Martin) to use the audio data from my interview for the study and for future publications and presentations.

_____I DO NOT give permission for the researchers (Tisa Trask and Tami Martin) to use the audio data from my interview.

_____	_____
Printed Name	Date
_____	_____
Signed name	Date

APPENDIX D: CULTURAL IMMERSION STUDENTS' PARENTAL PERMISSION LETTER

Dear Parent,

Hi! My name is Tisa Trask. I am working on a PhD at Illinois State University. I am doing a study on mathematics teacher preparation for instruction in classes with diverse students. I am interested in learning how mathematics teachers create word problems for specific students. As a class requirement, preservice mathematics teacher will interview your child on his/her culture (the music your family listens to, the holidays your family celebrates, the people your family and friends admire, the foods your family eats, the activities your family participates in…) so the preservice teacher can create a word problem that reflects the experiences of your child and others who share your culture. The audiotaped interview will last up to 30 minutes and will take place in the Fall semester of 2016. The interview data will be used by the preservice teacher to create a word problem for your child and other students from your child's culture. I am asking that you allow me to collect the audiotaped interview from the preservice teacher so that I can include it in my study.

I want you to know that it is your choice whether or not your child will be a part of this study. If, at any time, you or your child decide not want to participate anymore, you and your child can quit the study.Your choice to allow your child to participate in the study will not affect your child's participation at the program.

I am doing this research for my dissertation study. My supervisor for the project is Dr. Tami Martin. The project has been approved by the Institutional Review Board of ISU (IRB# 884673-1). Dr. Martin will also have access to the data to assist with the analysis.

Your child may benefit from participating in this study in several ways. One possible benefit is that your child will have an opportunity to think about the issues brought up in the interview questions. There are minimal risks from participating in this study. Your child's interview responses will be kept confidential. By this, I mean that your child's name will not be placed on any of the data or in any future presentation or publication. When the word problem that is created to reflect your child's experience and background is given to the adult supporters of your program, your child's name will not be placed on this document. Also, all interviews will be written out, or transcribed, so no one can find out that your child gave a particular response.

If you have questions about the study, please contact me, Tisa Trask, at tmtrask@ilstu.edu or Tami Martin at tsmartin@ilstu.edu. If you have questions about to your rights and what you should expect while in the study, have your parents contact Illinois State University Research Ethics & Compliance Office at (309)438-2529 or rec@ilstu.edu.

Sincerely,

Tisa Trask	Dr. Tami Martin
Mathematics Education Ph.D. student	Mathematics Professor

Please check your selected response of consent and sign the form at the bottom.

_____I DO give permission for the researchers (Tisa Trask and Tami Martin) to use the audio data from my child's interview for the study and for future presentations and publications.

_____I DO NOT give permission for the researchers (Tisa Trask and Tami Martin) to use the audio data from my child's interview.

_____	_____
Printed Name	Date
_____	_____
Signed name	Date

APPENDIX E: PRESERVICE TEACHER RECRUITMENT AND CONSENT FORM

Dear preservice teacher,

I, Tisa Trask, a PhD student at Illinois State University, am conducting a research study on prospective mathematics teacher preparation for the instruction of diverse students. For 2 to 3 weeks of class during the Fall semester of 2016, you will receive instruction on how to teach diverse students, such as the African American and Latin@ students at the program where you will be volunteering. I am inviting you to participate in the study by allowing me to conduct research on the activities you would normally engage in as a result of participating in your class. I am asking if you will allow me to videotape your in-class discussions and activities. And I am requesting your permission to collect assignments that you will complete as normal requirements for your class. For one assignment, you will create word problems that reflect the experiences and background of the students at the program. I am requesting that you allow me to collect these word problems and to give them to supporters of the program so they can give you and me feedback on how well you did. I am also seeking participants who are willing to be interviewed about your preparation to teach diverse students, such as those with which you will interact at the program. This in-person interview will last approximately 1 hour and will be audio recorded. This interview will take place at the end of the study in the Fall semester of 2016 or the Spring semester of 2017. You will be paid $10 for your interview.

Your participation in this study is voluntary, meaning you do not have to participate in this research if you are unwilling. If, at any time, you decide not to participate or to withdraw from the study, there will be no penalty or loss of benefits associated with participating in any class in

which you are enrolled at Illinois State University. Participating in the study is not associated with grade benefits in any class.

I am conducting this research under the supervision of Dr. Tami Martin. The project has been approved by the Institutional Review Board of ISU (IRB#). Dr. Martin will also have access to the data-during the Spring 2017 or Summer 2017 semesters to assist with the analysis.

You may benefit from participating in this study in several ways. One possible benefit is that you will have an opportunity to reflect on issues related to teaching diverse students that will be discussed in the interview. There are minimal risks from participating in this study. You may experience some feelings of self-consciousness as you give your interview responses. Your responses to all classroom activity and your interview responses will be kept confidential. The interview you conduct of the program students will be transcribed to preserve confidentiality. Furthermore, my interview of you, as well as the videos of your class activities and discussions, will be transcribed for this same reason. Also, I omit your name from your word problem task; therefore, the supporters of the program will not be able to associate you with a particular word problem. Instead, the word problems will be randomly numbered before they are given to supporters. If this research is published, participant identities will be masked using pseudonyms.

If you have questions regarding the research, please contact me, Tisa Trask, at tmtrask@ilstu.edu or Tami Martin at tsmartin@ilstu.edu If you have questions pertaining to your rights as a subject/participant in this study, or if you feel this investigation places you at risk, you can contact Illinois State University Research Ethics & Compliance Office at (309)438-2529 or rec@ilstu.edu.

Sincerely,

Tisa Trask	Dr. Tami S. Martin
Ph.D. Student	Mathematics Professor

Component A

Please check your selected consent response to Part 1 and Part 2 of Component A of the study and sign the form at the bottom.

Part 1 (classroom assignments)

_____I DO consent to participate in the class assignments portion of the study, and I give permission for the researchers (Tisa Trask and Tami Martin) to use my data from the class assignments to get feedback from program supporters and for future publications and presentations.

OR

_____ I DO NOT give permission for the researchers (Tisa Trask and Tami Martin) to use my data from the class assignments.

