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The Mathematics Socialization Experiences of Racially and Ethnically Diverse Pre-Service Early Childhood Teachers

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The purpose of this paper was to elucidate the mathematics socialization experiences of a racially and ethnically diverse sample of pre-service elementary and early childhood teachers. Research on mathematics socialization in pre-service elementary and early childhood educators of color is grossly undertheorized despite the established links between teacher experiences with mathematics, mathematics belief structures, and classroom instructional practices. Qualitative survey data on participants' previous experiences with mathematics as well as socio-demographic data were analyzed. The overwhelming majority of respondents recalled negative experiences with mathematics in childhood and adolescence suggesting that negative experiences with mathematics are enduring. Recollections from adulthood suggest that pre-service early childhood teachers are open to changing how they see themselves in relationship to mathematics. This research has implications for practices in teacher education programs, suggesting that in order to promote equity in early childhood mathematics education, teacher educators must directly address the mathematics socialization experiences and mathematics belief structures pre-service early childhood teachers bring to their teacher education coursework.

Keywords: Mathematics education, mathematics socialization, early childhood mathematics, pre-service teacher education

The gap in learning opportunities between white students and students of color in mathematics has been a long-standing concern in mathematics education research. In 2019, only 41 percent of fourth graders and 34 percent of eighth graders scored proficient or above in mathematics on the National Assessment of Educational Progress (U.S. Department of Education, 2019). The foundation for this persistent inequity is established early in life where children experience vastly different mathematical experiences. Disparities in access to rich conceptually based learning experiences in mathematics emerge as early as preschool and become more pronounced as students move through

school (Seker & Alisinanoglu, 2015; Xie, Fang, & Shauman, 2015). Despite repeated efforts to ameliorate inequities through reform, data show that the US educational system has failed to ensure equal access. Practices in early childhood and elementary learning settings often provide a weak mathematical foundation which over time leads to reproduced inequalities in access to high quality mathematics and mathematics knowledge.

Data drawn from the Third International Mathematics and Science Study (TIMSS) and the Promoting Rigorous Outcomes in Mathematics and Science Education (PROM/SE) project demonstrate dramatic differences in mathematics content between classrooms in the same school. In fact, data suggests that classroom differences are the greatest source of variation (Schmidt & Burroughs, 2013) and that these differences are caused by differences in exposure to mathematics content and in time spent covering particular mathematics topics. These classroom differences perpetuate existing disparities between minority and white students (Darling-Hammond, 2007). Therefore, teachers represent a critical component in the cycle of reproduction of unequal access to mathematics.

It is the relationship between teachers, teaching practices and early student experiences with mathematics that provides the foundation for this study. Specifically, the relationship between elementary and early childhood teachers' experiences with mathematics, the potential impact of these experiences on their classroom practices, and the subsequent exposure to mathematics experienced by young children in preschool, kindergarten, and elementary settings. Despite the fact that research has repeatedly demonstrated the capability of young children to engage with mathematics and reason mathematically (Clements & Sarama, 2011, 2014) mathematics learning is often underemphasized in elementary and early childhood settings (Engel, Claessens, Watts, & Farkas, 2016). Elementary and early childhood teachers report being uncomfortable and unsure teaching mathematics and feel underprepared to engage young children in mathematics content (Ginsburg, Lee & Boyd, 2008; McClure et al., 2017). The reasons for this discomfort can be attributed to the prevalence of math anxiety and other negative belief systems amongst pre-service and in-service elementary and early childhood teachers (Bursal & Paznokos, 2006; Gresham, 2007; Maloney & Beilock, 2012). The need to transform the approaches to mathematics that dominate elementary and early childhood classrooms by addressing the feelings, experiences, and belief structures of elementary and early childhood educators is urgent. Early childhood math skills and mathematics learning in kindergarten are key predictors of later academic success in both reading and mathematics (Claessens & Engel, 2013; Engel, Claessens, Watts & Farkas, 2016). Early mathematics knowledge is also essential for success in future grades. For example, students' formal understanding of place value begins with being exposed to patterns in first grade and continues to develop across the elementary and middle grades (Chan & Ho, 2010; Moeller, Martignon,

Wessolowski, Engel, & Nuerk, 2011). Without a firm foundation and understanding of place value, students may face chronic difficulty in mathematics (Chan & Ho, 2010; Moeller, Martignon, Wessolowski, Engel, & Nuerk, 2011). Math is also a critical part of how young children learn (Boutte, 2012). In other words, early childhood math is not only about counting skills or recognizing shapes, it is also about mathematical reasoning, critical thinking, and discovery. Additionally, children as young as first grade report experiencing math anxiety (Maloney & Beilock, 2012). This is due in part to math anxious teachers who unintentionally transfer their math anxiety to students.

