

LATINX PARAEDUCATORS LIVED MATHEMATICAL EXPERIENCES

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Mathematics teaching is an inherently social activity, highly dependent on the lived experiences of its members. Drawing on sociocultural perspectives, we explore the mathematical lives of Latinx paraeducators to better understand the ways in which their backgrounds might influence their attitudes toward mathematics and mathematics teaching. Eleven paraeducators participated in the study that used interviews, artifacts, and informal observations to document their lived experiences, particularly in regard to mathematics. The evidence suggests that aspects of their personal narratives, particularly family, home culture, and personal hobbies and interests, had important influences on many of the participants. Implications on the social aspects of mathematics teaching and the need for relevance are provided.

Keywords: Teacher Education – Preservice; Equity and Diversity; Teacher Beliefs; Culturally Relevant Pedagogy

Throughout this century, the percentage of teachers in the United States classified as white has held steady at about 80%, while the percentage of Latinx teachers remains below 10% (Taie & Goldring, 2019). Further, it is projected that by 2026 white students will make up less than half of the U.S. public school student population, with Latinx students nearing 30% (de Brey & colleagues, 2019). Why should this matter, particularly in regard to the teaching and learning of elementary mathematics?

One reason for considering the implications of these changing demographics is the role that teachers' backgrounds have on students and teaching (Glock & Kleen, 2019). For example, Copur-Gencturk, Cimpian, Lubienski, and Thacker (2020) found that teachers displayed the largest negative biases in regard to mathematical ability toward Black and Latinx girls. While explicit biases are more easily seen and measured, implicit biases are less visible but perhaps more harmful to those they marginalize (Greenwald & Banaji, 1995; Harber & colleagues, 2012). Implicit negative biases towards students, in regard to both academic and behavioral factors, tend to exist in teachers that come from differing backgrounds, cultures, and/or races (Glock & Kleen, 2019; Redding, 2019).

A second reason for considering the implications of the above changing demographics involves the role that dialogic interaction plays in mathematics teaching and learning (National Council of Teachers of Mathematics, 2000; National Governors Association, 2010). Mathematics teachers are participants in a dialogic process so, as in any such activity, draw on their personal backgrounds and resources when engaging students in active mathematics learning. It is important to understand the diverse perspectives that can be generated through lived experiences, and how this might impact the ways in which teachers view and approach mathematics instruction.

Frameworks

We view teaching as a social activity grounded in the perspectives and backgrounds of those involved (Vygotsky, 1978; Bruner, 1990). There are numerous perspectives on teaching that build on this idea and attend specifically to issues of equity, race, and power. This study draws from key precepts of *culturally responsive/sustaining pedagogy* (Ladson-Billings, 1995) and the *funds of knowledge* framework (Moll et al, 2005).

Culturally responsive/sustaining pedagogy is a strength-based perspective that celebrates students' home languages and cultures, but also emphasizes active learning and critical, reasoned challenges to the status quo (Ladson-Billings, 1995). While complex in nature, a central instructional premise of culturally responsive pedagogy is to find topics and contexts that are meaningful to a group of learners, and then create learning experiences that bridge these learners' cultural and linguistic heritages with more formal academic knowledge. Establishing meaningful connections to students is a key aspect of effective mathematics instruction, and teacher backgrounds play a significant role in this process (Boaler & Staples, 2008; Gholson & Martin, 2014; Téllez, Moschkovich, & Civil, 2011).

Funds of knowledge refers to an individual's historically accumulated set of abilities, strategies, or bodies of knowledge (Gonzalez et al. 2005; Vélez-Ibáñez and Greenberg 1992). These funds can be recognized by observing "the wider set of activities requiring specific strategic bodies of essential information that households need to maintain their well-being" (Vélez-Ibáñez & Greenberg, 1992, p. 314). In the context of this discussion, we employ the concept of funds of knowledge to encompass both academic and personal background knowledge, accumulated life experiences, skills used to navigate everyday social contexts, and world view(s) structured by broader historically situated sociocultural forces. Just as educators need to recognize the funds of knowledge that K-12 students bring to the school, teacher educator programs need to recognize, and tap into, the diverse social, linguistic, and cultural strengths and assets that teacher candidates bring to their programs.

Each of these theories is premised on building upon students' and families' linguistic and cultural resources and accumulated knowledge. This can support schools and teachers in sustaining students' linguistic and cultural identities and foster a more humanizing perspective of the learning process, including mathematics learning.