Part 2 (video taping class activities)

_____I DO consent to allow Tisa Trask to videotape me during classroom activities and I give permission for the researchers (Tisa Trask and Tami Martin) to use the data from the videotapes.

OR

_____I DO NOT want to allow Tisa Trask to videotape me during classroom activities and I DO NOT give permission to the researchers (Tisa Trask and Tami Martin) to use data related to me from classroom videotapes.

Printed Name	Date
Signature	Date

Component B

Please check your selected response to participate in Component B of the study (Interview Participation) and sign the form at the bottom.

_____I DO consent to participate in a 1-hour, audio-recorded interview regarding preparation for teaching diverse students.

Here is my contact information:

_____ _____

Illinois State email address **Phone number**

OR

_____I DO NOT consent to participate in a 1-hour, audio-recorded interview regarding preparation for teaching diverse students.

_____ _____

Printed Name Date

_____ _____

Signed name Date

APPENDIX F: DAY 1 OF LEARNING SEGMENT

November 1, 2016

Agenda Day 21

Objectives: Students should be able to:

Define equity

Justify the use of "equitable" teacher practices for students

Reading Discussion and GFE:

Moses, R. P., Kami, M., McAllister-Swam, S., & Howard, J. (1989). The algebra project: Organising in the spirit of Ella. *Harvard Educational Review, 59*, 423–443.

Oakes, J. (1995). Two cities' tracking and within school segregation. *Teachers College Record*, *96*(4), 681–690.

The Equity Principle

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

GFE (What do you think Oakes or Moses and his colleagues would say? Why?):

1. Is mathematics power?

2. To what extent do you believe that mathematics teachers are in a position of power, more so than teachers of other subjects, to help or hinder students from pursuing post-secondary education and jobs?

3. What (if any) is your role in making sure all students have access to post-secondary opportunities?

Keep in mind that in each three questions one of your goals is to answer the question in a way that will help us see you have read the articles.

Class Discussion:

1. Consider the picture on the back of this page. What do you think the picture means? Is what is communicated in the picture aligned with what is communicated in the Equity Principle? Please list 4 groups of students you think would require an equitable mathematics education. Describe the specific actions you would take to achieve equity for each group.

Homework **(Due November 3):**

(Up to 3 pages, double-spaced).

1. Discuss the extent to which you, a future mathematics teacher, will be in a position of power in school.
2. In your own words, define equity.
3. Assume you have a class of African American and Latin@ students, such as those at [the CI site]. Your students are not performing as well as those from other racial groups. Who is responsible for their performance? **PLEASE UPLOAD ON REGGIENET.**

Equity/Equality Distinction

Image Retrieved from http://schoolsofequality.com/equality-v-equity/

APPENDIX G: DAY 2 OF LEARNING SEGMENT

November 3, 2016

Agenda Day 22

Objectives: Students should be able to:

Acknowledge relative positions and their meanings

Activity 1: Physical Appearance Categorization Activity

Questions:

1. What characteristics of the people in the photos did you notice first? Were they the same or different for different pairs of photos?
2. Did those characteristics affect your judgments? Why or why not?
3. Do you think your first impressions of the people in the photos might affect your interactions with these individuals? Why or why not?
4. Think about the roles and stereotypes that are part of our cultural script. What are these? Where did they come from? Do you see any specific patterns in your answers that reflect these roles and stereotypes?

Activity 2: **Power Activity**

How we are positioned may influence our lived experiences and how we understand the experiences of others.

Please pull out your phones so we can do a survey on poll everywhere.

Make two statements that indicate that you are in a position of power. (e.g., "I make more money than my counterpart of the opposite gender.")

Make two statements for others who are in positions of power over you.

(The statements can consist of common ones, such as "I'm heterosexual" and uncommon ones.)

How should we rank these power statements? Should some be given 2 points, while others only a point? Maybe some no point at all?

What are the characteristics of an individual with a high total point value? Would a cultural immersion site student be more or less likely than a Metcalf student to have a high total point value? Why?

Can a teacher's position of power influence treatment of students with the same position as hers? If so, how?

Can a teacher's position of power influence treatment of students with different positions than his? If so, how?

Homework: **(Due November 8)**

(Up to 2 pages, double spaced)

1. To what extend to you believe you are in a position of power?
2. Are you in the same position of power as [the students at the CI site]?
3. How do similarities or differences in position of power between teacher and student influence instruction or learning?

APPENDIX H: DAY 3 OF LEARNING SEGMENT

November 8, 2016

Agenda Day 23

Objectives: Students should be able to:

Identify characteristics of a culturally responsive teacher

Video:

https://www.youtube.com/watch?v=eSwr6vsrqb0 (up to 6:00)

Readings:

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Kea, C., Campbell-Watley, G., & Richards, H. (n.d.). Becoming culturally responsive educators: Rethinking teacher educator pedagogy. Retrieved from http://www.champaignschools.org/sites/default/files/Teacher_Ed_Brief.pdf

Strategies for Promoting Culturally Responsive Classrooms in Alexandria City Public Schools. (n.d.). Retrieved from http://www.acps.k12.va.us/equity/strategies.pdf

Discussion 1: Traits of a culturally responsive teacher

What are the characteristics of a culturally responsive teacher? Small group then larger group

(Write on board.)

A probing question: As a culturally responsive teacher, should you include the culture of students who are not in your class?

Discussion 2: I know myself (own culture)…and others???

In your groups, please answer the questions listed below that pertain to your culture.

1) What type of things do you like to do outside of school or on the weekends? Does your family have a special activity they do or are there special trips they take? If so, please describe. What is special about this activity?
2) What holidays does your family celebrate? Can you please describe one? Why is this holiday important to your family?
3) What languages do you speak?
4) What are your religious practices? What do these practices mean to your community?
5) Who are your role models? Can you give three? Why do you (or members of your community) admire them?

Discussion 3: Cultural similarities and differences

How does your culture resemble or differ from the students at the cultural immersion site? How may cultural differences or similarities between you and the cultural immersion site students influence instruction and learning?