Recognizing the critical role of teachers in this cycle of socially reproduced inequity, recent work in teacher education (Association of Mathematics Teacher Educators [AMTE], 2017; National Council of Supervisors of Mathematics & TODOS: Mathematics for ALL, 2016; National Council of Teachers of Mathematics, 2014) has specifically called for teachers to disrupt inequities through specific practices including interrogating power and privilege in mathematics and supporting students' cultivation of positive mathematics identities. However, the degree to which teachers are prepared to engage in this work is unclear. As Guzman (2019) points out, current framings of the thought processes of prospective teachers fail to clarify the complexities of their belief structures about mathematics.

Meaningful change in mathematics education cannot occur without interrogating the experiences and belief structures of elementary and early childhood teachers. Teachers are not only significant in their one-on-one interactions with students, teachers also play a significant role in shaping the classroom environment, in the pedagogic practices employed and the degree to which students have opportunities to experience their participation in mathematics as meaningful and develop positive dispositions towards the subject. McClure et al., (2017) note that the strongest predictor of preschoolers' learning of mathematics is their teacher's belief that math education is appropriate for that age.

An intentional focus on a racially and ethnically diverse sample of pre-service elementary and early childhood teachers promotes equity in mathematics education research and in the field of teacher education. In a review of early childhood mathematics literature, Linder and Simpson (2018) found that very few studies included research on mathematics in preschool or other early childhood learning settings and very few studies examined pre-service teachers. Despite the fact that children of color make up the majority of US public school children, and the percentage of Latinx, Asian/Pacific Islander, and multi-racial students is expected to increase in coming years, policy conversations rarely include the experiences of teachers of color, especially during their pre-service teacher education (Haddix, 2017), heightening the lack of representation of students of color in public policy discussions. With few exceptions (Castro, 2010; Gautreau, Byre & Lunceford,

2016; Martin, 2009; McGhee, 2014), research on the mathematics experiences of pre-service African-American teachers is grossly undertheorized and Asian and Latinx pre-service elementary and early childhood teachers are virtually absent from the literature. Research has shown that having a teacher of the same race/ethnicity can positively impact a student's attitudes, motivations, and achievement. However, more than three-fourths of students in teacher education programs are white (Ladson-Billings, 2017; U.S. Department of Education, 2016). Recent national studies also show that turnover rates for teachers of color are significantly higher than those for white teachers (McGhee, 2014). Research examining the mathematics related experiences of pre-service elementary and early childhood teachers from racially and ethnically diverse backgrounds including Black, Latinx, and Asian students is needed to address this glaring equity gap.

Literature Review

Teachers can positively or negatively impact the mathematics identities of many learners because schools are primary sites of mathematics socialization. Previous research on mathematics identity has illuminated the ways in which beliefs about mathematics are constructed through the experiences of learners in specific social and cultural contexts and the modes of interaction the context affords (Boylan, 2009). The conceptualization of mathematics socialization in this study draws heavily from Martin's (2000) model of mathematics identity and mathematics socialization. According to Martin (2000), mathematics socialization encompasses the experiences that individuals and groups have within various mathematical contexts. These interactions at school, at home, or in the community reinforce or discourage meaningful mathematical interactions. It is through these experiences that learners come to hold beliefs and expectations regarding their ability to perform in mathematical contexts. While students are learning mathematics, they are also learning how it is defined, how valuable it is, how it is to be learned, who should learn it, and what mathematical reasoning requires (Philip, 2007).

Math socialization remains undertheorized and under-researched in mathematics education. Few studies have specifically investigated mathematics socialization and even fewer have examined math socialization in a racially and ethnically diverse sample of pre-service elementary and early childhood teachers Still, there is a plethora of research that establishes a connection between elementary and early childhood teachers' experiences with mathematics, classroom pedagogical and instructional choices, and early childhood and elementary student learning experiences. Drake, Spillane, and Hufferd-Ackles (2001) examined the ways in which adoption of new mathematics content and pedagogy required first through fourth-grade elementary teachers to reject both their previous practices and beliefs as math

learners and math teachers. The teachers in this study believed that they possessed the necessary skills, knowledge, and desire to implement change in the way they approached literacy in their classes. In contrast, teachers reported not being comfortable with mathematics, adhering strictly to the textbook, and viewing concepts as too confusing to teach. The authors found that these teachers often taught lessons without understanding the material. Surveys of teachers in Ohio and Michigan conducted as part of PROM/SE indicated that a majority of elementary teachers did not feel well prepared to teach all of the mathematics topics included in the CCSS-M, either in their own grades or later grades (Schmidt & Burroughs, 2013). Teachers who lack content knowledge or knowledge about various teaching methods are less effective in producing learning gains in students (Darling-Hammond, 2007).