Methods

Context

The 11 participants in this study come from various linguistic, cultural, ethnic, and national backgrounds, including Panama, El Salvador, Guatemala, Cuba, Mexico, and the United States. Over half are fully bilingual English and Spanish. All earned a BA in Elementary Education, K-8 state teaching certification, and a K-12 ELL endorsement. In addition, eight pursued a K-12 bilingual endorsement (see Table 1 for more detail).

The participants completed their elementary education certification program while working 30 hours per week in one partnering district in the Pacific Northwest. Participants were selected due to experience and dedication as paraprofessionals working with English learners. Ten are female, over half are first generation college students, nine are Latinx (age range: 23-53), and three have foreign/domestic postsecondary degrees (e.g., dentistry, Spanish, journalism). Each participant also completed numerous requirements for acceptance into their elementary teacher education program at a Research 1 institution.

This preservice program was offered in two locations and served paraeducators located in seven school districts with large English language learning school populations (15%-95%). However, for this study, we focus on one program working in one school district that serves a diverse student population including Spanish speakers (40%), Russian and Ukrainian speakers (33%), and smaller percentages of Vietnamese, Hmong, and Tagalog speakers, among others. The elementary and middle schools where the 11 paraeducators worked are located in urban and semi-urban settings. Most teacher education classes were offered face-to-face at the school district location. One course was conducted via videoconferencing and several courses were provided using a hybrid model (a combination of traditional face-to-face and online learning activities). In addition, through the Prior Learning Assessment process, many of the participants earned additional course credits by

demonstrating work that matched specific competencies listed in the state standards for new teachers (Morrison & Lightner, 2017).

Table 1: Personal and professional backgrounds of participants

Participant	Languages Spoken	Ethnicity/Race	Origin	Years as a Paraeducator
Meredith	Spanish/English	Latinx	U.S.	1
Janice	Spanish/English	White	U.S.	2.5
Magdalena	Spanish/English	Latinx	Cuba	4
Inez	Spanish/English	Latinx	Panama	14
Javier	Spanish/English	Latinx	Mexico	2.5
Gabriela	Spanish/English	Latinx	Honduras	1.5
Maribel	Spanish/English	Latinx	U.S.	2
Evelyn	Spanish/English	Latinx	U.S.	1
Magda	Spanish/English	Latinx	U.S.	4
Sabrina	Spanish/English	White	U.S.	1
Irene	Spanish/English	Latinx	U.S.	8

Data collection and analysis

Mathematical autobiographies of all 11 participants represent the primary data set. The written stories of the participants’ mathematical lives were part of the elementary mathematics methods course taken towards the end of their teacher education program. The evening course was conducted in an abbreviated five-week session while the participants were working in schools as paraprofessionals during the day. The stated purpose of the assignment was for the participants to “become conscious of your mathematical beliefs and the events that may have contributed to their creation.” The four specific components of the mathematical autobiography were: 1) self-perceptions about your mathematical abilities and understandings, 2) feelings and attitudes toward mathematics, 3) important events in your mathematical life (in and out of school, with preference given to out-of-school experiences), and 4) where you are now in regard to both mathematics and mathematics teaching. The participants shared their autobiography in oral presentations throughout the semester.

Open, emic coding (Miles, Huberman, & Saldaña, 2015) was conducted on each of the participants’ written stories in order to find salient features as identified by the participants. First-cycle codes provided broad categorizations of the kinds of stories being told. Specific codes included age (childhood/adolescence/adult), setting (school/home/community), and location (U.S., home country, other). Second-cycle codes began to delineate the salient features of the stories and included mathematical beliefs/attitudes, mathematical activities (e.g., budgeting), mathematical topics (e.g., numbers, measurement), role of language, and implications on teaching. This thematic analysis led to conclusions about the participants’ feelings and attitudes toward mathematics, the role of mathematics in the participants’ lives, and how these aspects of the participants’ backgrounds were brought to bear on their perspectives on mathematics teaching and learning.

Results

Participants’ lived experiences

The narratives of this group of mostly Latinx paraeducators emerged through oral and written reflections of personal language as they practiced culturally responsive teaching and engaged with their students’ families and communities, all while enrolled in the elementary mathematics methods course. Recognition of the sociohistorical and political contexts of their own lives, along with the

lives of their students, is an important aspect of enacting culturally responsive teaching (Ladson-Billings, 1995). Through their stories, these paraeducators demonstrate great courage and resilience. In many cases, their professional journeys include adapting to a new country or cultural context, learning a new language, facing immigration threats, and resisting pervasive local and national monolingual/monocultural ideologies. Their stories and reflections reveal the importance of listening to students' stories and building on their experiences and trajectories.