Homework (Due November 10):

Part 1:

Please create a **mathematics word problem** that reflects your own experiences (based on the information you provided about your culture in class).

Part 2:

Create a list of information (or questions one might ask you) that would be helpful to create this culturally-responsive-to-you task.

Part 3:

(1 page double spaced). Please research a social issue **you perceive** [a student at the cultural immersion site] or the student's family members may be facing. (e.g., racism, sexism, homelessness, poverty, food desert, joblessness, domestic violence, ageism, lack of health

care/health care coverage). Look for statistics that illustrate this issue. In particular, please find statistics that show how the issue affects your student's group and other racial groups. Please bring this information to class.

GOOD FAITH EFFORT for November 10:

Readings:

Kea, C., Campbell-Watley, G., & Richards, H. (n.d.). Becoming culturally responsive educators: Rethinking teacher educator pedagogy. Retrieved from http://www.niusileadscape.org/docs/FINAL_PRODUCTS/NCCRESt/practitioner_briefs/%95%20TEMPLATE/DRAFTS/AUTHOR%20revisions/annablis%20pracbrief%20templates/Teacher_Ed_Brief_highres.pdf

Ten quick ways to analyze children's books for racism and sexism (n.d). Retrieved from http://cmascanada.ca/wp-content/uploads/2011/11/article-10-ways-to-analyze-childrens-books-for-sexism-and-racism.pdf

What are the components of a culturally responsive (mathematics) task?

APPENDIX I: DAY 4 OF LEARNING SEGMENT

November 10, 2016

Agenda Day 24

Objective:

Students will be able to identify the components of culturally responsive mathematics tasks

Additional readings:

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*, 37–73.

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American students* (2nd ed.). San Francisco, CA: Jossey-Bass.

Nasir, N. S. (2000). Points ain't everything: Emergent goals and average and percent understandings in the play of basketball among African American students. *Anthropology & Education Quarterly, 31*, 283–305. doi:10.1525/aeq.2000.31.3.283

Style, E. (1998). Curriculum as window and mirror. In C. Nelson & K. Wilson (Eds.), *Seeding the process of multicultural education* (pp. 149–156). Plymouth: Minnesota Inclusiveness Program.

Tate, W. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory into Practice, 34*, 166–173. doi:10.1080/00405849509543676

Discussion 1 (GOOD FAITH EFFORT):

What are the components of a culturally responsive (mathematics) task?

Information for reflection:

The benefits of culturally responsive (mathematics) tasks

Style (1998) argued:

> If the student is understood as occupying a dwelling of self, education needs to enable the student to look through window frames in order to see the realities of others and into mirrors in order to see her/his own reality reflected. (p. 150)

Tate (1995) found that when a teacher engaged minority students in the doing of mathematics by centering classroom projects on issues, the larger community was affected as well. Students in Tate's study solved problems, communicated mathematics to each other and to their teacher, reasoned about mathematics, extended mathematics to other contexts, and developed procedural fluency. Likewise, students used what they learned in their mathematics class to develop suggestions to effect change in their communities. Nasir (2000) engaged African American students in mathematical discussions regarding basketball, an activity with which this set of students was familiar. She found that in doing so, students were able to perform both qualitative and quantitative analyses, and were engaged in mathematical thinking and discourse.

Activity 1:

Video of secondary students

Gay's (2002) Culturally Responsive Curriculum Model

According to Gay (2002), curriculum should be analyzed according to "the quantity, accuracy, complexity, placement, purpose, variety, significance, and authenticity of the narrative texts, visual illustrations, learning activities, role models, and authorial sources used in the instructional materials" (p. 108).

Reading:

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*, 106–116. doi:10.1177/0022487102053002003

Activity 2:

List the questions you might ask the African American or Latin@ students at the cultural immersion site to gather details for a culturally responsive word problem. Your questions should allow you to carefully document cultural details, as well as the meaning/significance students attach to these details.

Homework:

Part 1:

Use the information you gathered about the issue you perceive your [student at the cultural immersion site] student or a family member faces to create a culturally and critically responsive word problem.

Part 2:

(up to 2 page double spaced) Please reflect on the difficulties you had in making this problem (and in making it significant to this group of people). In what ways might your student benefit from your culturally and critically responsive word problem? In what ways might students from other groups benefit from your word problems?

Readings for Tuesday:

NCTM's Process Standards

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practise. *Mathematics Teaching in the Middle School, 3,* 344–350.

GOOD FAITH EFFORT: What are the components of a cognitively demanding mathematics task?

Table I1

Criteria for Culturally Responsive Mathematics Curriculum with Examples[15]

Curricular Features	Indicators of culturally unresponsive mathematics curriculum	Indicators of culturally responsive mathematics curriculum
Authenticity: Name choices	Chandler and Kim decided to go on a bicycle tour.	Demetrius and Pablo decided to go on a bicycle tour.
Authenticity: Context details	Shopping at Schnucks–a local store with a small ethnic food section	Shopping at El Progreso or eating at BJ's Market and Bakery—a soul food store
	Eating pumpkin pie	Eating sweet potato pie or eating Arros con Leche
Authenticity: Activity familiarity	Taking a bicycle tour through Iowa	Taking the L-train to visit grandmother or to attend a Dre concert
	Camping	
	Playing euchre	Playing spades or playing Mexican Loteria card game
	Backpacking in Europe or skiing	Riding bicycles in the neighborhood or to work
	Playing hockey or recreational Biking	playing basketball or Soccer/fútbol, quinceañera
Significance: Personal or Communal meaning	Sweet sixteen, Columbus Day	Dia de Los Muertos, Kwanza,
	Recycling, fund raising, pollution, organic foods, organized sports, recreational traveling	Immigration, illegal waste dumping, racial profiling, water safety, transit justice, loan acceptance, poverty/income disparities, unemployment, incarceration, food deserts, lead poisoning

(Table Continues)

[15] Cook-Sather (2015) defined an authentic text as one that attends to the "experiences and insights of students" (p. 1). The examples in this table emerged from discussions I had with another African American and a Latin@, and because these examples come from our lived experiences, they are authentic to us. Although these examples reflect some of our individual experiences, they do not reflect the totality of our experiences, nor do they reflect the totality of the experiences of members from our ethnic communities. This table serves as one possible set of indicators for culturally responsive mathematics. However, to create curriculum that addresses their African American and Latin@ students' cultural and learning needs, teachers would have to ask these ethnic minority students about the cultural referents that were meaningful to those students.