In addition to feeling unprepared to teach mathematics, elementary and early childhood teachers also possess negative beliefs related to mathematics. Among elementary pre-service teachers, math anxiety is common (Gresham, 2007; Gautreau, Brye, & Lunceford, 2016).In a sample of 490 in service elementary teachers, Wilkins (2010) found that mathematics was consistently ranked as the least favorite subject to teach. Teachers with more positive attitudes, however, were more likely to believe in the effectiveness of inquiry-based instruction. Many education majors choose elementary or early childhood education at least partially because there are minimal STEM course requirements and students believe they will teach a minimal amount of math or science content (Boutte, 2012). Many continue to hold negative feelings about math and science even after completing teacher education coursework (McClure et al., 2017). These negative feelings lead to undervaluing mathematics, avoiding math instruction, and teaching math in suboptimal ways (McClure et al., 2017). Engel et al. (2016) found that in kindergarten teachers spent most mathematics instructional time focusing on simple concepts like basic counting and shapes. Hodgen and Askew (2007) found that some elementary teachers adopt a protective mathematics pedagogy with their students in an attempt to shield them from the difficulties they experienced in mathematics. These practices while well intentioned are likely to reproduce negative feelings and cause students to feel that math is boring and useless. Lee (2005) examined the relationship between kindergarten teachers' attitudes towards mathematics, mathematics teaching and teacher use of developmentally appropriate practice. Teachers' attitudes towards teaching mathematics were found to be significant predictors of use of developmentally appropriate practice.

The Current Study

This paper is based on qualitative findings from a larger-mixed methods study that explored mathematics identity in a racially and ethnically diverse sample of pre-service early childhood teachers. Qualitative data and

analyses examined mathematics socialization and the salient events pre-service teachers recalled from their elementary, secondary, and post-secondary experiences. The methodology and data presented here address two research questions:

1)What are the salient mathematics socialization experiences of pre-service early childhood teachers as defined by critical events?

2) What are the interactions at home, school, or in the community through which individuals negotiate their mathematics identities?

The analyses presented in this paper contribute to the field by elucidating the mathematics socialization experiences of a racially and ethnically diverse sample of pre-service early childhood teachers which provides insight into necessary changes in early childhood teacher education program practices.

Method

Participants

Participants were 77 teacher education students from a large urban community college in New York City. Two surveys were excluded from final analysis because respondents did not consent to participate in a research study. One survey was excluded because the participant indicated that he/she was under 18 years of age. All remaining participants were over 18 years of age and were majoring in early childhood education. The mean age of participants was 24.16 years. Approximately 92% of the sample identified as Black or African-American, Latinx/Hispanic, Afro-Caribbean, Asian, South-Asian or Pacific Islander, Middle Eastern, Native American/American Indian or multiracial. Although the literature basis for this study was drawn from research on both elementary and early childhood teachers, 100% of the sample were early childhood education majors. Table 1 displays the socio-demographic characteristics of the sample.

Data Collection

Data collection occurred from February to July of 2018 at a large urban community college in New York City. The study was approved as exempt by the IRB. The survey was distributed to course professors online through Survey Monkey. Professors made the survey link available to students through email or by posting the link on their course Blackboard website. The survey consisted of 4 sections, 2 of which were analyzed for this paper, math socialization, and personal and educational history. The survey did not collect any identifying information that could be directly linked to students. Students were eligible to participate if they were 18 years of age or older and majoring in elementary or early childhood education.