Therefore, we focus on the lived experiences of these emerging teachers from their childhood through their adult and professional life. We provide the above overview as background to the salient mathematical features of their lived experiences that constitute the focus of this particular study. The data below build on the above narrative, but provide a much deeper view of the role of mathematics in the life trajectories and eventual professional work of the participants.

Feelings and attitudes toward mathematics

The students exhibited a variety of feelings towards mathematics, including “love,” “love-hate,” “useful,” “neutral,” and “negative.” Many of these feelings stemmed from experiences as a child. For example, while speaking fondly of her times tending to farm animals and baking with her mother, Maribel also recalled several negative school mathematics experiences that framed her overall self-perception:

I was usually one of those students that would take longer to find solutions to problems. One reason was because I would process what teachers were telling me in English and try to translate it into Spanish in order to understand it. Another reason is because I like to think about the process when trying to find solutions to a problem . . . I don't remember ever being asked to find more than one solution to a problem by a teacher, or to find different ways to show my thinking. There was only one way, and if it was not how my teacher taught me it was wrong. I believe that this is when my fear of math, and answering questions in front of the class, started.

Many students also reflected on their adult experiences as helping to frame their views of mathematics. Magdalena described her mathematical experiences while making and selling cakes and *bocaditos* (snacks), and Gabriela spoke of her work in the dental field.

Overall, the participants relayed a variety of attitudes toward and self-perceptions of mathematics in their personal narratives. Many of these attitudes and self-perceptions were connected by the participants to particular events in their lived experiences, both as a child and adult. The next section provides more examples of these lived experiences and their importance in shaping their personal and professional lives.

Mathematics in the participants' lives

The collection of mathematical autobiographies represents a rich set of examples of how personal, family, and cultural background impact the mathematical development of individuals. Javier related numerous examples of this from both his boyhood and adult life. Reflecting on his family heritage and youth, he stated:

I come from a family of farmers who valued an education. I am the second of nine children and the second to go to college. My family always wanted us to get an education so that as we grew older, we would be able to know how to negotiate prices and know their value. My father sometimes bought and sold cattle and knew the importance of being able to calculate the weight of animals without weighting them and know their worth. As a result, he always encouraged me to study hard and do well in school so that in real life, I would be able to know what something was worth and others would not take advantage of me. When I was around 11 years old, my mom would often send me to buy a few grocery items and even medicine from the pharmacy. It was then that I started applying my math knowledge to buy

and pay for items. I also started working selling jelly, popsicles, and ice-cream . . . I remember that Sundays were my best days because I would go to the football (soccer) games to sell popsicles and ice-cream. Most Sundays, I would sell around 300 pesos (\$13) worth of popsicles and ice-cream. I usually made around 105 pesos (\$4.5) from 8:00 am to 3:00 pm.

Javier related additional stories as an adult that involved woodworking, choosing phone plans, and making predictions. All were detailed and grounded in his personal story. Javier's stories reflect a use of mathematics that was grounded in his parents' desire for him to succeed, and in the life activities that dominated his early and adult life. Javier developed an applied view of mathematics throughout his life that, as an educator, translated into an instructional perspective in which mathematics is best learned through the use of applied contexts.

Maribel also had numerous reflections on the importance of her family, setting, and upbringing:

I was born in a small farm town. Growing up every morning before school my brother and I would feed our farm animals, and make sure they had water for the day . . . Each animal needed a different amount of water in their tanks so the amount of buckets varied depending on the size of the tank, and the animal. Without knowing, I was figuring out volume, by figuring out how many smaller units would be needed to fill a larger unit. This is something that I remembered and used when I started learning about volume in school. I always thought of them as tanks being filled by little buckets.

Maribel's personal relationship with her mother also played a significant role and had an impact on her understanding of fractions:

My mom would ask me to put $\frac{1}{4}$ cup of sugar into a mix, or $\frac{1}{2}$ cup of flour into something before stirring. At the time fractions for me were just lines on a cup. As I continued to help my mother I started noticing how each measurement had a relation with the other. For example, if I filled the cup to $\frac{1}{2}$ and then filled the other $\frac{1}{2}$ I would have 1 cup. Or if I was to fill the cup with water to the $\frac{1}{4}$ line and then add $\frac{1}{4}$ more the water would add up to the $\frac{1}{2}$ line. This led me to realize that I needed four $\frac{1}{4}$'s to fill 1 cup. I was around 2nd grade when I started making these relationships with fractions. When I got to 4th grade and started learning about fractions, the numbers looked familiar.