Curricular Features	Indicators of culturally unresponsive mathematics curriculum	Indicators of culturally responsive mathematics curriculum
Role Models	Carrie Underwood, Jana Kramer, Tracey Musgraves, Ron Paul, Humphrey Bogart, John Wayne, Andre Agassi, Mario Lemieux, Roberta Donbar, Wolfgang Puck, Bobby Flay	Kobe Bryant, Matt Forte, Dre, Chief Keef, Selena Gomez, Shakira, Pitbull, Selena, Javier Hernández, President Obama, Michael Jordan, George Washington Carver, Magic Johnson, Ursula Burns, Guy Bluford, Keith Black, Ertha Kitt, Denzel Washington, Fredrick Douglas, Richard Wright, Calderon, Enriquie Peña Nieto, Pablo Alvarado, J. Lo, Dolores Huerta, Susana Martinez, Sonia Sotomayer, Alberto Gozalez, Phillip Bazaar, Edward Hildalgo, Franklin Chang-Diaz, Rita Moreno, Roberto Clemente, Desi Arnaz, Lucy Gonzalez Parsons, Antonia Coello Novello

APPENDIX J: DAY 5 OF LEARNING SEGMENT

November 15, 2016

Agenda Day 25

Objective:

Students will be able to classify cognitive demand levels of mathematics tasks using Smith and Stein's (1998) framework

Follow up:

Difference between privilege and power

The extent to which our backgrounds influence the tasks we choose

Other questions to add to the interview protocol

Activity 1:

Using the rubric on page 348, classify the mathematics tasks provided on page 346.

Activity 2:

Assess the level of cognitive demand of the following problems:

Preservice teachers were given the following problem and were asked to create a problem that was as cognitively demanding and was culturally responsive to African American or Latin@ students.

Jeffrey, Chandler, Kim, Sarah, and Tom decided to do a bike tour in Iowa which began in Sioux City and ended in Davenport. Fred and Theresa follow along in a truck with the groups' camping gear, food and repair equipment. On the first day of the tour, Theresa documented the distance reading on the truck's odometer every other hour from 9:00 am to 5:00 pm.

Time (hours)	*0*	*2*	*4*	*6*	*8*
Distance (miles)	*0*	*24*	*24*	*51*	*74*

Provide a report that summarizes the data Theresa gathered on the first day of the tour. Provide a graph of the data to describe the distance in comparison to the time. What are the advantages of each representation (e.g., table, report, and graph)?

What follows are two word problems preservice teachers created in response to the task.

Abby:

Jason was looking at his watch, and saw that it was 2:30. He noticed the positioning of the hands on his watch, and thought about the times when the second hand and the minute hand would meet. Knowing that his watch read 2:30, Jason wanted to know the next time that the second and minute hands would meet. a. Predict the time in which the minute and second hand would meet next. Explain your thinking. b. Create an algebraic expression that would allow you to find the time at which the hands would meet at any time. c. What components of an analog clock could you use to create your expression? Explain your thinking.

Edward:

The way to drive to work costs $.75 for every mile driven. If you have to go 20 miles there and 20 miles back and there are 200 miles in a tank of gas answer these questions: 1. How many trips will it be until you have to get gas again if you strictly drive from home to work? 2. How much does a round-trip drive cost? 3. Make an equation for the cost up to 200 miles.

How well do you think the preservice teachers did? Were the tasks as cognitively demanding as the original problem?

Discussion:

Who should receive tasks at the various levels of cognitive demand? Why?

Homework:

1. Using the Cultural Information Interview Protocol, complete your interview with an African American or Latin@ [student at the cultural immersion site]. Use information from this interview to create a culturally-responsive-to-student task. Please upload your word problem and audiotaped interview on Reggienet (Due Nov. 29).

2. (From 1 to 2 pages). Describe the type of student who should receive the high cognitive demand tasks. Describe the type of student who should receive the low cognitive demand tasks. Please provide an explanation for your descriptions. (Due November 29)

Interview protocol for cultural immersion site students

1) What type of things do you like to do outside of school or on the weekends? Does your family have a special activity they do or are there special trips they take? If so, please describe. What is special about this activity?
2) What holidays does your family celebrate? Can you please describe one? Why is this holiday important to your family?
3) What languages do you speak?

4) What are your religious practices? What do these practices mean to your community?
5) Who are your role models? Can you give three? Why do you (or members of your community) admire them?

IPhone information about recording and sending interview data:

In the apple store you can purchase (it's free) "Audio recorder"

This app will allow you to audio record your interview.

Once you have clicked on your recording, you can click on the send box in the upper right corner and share/email it to yourself to email to your primary instructor (share, then share audio, then click mail, enter email address).

Please shoot me an email if you have another type of phone. I'll try to locate a recording app for you.

APPENDIX K: DAY 6 OF LEARNING SEGMENT

November 17, 2016

Agenda Day 26

Objective:

Students will be able to classify cognitive demand levels of mathematics tasks using Smith and Stein's (1998) framework

Discussion of future assignments:

Activity 1:

Assess the level of cognitive demand of the following problems:

Preservice teachers were given the following problem and were asked to create a problem that was as cognitively demanding and was culturally responsive to African American or Latin@ students.

Jeffrey, Chandler, Kim, Sarah, and Tom decided to do a bike tour in Iowa which began in Sioux City and ended in Davenport. Fred and Theresa follow along in a truck with the groups' camping gear, food and repair equipment. On the first day of the tour, Theresa documented the distance reading on the truck's odometer every other hour from 9:00 am to 5:00 pm.

Time (hours)	*0*	*2*	*4*	*6*	*8*
Distance (miles)	*0*	*24*	*24*	*51*	*74*

Provide a report that summarizes the data Theresa gathered on the first day of the tour. Provide a graph of the data to describe the distance in comparison to the time. What are the advantages of each representation (e.g., table, report, and graph)?