Table 1
Socio-Demographic Characteristics of the Sample

Socio-demographic characteristics			
Characteristics		**N**	**(%)**
Gender	Male	3	4.2
	Female	69	95.8
Race	Black or African American	12	16.4
	White	6	8.2
	Latinx/Hispanic	31	58.9
	Afro Caribbean	2	2.6
	Middle Eastern	1	1.4
	Native American or American Indian	1	1.4
	Asian, South Asian or Pacific Islander	15	20.5
	Multiracial	5	6.8
Remedial Math	Yes	50	64.9
	No	24	32.4
Some Math Coursework Outside of US	Yes	22	30.6
	No	50	69.4
First in Family to Attend College	Yes	36	49.3
	No	37	50.7

Measures

The survey instrument included demographic items and open-ended items that asked respondents to recall critical events related to mathematics. Critical events were defined as a key event, a critical incident, or a significant episode in the past set in a particular time and place. Critical events could be negative or positive. Respondents were asked to recall one critical event from childhood, one from adolescence, and one from adulthood. The prompt instructed participants to recall each event in as much detail as possible and include specific information regarding what happened and who was involved. The prompt was adjusted to read either "childhood", "adolescence", or "adulthood" but was otherwise unchanged.

Critical Events Prompt: "Describe a memory about mathematics from your childhood that stands out in your mind as especially important or significant. It may be a positive or negative memory. What happened? Who was involved? What did you do? What were you thinking and feeling? What impact has this event had on you? How did this event impact your thoughts and feelings about mathematics growing up? This critical events item was adapted from Drake, Spillane, and Hufferd-Ackles (2001) mathematics life-story interview protocol for teachers. This protocol was based on McAdams (1993) *The Stories We Live By: Personal Myths and the Making of the Self.*

Analysis

Inductive thematic analysis was used to identify themes within responses to the critical events item. Aligned with the survey prompt, analysis of critical events occurred at two levels. The survey prompt asked participants to recall a positive or negative event. Therefore, the first level of coding concentrated on whether or not the recollections were positive or negative. After determining whether or not the recollections were positive or negative thematic analysis focused on the remainder of the prompt to determine what happened, who was involved, participant actions and reported feelings and any enduring impact. Repeated reading of the data occurred before coding or identifying themes, particularly at the second level of analysis. The focus was on identifying patterns in pre-service teachers experiences with mathematics.

Results

Analysis of recollections yielded four codes at the first level of analysis: positive, negative, mixed (both positive and negative) and neutral (neither positive nor negative). Responses were only coded if they were substantive enough to constitute meaning at this level. Responses such as "I don't remember" and "problem solving" were not coded. One hundred and sixty critical events were coded, 56 childhood, 55 adolescent, and 49 adult. At the childhood level, 51.8% of recollections were negative and 39.3% were positive. At the adolescent level, 54.5% of recollections were negative and 34.5% were positive. At the adult level, 40.8% of recollections were negative and 42.9% were positive. Table 2 displays representative positive, negative, mixed and neutral responses.

Negative, positive and mixed recollections were analyzed for identifiable themes regarding what happened, who was involved, participant actions, reported feelings and any enduring impact. Inductive thematic analysis revealed 7 themes: teaching practices, conceptual understanding, family support, testing, course grades, emotions/fear and remedial math. One hundred and forty-six of the 156 childhood, adolescent, and adult recollections coded at the second level of analysis fell into these response categories.

Recollections of teaching practices included positive memories about teachers, who related mathematics to the real world, used authentic materials in the classroom, made students feel positively about mathematics and presented multiple strategies for solving math problems. Negative recollections of teaching practices included memories of teachers who humiliated students, presented mathematics material in an inconsistent or confusing manner, and embarrassed students in front of other students or in front of the class. Recollections of conceptual understanding included positive memories about understanding the mathematics material being taught in classrooms and negative memories about not understanding and the negative feelings associated with this lack of understanding.

Table 2

Critical Event Recollections: Representative Negative, Positive, Mixed, and Neutral Responses

	Positive	**Negative**	**Neutral**	**Mixed**
Childhood (N=56)	"I remember in the 1st grade I got really excited over a math problem because I understood the problem."	'I was in 2nd grade- I got a bad grade on a test. When I got it back, I tried to correct a few problems and give it back to the teacher, but she wouldn't take it because she said it was not worth her time."		"I don't know how to do addition and subtraction in kindergarten, I was so frustrated. But my mother used materials to teach me. Finally, I got it and I felt happy."
Adolescence (N=55)	"In high school I took statistics, it came so natural to me. It was very easy. I understood it, which made me feel so much better at math. I loved taking that class."	"In middle school I realized math wasn't for me. There was a time we were given a sheet with several problems on it, and I had to work with my partner. We had gotten many of the questions wrong…I felt like I wasn't smart."	"On the last day of my geometry class, the professor said we were going to learn about the cube. Then he took out a game cube and played for the whole class.	"In middle school year I performed math pretty well and the teacher explained well. As for high school I began to hate math again because the teacher was teaching in a way that I didn't understand meanwhile others did."
Adulthood (N=49)	"A math tutor gave me some good guide for my math 56 test, and I passed it later."	"I failed math 51 twice…I cried and there was nothing that I could do so now I'm retaking the course again."	"In college, I took math 214 and my teacher gave three projects for understanding the math, such as Fibonacci, Chinese, and Hindu Arabic math.	"I had to take remedial algebra math that was very hard to me. It gave me such a hard time I was scared to take another math class…the next class I had an excellent math teacher. She made me reflect that the reason I feel not confident at math… Nowadays I feel more confident when it comes to math.