As in the case of Javier, Maribel's hands-on experiences with mathematics have translated into a desire to use both visual and hands-on representations when working with mathematics learners.

Evelyn described her parents as "from Mexico and have elementary and middle school level education. My father was always the one to work as my mother chose to stay home." Evelyn felt a power in mathematics at an early age:

When it was time for me to start school, I entered Kindergarten with not being able to speak, write or understand English as only Spanish was spoken at home; however, I was able to count to 100 at the end of Kindergarten, and by first grade I was able to add and subtract.

Unfortunately, mathematics became an increasing challenge for Evelyn. In her view, this was because of a lack of support from both teachers and her own parents. These experiences brought on serious professional doubts:

The things we were learning were beyond me. So since math was too hard for me, there was no way I could become a teacher.

Over time, Evelyn worked to overcome these doubts and recognized several positive mathematical traits in her current life. Her attitude towards mathematics instruction is promising:

I am working on being more positive with math and am a little nervous about creating a lesson on it, but with supportive educators by my side, I think I will be okay!

Perspectives on mathematics teaching and learning

Despite the variety of personal stories and self-perceptions of mathematics, there was near consensus in regard to perspectives on teaching mathematics. All but one participant talked about allowing students to develop their own ways of thinking and solving problems and to develop understandings through the use of visual and hands-on representations. A variety of reasons were cited, including their own experiences, university mathematics and methods courses, and experiences working with students as paraeducators.

The above examples of Javier and Maribel provide details on two specific ways in which the participants' life stories had direct impact on both their views of mathematics and instructional perspective. Meredith used artistic representations to support the personal narrative of her lived mathematical experiences. As a young girl, she had difficulty engaging in the mathematics learning experiences that were devoid of context or lacked personal meaning. Her self-portrait during this time is quite telling:

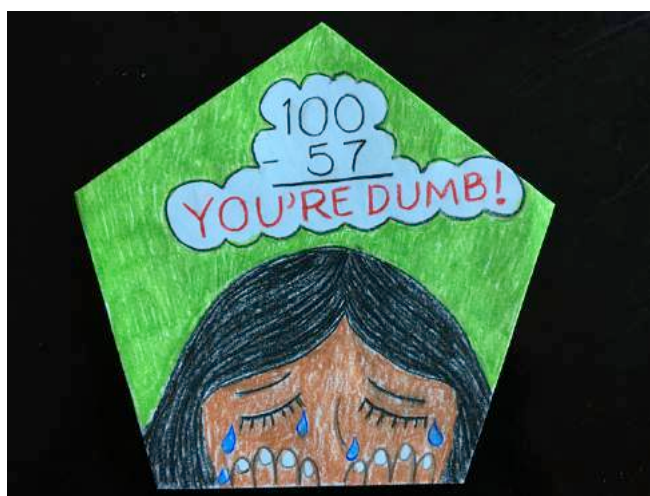


Figure 1: Image of Meredith as a young girl in a mathematics class.

Meredith learned to overcome these challenges, eventually making meaning of complex mathematical ideas in calculus. Her personal goal is to utilize students' home languages and cultures in the core of her mathematics teaching, and to work consistently on making mathematics relevant and personal to her students.

Conclusions

Our study is limited in that it considers only 11 participants who worked as paraeducators and achieved their elementary teacher certification in the same school district. We acknowledge this limitation, but argue that a similar study that would seek to decontextualize either the context or the participants' backgrounds would have other, and perhaps more alarming, methodological issues. The study also draws primarily from one data source when analyzing the participants' attitudes towards mathematics and mathematics instruction, though a secondary and much larger body of data was used to describe the broader socio-cultural backgrounds of the participants. Finally, while we document the participants' views of both mathematics and mathematics teaching, this paper does not address actual classroom practice. Future studies are ongoing to determine the degree to which the participants' views of mathematics instruction are being enacted in their own classrooms.

Our analysis of the stories of these paraprofessionals' lived experiences with mathematics provides a lens into key interactions with their families and other contexts that contributed to their

mathematical and professional development as teachers of mathematics. While their views of mathematics differed markedly, nearly all shared the view of teaching mathematics that seeks to generate active learners through the use of contexts, language, and other representations meaningful to students, and that preferably utilize the lived experiences and backgrounds of their students. Each of these principles are consistent with both culturally relevant/sustaining pedagogy as well as funds of knowledge perspectives. Given the changing demographics and anticipated increase in the number of Latinx students over the next ten years, and the importance of caring educators who share students' backgrounds, interests, language, and culture, we hope that more Latinx teachers can enter the teaching profession and develop mathematical perspectives similar to those of the participants in this study.

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