What follows are two word problems preservice teachers created in response to the task.

Abby:

Jason was looking at his watch, and saw that it was 2:30. He noticed the positioning of the hands on his watch, and thought about the times when the second hand and the minute hand would meet. Knowing that his watch read 2:30, Jason wanted to know the next time that the second and minute hands would meet. a. Predict the time in which the minute and second hand would meet next. Explain your thinking. b. Create an algebraic expression that would allow you to find the time at which the hands would meet at any time. c. What components of an analog clock could you use to create your expression? Explain your thinking.

Edward:

The way to drive to work costs $.75 for every mile driven. If you have to go 20 miles there and 20 miles back and there are 200 miles in a tank of gas answer these questions: 1. How many trips will it be until you have to get gas again if you strictly drive from home to work? 2. How much does a round-trip drive cost? 3. Make an equation for the cost up to 200 miles.

How well do you think the preservice teachers did? Were the tasks as cognitively demanding as the original problem? Why? What specific changes would you make to either problem so that it is of similar cognitive demand to the original problem?

Discussion:

Who should receive tasks at the various levels of cognitive demand? Why? Please describe the student who should receive the "Complete the square" problem.

Discussion:

What steps can you, a future mathematics teacher, take to maintain the level of cognitive demand from the time the word problem is introduced to when it is completed?

Opportunity to ask questions:

What clarity can be provided on the homework you will submit? What information can be provided on how to record and send interview data? Other issues or concerns…?

Opportunity to get a jumpstart on future assignments…

From Tisa:

A big THANK YOU for helping me with the study!

APPENDIX L: ANALYSIS OF THE PERSONAL DETAILS IN CRS AND CRP TASKS

The following table outlines the analysis of the inclusion of authentic personal information (i.e., names, contexts, or activities) in the backdrop of CRP tasks. Directly after the CRP task analysis, CRS tasks were similarly analyzed

Table L1

The Inclusion of Personal Details in the Backdrops of CRP Tasks

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
Angela European American	At Angela's Grandma's house, Grandma is making a 10-lb turkey for Christmas. Grandma has 3 hours to finish cooking the turkey before the family arrives at 5. If it takes 1-pound of turkey meat 30 minutes to cook, will Grandma finish cooking the turkey in time? If Grandma does not have enough time, when should she have begun cooking the turkey?	PST's name.	PST's grandmother's house.	Cooking turkey. (In the PST reflection, the PST stated, "This is an actual scenario that a family goes through on holidays." She did not explicitly say it reflects her family's experience.)
Brian European American	The MacArthur family is hosting their annual volleyball tournament at Thanksgiving. There 20 people there. Brian brought 55 servings of mac and cheese, and his brother Fred brought 47 servings of beef. How many whole servings of each dish could each person have? How many servings are leftover of each dish?	PST's name.	PST's home. Thanksgiving holiday. Annual volleyball tournament. (In the PST reflection, he stated he used the "best family gatherings.")	Playing volleyball. Eating servings of dishes. (In the PST reflection, the PST said he included "some of my interests.")

(Table Continues)

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
Carmel Jewish European American	Sarah is cooking Rosh Hashanah dinner this year for 9 relatives. She wants to cook sweet honey carrots, bake honey into the challah bread, and have honey on the table to dip apples and other foods in to celebrate the beginning of a sweet year. One dish of sweet honey carrots feeds 3 people and uses 1 tablespoon of honey. One batch of challah bread is more than enough for everyone and, to bake it with honey, you need to add 4 tablespoons into the mixture. Each person will need about 2 tablespoons of honey to dip into in addition. She already has bought a new 8oz container of honey (1 oz=2 tablespoons). Does Sarah have enough honey for Rosh Hashanah dinner or will she need to buy more?	PST's sister's name.	Rosh Hashanah /Jewish New Year. Sweet carrots, challah bread, honey dips. (In the PST reflection, the PST stated that she is Jewish and celebrates the Jewish New Year "eating sweet things.")	Cooking carrots and bread with honey and using honey for dips. (In the PST reflection, the PST stated that she specifically eats honey challah bread, sweet honey, carrots, and honey dipped apples.)

(Table Continues)

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
David European American	Assume three hundred and sixty eight people attend the Simbang Gabi gathering at *a Catholic church*[16] on Friday. Also assume that everyone attends the after party where noodles are one of the dishes that will be served. If one tray of noodles serves thirty people, how many trays of noodles are needed to make sure everyone gets at least one serving of the noodles?	No name.	Simbang Gabi/Filipino Christmas tradition. *A Catholic church* on Friday[17]. After party. Noodles. (In the PST reflection, the PST stated one should ask him to describe his favorite holiday.)	Eating noodles. (In the PST reflection, the PST did not explicitly note that the eating of noodles was part of the Simbang Gabi celebration. However, my search of online sources reveals that this dish may be an artifact from his culture[18].)
Eli European American	Paul owns a store that sells video games, new computers, and trading cards. In Paul's store, each video game costs $50, a new computer costs $525, and a pack of trading cards is $3. From the sale, Paul made $3509. Sixteen items were sold in total and there were twice as many computers sold as there were trading cards. How many video games, computers, and packs of trading cards did Paul sell?	A name. (No clear connection to PST given in the reflection.)	Game store selling games, computers, and trading cards. (In the PST reflection, the PST stated, "I think questions that gather information about my interests or maybe interests of a family member are sufficient.")	Selling games, computers, and cards. (In the PST reflection, the PST generally stated, "I think questions that gather information about my interests or maybe interests of a family member are sufficient.")

(Table Continues)

[16] To protect the identity of students and PSTs, generic labels were assigned to the locations they provided. Generic labels have been italicized and proper names have been capitalized.

[17]Simbang Gabi is a set of 9 masses held at a Catholic church starting December 16th and ending December 24 (Del Rosario, 2016).

[18]Mami noodles are consumed for the Simbang Gabi celebration ("Simbang Gabi", 2016).