Recollections of interactions with family members included memories of parents who attempted to assist their children in learning mathematics content either by teaching them themselves or by seeking assistance from a friend or another family member. Recollections of testing included participant experiences with both standardized and classroom assessments and the positive memories associated with performing well on an exam or the negative memories associated with failing a state standardized exam or

classroom test. Recollections of course grades included memories of failing a math class, passing a math class, or receiving an unexpected grade in a math class. Recollections of emotions and fear centered on experiences where participants felt nervous, anxious, scared and dumb in math class. There were no other emotions that emerged from this analysis of participant recollections. Recollections of remedial math were isolated to adulthood, but included positive memories of passing remedial math, or negative memories of not passing remedial math and in some instances having to take a remedial math class more than once before passing. Table 3 shows representative responses for each theme. Table 4 shows the frequency of each theme.

Discussion

The goal of this study was to explore the mathematics socialization experiences of racially and ethnically diverse pre-service elementary and early childhood teachers. This study considered the salient mathematics socialization experiences of pre-service teachers and by extension, the interactions at home, school, or in the community through which mathematics identities are negotiated. The results from the analysis of recalled critical events indicate that for this sample, mathematics experiences during childhood and adolescence were more negative than experiences in adulthood. More than half of the sample recalled negative experiences with mathematics from childhood and adolescence suggesting that early negative experiences with mathematics do have an enduring impact. The prevalence of negative recollections from childhood and adolescence suggest that university mathematics and teacher education faculty should directly address pre-service teachers' past experiences with mathematics as well as enduring feelings and belief structures. Focusing on pedagogy and content without addressing underlying belief structures is unlikely to help students develop positive dispositions towards mathematics.

Emergent themes provide insight that directly addresses the second research question. The overwhelming majority of recollections involve teaching practices or interactions in school as a student, suggesting that in school experiences make up most of the experiences through which students negotiate their mathematics identities. In childhood and adolescence these experiences varied and included direct interactions with teachers, understanding or not understanding mathematics content, experiencing success or a lack of success with standardized testing, achieving good grades in mathematics courses or not, and experiencing strong negative emotions in relationship to mathematics. In adulthood these experiences included interactions that occurred within the context of remedial mathematics courses, where some students experienced mathematics success for the first time, and other students experienced what they perceived to be continual failure. This finding is significant as it is well aligned with the research that has established

strong links between experiences as a student and practices and beliefs as a teacher (Furner & Berman, 2005; Peker 2009).

Table 3

Critical Event Recollections: Representative Thematic Responses

Theme	Representative Positive Response	RepresentativeNegative Response
Teaching Practices	I remember in 7th grade, had a great math teacher who found ways to use manipulatives or took us outside of the classroom to give us concrete examples.	I remember in 8th grade, I had a bad experience with my teacher. My class was taking the regents so he didn't care to prepare my class for the next milestone in our life, high school. He was a teacher who allowed his class to fail and only taught in the moment. Although I passed eighth grade on time, I didn't learn anything pertaining to math that year and I doubted my abilities.
Conceptual Understanding	In high school I took statistics, it came so natural to me. It was very easy. I understood it which made me feel so much better at math. I loved taking that class.	I never understood math, it was hard to figure out how all the numbers made sense in the problem. I asked for help and it still didn't make sense…"
Family Interactions	As an adolescent I helped my parent on his small business. It includes some job as cashier. I learned some skills there working with money and helped develop some math skills that have helped me feel very confident at adding and subtraction.	My father taught me but it was not good feelings because I was not good in math.
Testing	As a child I remember always doing better in mathematics on the state exam than on English even though I was more confident in English…This was a positive experience it made me stop doubting my abilities in math.	In 7th grade when I went to summer school for not passing my state math exam I was so upset.
Course Grades	When I received a C in my math course I got so excited because I assumed I was going to fail the course.	Held back because of math.
Emotions/Fear	n/a	I was scared in my first class because I did not know how the teacher was.
Remedial Math	In college, I was placed in a remedial math class. The remedial math class that I had to take was Basic Algebra. Since my teacher helped me so much in high school I was a pro in the math problems, exams, projects, etc. Many people from my class asked for help because I understood most of the questions. I learned that yes math won't be my favorite subject but you can help others out in various amount of ways.	I failed Math 51 twice…I cried and there was nothing that I could do so now I am retaking the course again.

Table 4
Frequency of Themes

Childhood	
Teaching Practices (N=19)	33.9%
Conceptual understanding (N=17)	30.4%
Family (N=6)	10.7%
Testing (N=7)	12.5%
Course Grades (N=2)	3.6%
Emotion/Fear (N=2)	3.6%
Adolescence	
Teaching Practices (N=23)	35.4%
Conceptual understanding (N=10)	15.4%
Family (N=3)	5.6%
Testing (N=11)	20.4%
Course Grades	n/a
Emotion/Fear (N=2)	3.7%
Adulthood	
Teaching Practices (N=24)	36.9%
Conceptual understanding (N=3)	4.6%
Testing (N=5)	7.7%
Course Grades (N=2)	3.1%
Remedial Math (N=7)	10.8%
Emotion/Fear (N=4)	6.2%

The non-school experiences that emerged from this sample as significant to mathematics identity formation were experiences with family members. Students described parents who intervened in their mathematics learning by seeking out tutoring or additional support and parents who attempted to provide additional mathematics support themselves. One student mentioned assisting his/her parent with a small business, working as a cashier, and learning some mathematics skills through this experience. There were no significant community experiences that emerged from this research. These findings are aligned with research that establishes that schools are primary sites of mathematic socialization (Boylan, 2009). Although it is beyond the scope of this study, the overwhelmingly negative recollections from childhood and adolescence also suggest that many students of color experience embarrassment, shame and fear in elementary and middle school mathematics classrooms. Souto-Manning and Emdin (2020) challenge teacher education programs to acknowledge and address the historical trauma experienced by teachers of color. Indeed, this work is necessary if teachers are going to be prepared to disrupt inequities by interrogating power and privilege in mathematics education. The shift in negative and positive recollections from

adolescence to adulthood suggests that pre-service teachers are open to new mathematics experiences when they enter college and that positive experiences in college, even in remedial math, have the power to shift the way pre-service teachers see themselves as doers of mathematics. Further research should examine through structured interviews the mathematics socialization experiences of a diverse sample of pre-service elementary and early childhood teachers to more clearly establish the relationship between critical events and later feelings towards mathematics.

Despite the diversity of the sample, analyses did not yield any connections between socio-historical and socio-cultural factors such as race or gender and pre-service teachers' experiences with mathematics. In querying critical events, the study did not explicitly ask participants to discuss their experiences with race in relationship to mathematics. Given that research on the mathematics experiences of ethnically and racially diverse pre-service elementary and early childhood education teachers is undertheorized (McGee, 2014), this study could have made a more substantive contribution to the field by examining mathematics socialization in relationship to race and racial identity as opposed to simply examining mathematics socialization with a diverse sample of teachers and expecting socio-historical and socio-cultural themes to emerge. This is a pressing area for future research. This study was conducted with a group of students from one urban community college in a large city. Therefore, the results may not generalize to ethnically and racially diverse students in rural or suburban environments or to racially and ethnically diverse students at other urban community colleges. Finally, while it is true that certain types of self-report measures are susceptible to social desirability responses, not all constructs are equally vulnerable to desirability responding (Chan, 2010). Social desirability responding is reduced through anonymous administration, instructions that highlight the non-evaluative nature of the items and the lack of right or wrong answers (Chan, 2010). Therefore, while it is possible that students responded in socially desirable ways, it is unlikely due to the structure of this study.

Teacher educators must find ways to make conversations about previous mathematics experiences more visible in their classrooms. As a consequence of the negative feelings many teachers experience, certain suboptimal styles of mathematics teaching are perpetuated. Studying mathematics socialization in racially and ethnically diverse pre-service teachers of color provides insight into the ways that responses to mathematics are produced through salient mathematics experiences. The field of teaching and society in general would benefit from a racially and ethnically diverse teaching force that views mathematics and mathematics learning as a positive and worthwhile endeavor, especially for young children. Efforts to break the cycle of intergenerational transmission of inequity in mathematics education will undoubtedly fall short until elementary and early childhood teachers

tasked with transmitting mathematics to the next generation are properly prepared to do so.

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