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
Faith European American	A group of five friends go to a donut shop. The group decides to order one dozen identical donuts. Lauren wants at least one donut, Sanjana wants less than three, Mateo only wants 3 donuts, Deja wants at least two donuts, and Adam would like less than four donuts. How many different ways can the dozen donuts be distributed to the five friends?	Multiple names. (No clear connection to PST given in the PST reflection. PST stated, "I included names that would indicate different ethnicities. ")	Donut shop. (In the reflection, the PST stated she loves donuts.)	Going to donut shop. Parsing out donuts. (In the PST reflection, the PST stated, "A problem that determines the ways I could end up with different amounts of donuts would interest me.")
Henry European American	A tradition in the Schmidt family is going to the *Professional football team 1* game every year on Thanksgiving Day or the Sunday following Thanksgiving. This year, 20 members will be attending the *Professional football team 1* vs. *Professional football team 2* at *the Local stadium*. It cost the family a total of $1240 to go to the game. If it costs $55 for a children's ticket and $85 for an adult ticket, how many adults and children from the Schmidt family will go to the game.	PST's surname.	*Professional football team* 1 game at *the Local stadium.* Thanksgiving holiday. (In the PST reflection, the PST stated, "The three things in my problem were a sense of family, a tradition, and love for football.")	Attending football game. Calculating cost of game attendance. (There was no mention of the meaning of this calculation in the PST reflection.)

(Table Continues)

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
Ivan European American	A Catholic Wedding is being planned. On the guest list is 40 people the bride has invited and 60 people the groom has invited. Of the Bride's guests, 80% are Catholic. If the overall percentage of non-Catholic guests is 40%, how many of the Groom's guests are Catholic?	No name.	Catholic wedding. (In the PST reflection, the PST stated, "I am a Catholic who is in the midst of wedding planning.")	Planning wedding/Determining the percentage of non-Catholic and Catholic attendees. (The PST noted in his reflection that he has to calculate the number of Catholic attendees so that he can determine how many will receive the Eucharist.)
Javi European American	If you play a minimum of four hours a night and additional hour for each class that you have an A in. How can you write this as an equation with c for the number of classes and h being the number of hours that you play video games.	No name.	No context.	Playing video games. (In the PST reflection, the PST stated that he "plays video games.")
Keenan African American	Jaleel accompanied his grandfather to church one Sunday morning. While at church, he notices that approximately 33% of the congregation give verbal confirmations to the pastor whenever he makes a good point. Today, there are 396 people in attendance at church today. About how many people will there be to give the pastor verbal confirmations whenever he makes a good point?	A name. (No clear connection to PST given in the reflection.)	Church on Sunday. (The PST mentioned attending church in his post-LS interview.)	Giving verbal confirmations. (In the PST reflection, the PST noted that an interviewee should ask him "What are some common activities that people of your culture participate in?")

(Table Continues)

PST and Self-described race or ethnicity or culture	CRP tasks	Personal details		
		Names	Contexts	Activities
Micah European American	A family goes camping in the woods. One of the campers brought a guitar that has 20 frets, which are the spaces where you place a finger on a string, within the space, to get a specific note, and 6 strings. How many notes could be played using one finger?	No name.	The woods. (In the post-LS interview, the PST stated that he camps with his family.)	Camping. Playing guitar. (In the post-LS interview and the reflection, the PST reported he plays the guitar as he camps with his family.)

Note. PST=Preservice teacher. CRP=Culturally responsive-to-preservice teacher. LS=Learning segment.

* PST reflections or post-LS interviews provide additional evidence of the authenticity of task details.

This evidence is given in parentheses.

Table L2

The Inclusion of Personal Details in the Backdrops of CRS Tasks

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Angela Student was African American.	Afia and her family made yams to bring to her Nana's house in *City 1* for Thanksgiving. From *City 2*, Afia and her family go straight East for 50 Miles, and then they go straight North for 110 miles to arrive in *City 1*. Using the Pythagorean Theorem, determine if it would have been more or less miles to take I-55 to *City 1*, which runs diagonal to the city. Explain your reasoning.	Student's name.	Nana's/ grandmother's, house in *City 1*. (In the student interview, the student mentioned Nana's house in *City 1*.)	Making yams. Traveling. (In the student interview, the student mentioned that she liked to eat yams and traveled to see Nana with her family.)
Brian Student was European American.	Andrew wrote some comic books for his sister, Ashton. Each comic book has 30 pages. If Ashton can read 6 pages in 5 minutes, write an equation that gives the amount of time it will take Ashton to read a certain amount of books. How long would it take Ashton to read 7 books in minutes? Hours?	Student's name.	No context.	Reading comic books. (In the student interview, the PST stated he used his student's hobbies.)

(Table Continues)

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Carmel Student was European American.	Your aunt, uncle, and cousin are coming to visit on Saturday. They are driving all the way to *City 2* from a *Group of cities*, which is about 150 miles. They can choose to either drive or to take the bus. If they drive, they will average about 55 miles an hour and 25 miles per gallon. Gas is about $2.00 per gallon. If they take the bus, bus tickets are $36.50 per person. Create an equation for the cost of each method of transportation. Then determine how much money it will cost for your family to drive or ride the bus the one way. How should your family travel and why?	No name. (The PST generally wrote "your aunt, uncle, and cousin." Also, the student does not provide names for such family members in the student interview.)	*Group of cities*. *City 2*. (The student mentioned the *Group of cities* in the student interview. Also, the student mentioned that his family drives to where he lives.)	Visiting. Traveling. (In the student interview, the student mentioned that his family comes to visit on weekends.)
David Student background not reported.	Every year, Thomas and his family drive down to his grandparents' house for an Easter party where he gets to see all of his family. Thomas lives in *City 1* whereas his grandparents live in *State 1*. It is 917 miles from *City 1* to where his grandparents live in *State 1*. After all 917 miles were been driven, Thomas's dad ended up spending $85.97 on gas. If every gas station that Thomas's dad stopped at charged $2.25 per gallon, how many miles per gallon does his dad's car get?	MissI, MissS.	MissI, MissS.	MissI, MissS.

(Table Continues)

<table>
<tr><th>PST and PST reports of student's ethnicity or culture</th><th>CRS tasks</th><th colspan="3">Personal details</th></tr>
<tr><td></td><td></td><td><u>Names</u></td><td><u>Contexts</u></td><td><u>Activities</u></td></tr>
<tr><td>Eli

Student was African American.</td><td>The College football team 1 played a football game against the College football team 2 over the weekend. Use the following table to answer questions.<table><tr><th>Team</th><th>TD</th><th>EP</th><th>FG</th></tr><tr><td>College football team 1</td><td>6</td><td>6</td><td>0</td></tr><tr><td>College football team 1</td><td>3</td><td>3</td><td>0</td></tr></table>If a touchdown is worth 6 points, an extra point is worth 1 point, and a field goal is worth 3 points, then how many points did College football team 1 score? What about College football team 2? If College football team 1 scored 0 touchdowns in the first quarter, 1 in the second quarter, and 3 in the third quarter, then how many touchdowns did they score in the fourth quarter of the game? For t, e, f, where t is the number of touchdowns, e is the number of extra points, and f is the number of field goals, come up with an expression to find the final score of a football game.</td><td>No name.</td><td>College football team 1 and College football team 2 game.
(The student mentioned neither Kansas State nor Baylor as meaningful contexts in the student interview.)</td><td>Playing football.
(In the student interview, the student stated he likes to play football.)</td></tr>
</table>

(Table Continues)

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Faith Student was Latin@.	Christmas time is coming and Gabriela's parents want to fool Gabriela into thinking that she received the new iPhone. Gabriela's parents put her new phone inside of a box of clothing. Gabriela knows that the total weight of the new iPhone in a box is 145 grams, and with wrapping paper, 150 grams. Gabriela has been weighing all presents with her name on it in order to figure out the one present she is allowed to open on Christmas eve. If a paper clip weighs 6 grams, a fun size snickers bar weights 38 grams, and a dollar bill weighs 13 grams, the box weights 20 grams, and the wrapping paper weighs 5 grams, how many paper clips, snickers, and dollar bills are needed to be placed in the box in order to stump her if we want to place at least one of each item in the box?	Student's name.	Christmas Eve. (In the student interview, the student stated she celebrates Christmas/Christmas Eve.)	Gift opening. Weighing presents. (In the student interview, the student stated she is allowed to open one gift on Christmas Eve. She did not mention that she weighed gifts to determine which one she should open.)

(Table Continues)

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Henry Student was African American.	Devonte's family has a big celebration on Christmas Eve at his house. While most of the family doesn't travel far for the occasion, His Uncle Dave travels from *State 2* and his Aunt Lisa travels from *State 3*. If Uncle Dave travels 90 miles east and 150 miles south and Aunt Lisa travels 75 miles west and 165 miles south to get to his house, which person lives the furthest? (Hint: Use what you know about right triangles.)	Student's name.	Christmas Eve. (In the student interview, the student stated he celebrates Christmas.)	Celebrating Christmas Eve. Traveling. (The student did not describe the Christmas Eve celebration in the student interview. Although the student mentioned family traveling, he did not explicitly give the states in which family members reside.)

(Table Continues)

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Javi Student was European American.	Jordan's family is trying to plan a vacation to take over winter break, but money is tight in the family. In order to figure out how far the family can travel, there is some budgeting that needs to be done. The family can barely make it to the end of every month, and they have only been able to save $250 for this vacation. Gas costs $3 per gallon, and their car can gets 20 miles per gallon. They also want to spend at least $100 of the money on activities during the vacation. How far can the family travel and still spend money during the trip? What is the maximum that the family can spend on activities? How far do they travel in this situation? Hint: Remember that a trip requires driving there and back. What are the independent and dependent variables to this situation? Can you graph this as a function using x and y? What is the function? What is its domain and range?	A name. (No clear connection to student was given in the survey. The PST did not submit student interview.)	Winter break. (This context was not mentioned in the survey. Again, the PST did not submit a student interview.)	Budgeting. Traveling. (In the survey, the PST stated "My student did not sound like his family was financially sound, so this is the area I used for my task.")
Keenan Student was African.	Beye's mother is preparing puff puffs for her children. She only makes puff puffs for the children who have come in from playing. The children, on average, eat 12 puff puffs each. There were 4 children present, but one left, then 2 arrived. How many puff puffs will Beye's mother have to prepare for her children?	Student's name.	Puff puffs. (In the student interview, the student stated that he likes to eat something like puff puffs.)	Making puff puffs. Playing. (In the student interview, the student reported that his family makes a pastry that is "basically" like a puff puff.)

(Table Continues)

PST and PST reports of student's ethnicity or culture	CRS tasks	Personal details		
		Names	Contexts	Activities
Micah Student was African American.	Paul George, from the Indiana Pacers, and Eddie Murphy, an actor and comedian, decide to play one another in a game of basketball. They decide to meet each other at the *College 1* to play each other. If Paul is traveling from *City 3* to *City 4*, which is approximately 868 miles, at a rate of 60 miles per hour, how long will it take him to get to *City 4*? If Eddie Murphy is traveling from *City 5* to *City 4*, which is approximately 2,412 miles, at a rate of 70 miles per hour, how long will it take him to reach Gainesville?	Student's role models' names.	*State 4*. *College 1*. (In the student interview, the student mentioned that his family goes to Florida each year.)	Playing basketball. (In the student interview, the student mentioned he enjoys playing basketball.)

Note. PST=Preservice teacher. CRP=Culturally responsive-to-preservice teacher. LS=Learning segment. MissI=Missing student interview. MissS=Missing survey.

* Student interviews or PST surveys provide additional evidence of the authenticity of task details. This evidence is given in parentheses.

Data described in the above tables are summarized in below. PSTs' task details are classified according to the alignment to their self-reported details or the alignment to student-reported details.

Table L2

Summary of PST Tasks Based on the Authenticity of Personal Details

PST	Angela	Brian	Carmel	David	Eli	Faith	Henry	Ivan	Javi	Keenan	Micah
Culturally Responsive to Preservice Teacher (CRP) Tasks											
Names	X	X	X		Inc	X⁻	X			Inc	
Contexts	X	X	X	X⁻	X⁻	X	X	X		X⁻	X⁻
Activities	X⁻	X⁻	X	X⁻	X⁻	X	X	X	X	X⁻	X
Culturally Responsive to Student (CRS) Tasks											
Names	X	X		MissI, MissS		X	X	MissT	Inc	X	X
Contexts	X		X	MissI, MissS	Inc	X	X	MissT	Inc	X⁻	X
Activities	X	X⁻	X	MissI, MissS	X	X	X⁻	MissT	Inc	X⁻	X

Note. PST=Preservice teacher. X=Consistent with reflection or post-LS PST interview, or student interview. X⁻=Potential connection with reflection or post-LS PST interview, or student interview. Inc=Inconsistent with reflection or post-LS PST interview, or student interview. MissI=Missing student interview. MissS=Missing survey. MissT=Missing task.

In general, PSTs incorporated their own or student details into tasks. In the CRP tasks, 5 of 11 PSTs who provided tasks included names; 10 of the 11 included contexts; and all included activities that explicitly were or could have been personally relevant to the PSTs. The ability to incorporate personal information was repeated in their CRS tasks. Of those providing CRS tasks along with an interview or a survey, 6 of 9 included names; 6 of 9 included contexts; and, with one exception (Javi), all of the PSTs included activities that explicitly were or could have been personally relevant to their students.

APPENDIX M: INSTRUCTIONS FOR CULTURAL IMMERSION REFLECTIONS

You will be required to keep track of your own hours as well as a short log of your activities each week. Additionally, there will be three written reflections due throughout the semester after approximately 7 hours, 14 hours and 20 hours are complete. These three reports (550-600 words) will be graded using the rubric below. You should be reflective in these reports. (e.g., Into what critical issues have you gotten insight? How does this experience connect to issues discussed in class or in the readings? How has this experience influenced your thoughts about your future as a teacher?) In addition to this report you should also include your weekly records, not counted toward the 550-600 words.

You are expected to turn in a hard copy of each of these reports within one week of the final visit included in the report.

After each visit record the following information.

Table M1

Volunteer Log

Visit	Date	Time	Description of activity	Total time to date
1				
2				
3				
4				
5				
6				
7				
8				
9				

You are required to get a minimum of 20 hours. Many students continue to volunteer beyond what is required. Please consider the needs of the students you work with and the needs of the site when you are deciding when to finish your tutoring for the semester.

Make sure to communicate with the staff at [the cultural immersion site] about any days that you will miss. If you have to reschedule to keep up with your hours make sure to clear this with the staff. I prefer that you are aiming for one day a week, but it is ok if you end up with a week or two where you have more than one day.

Grading of the reflection will be based upon the following rubric:

Table M2

Rubric for Critical Reflections on Mathematics Teaching and Learning

5	Provides a rich description of the activities in the report as well as a critical reflection on how these experiences have influenced your views or ideas about education, your future as an educator, and/or the readings/discussions from class. The weekly record log is complete and included.
4	Provides a description of the activities in the report as well some reflection on issues in education, your future as an educator, and/or the readings/discussions from class. Although there maybe a connection between the experience describe and the reflection the connection is not explicitly made.
3	Provides a report of what has been observed and some discussion of issues related to your future as an educator, and/or the readings/discussions from class. It is unclear how the experience is related to the discussion of issues. The weekly record log is complete and included.
2	Provides a report of what has been observed and some surface level attempt at a reflection of issues related to your future as an educator, and/or the readings/discussions from class. There is no connection between the description of the experience and the reflection. The weekly record log is complete and included.
1	Provides a report of what has been observed with little or no analysis or interpretation. The report is a summary of the weekly activities. The weekly records may or may not be included.

APPENDIX N: SAMPLE END-OF-LEARNING SEGMENT INTERVIEW QUESTIONS

End of learning segment-Keenan

1. Throughout the learning segment, you constantly advocated for students of color. At one point, you even challenged your professor about the distribution of human resources in the mathematics class. Why did you feel it was necessary to do this?

2. For your critical math word problem, you provided information about the achievement gap between minority and majority students. Do you have the word problem you made with this information?

3. In one of your word problem reflections, you stated that you had "include[ed] a feature from a culture of the students without coming off as offensive." Why was this important to you? Why were you sensitive to this issue? When you were making your tasks, did you try to put yourself in the students' shoes? Why or why not?

4. Are culturally responsive tasks necessary for mathematics instruction?

5. For your BG interview, you chose an African student. Was this purposeful? Were you trying to chose someone from a culture that is different than your own? Do you think you struggled more to write a word problem for this student than you would have for an African American student? Why or why not?

6. In the culturally responsive to bg student task, you discussed "puff puffs", a cultural dish the student said he ate for Christmas. Was there a reason, you chose to make the students playing outside as a context for the task, as opposed to some Christmas celebration? Did you feel you had too little information about the student's holiday experience to write about it?

7. Where did you get the name that was included in your bg word problem?

8. It seems the interview taping was cut off. Were you able to gather information about the student's role models?

9. In what ways did the learning segment grow your knowledge of culturally responsive teaching and task? **See other page for ranking.**

How did these readings, discussions, observations, or student-interactions influence your creation of your word problems?

10. If you had to create a culturally responsive mathematics task for your future students, what would you do differently? What additional information would you gather? What would you want to know more about? Who would you consult?

9. In one of your reflections, you stated that you would like a person who interviewed you to ask the following questions:

Questions that I would like to be asked

-What are some common pass times within your culture?

-What are some habits that are specific to people of your culture?

-What are some common music genres of your culture?

-What are some common activities that people of your culture participate in?

-What are some common parental that parents of your culture practice?

-What are some common foods that people of your culture prepare?

Did you get a chance to ask your student these questions?

APPENDIX O: STUDENT INTERVIEW PROTOCOL

Interview protocol for cultural immersion site students

1) What type of things do you like to do outside of school or on the weekends? Does your family have a special activity they do or are there special trips they take? If so, please describe. What is special about this activity?

2) What holidays does your family celebrate? Can you please describe one? Why is this holiday important to your family?

3) What languages do you speak?

4) What are your religious practices? What do these practices mean to your community?

5) Who are your role models? Can you give three? Why do you (or members of your community) admire them?