Preparing Bilingual Pre-Service Teachers to Foster Equitable and Open Communication With Latinx Immigrant Parents *en la Enseñanza de Matemáticas*

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Abstract

We examine how bilingual pre-service teachers developed a practice of communicating to parents their children's mathematical thinking and how the teachers invited parents to participate in instructional practices in the mathematics classroom. We argue that these practices are knowledge-intensive, in that bilingual pre-service teachers draw on both their knowledge of children's mathematical thinking and their own experiences as bilingual students, and that communicating this to parents reflects this knowledge. We conceptualize this knowledge as situated in, and integrated with, the practice of teaching. We therefore consider it necessary to support the development of this knowledge early in pre-service teacher education.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. As a mathematics teacher educator, how do you incorporate the lived experiences of bilingual pre-service teachers (BPSTs) into their preparation as mathematics teachers?

2. In your experience preparing future teachers, what are specific assignments or activities you use to teach future teachers to communicate with parents and involve them in the teaching and learning of mathematics?

3. As a mathematics teacher educator, how do you prepare BPSTs to notice and interpret children's mathematical thinking to inform their instructional decisions when teaching mathematics to bilingual elementary school students?

4. How are you, as a teacher educator, preparing BPSTs to communicate knowledge of children's mathematical thinking effectively to parents?

5. In your own experience as a teacher, what have you identified as the most effective way to communicate with parents and involve them in their children's mathematics learning?

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Introduction

This paper builds on previous work that proposed the creation of a bridge by which Latinx immigrant parents and schools could engage in a dialogue that establishes equitable instructional practices of open and dynamic communication between both parties (Colegrove & Krause, 2017). The communication we refer to in this paper is framed within the mathematics curriculum following the findings from our previous work: (1) Latinx immigrant parents expressed feeling tremendous responsibility to support their children's schoolwork at home, (2) Latinx immigrant parents made clear their desire for open communication and teamwork between the school and home emphasizing that this communication includes curricula, (3) the ways in which Latinx immigrant parents' navigated the differences in mathematics teaching methodologies in the United States and their countries of origin. In our previous work, we proposed that teachers must engage in dialogue with families and that such dialogue needs to be initiated by the teachers at schools. Starting a dialogue might seem simplistic, but is, in fact, complicated. It engenders a natural series of questions:

- What should this dialogue entail?
- Where and how should it start?
- What aspects of teaching and learning should be included in this dialogue?

In this paper, we share how our previous work led to practical changes in the classroom. The first author modified assignments and developed a Problem Solving unit in her bilingual mathematics methods courses to start building a bridge for meaningful and reciprocal communication between pre-service teachers and Latinx immigrant parents. The work we present in this paper is just one step forward after our initial work with Latinx parents. We do not intend to present a "solution" for a problem that has deep historical, political, social and economic roots. Neither does this work present answers to the questions above, nor do we think these questions can be answered by implementing an assignment in a methods class. However, our work here foregrounds instructional practices that can be used in bilingual mathematics methods courses to better understand bilingual pre-service teachers' (BPSTs') perspectives on teaching and learning mathematics. This understanding, in turn, contributes to the development of a teaching practice that is culturally inclusive.

Connection to Literature

In most mathematics education courses pre-service teachers (PSTs) learn how to make connections with out-of-school experiences through coursework and assignments that allow for these opportunities. For example, TEACH Math (Drake et al., 2015) has a complete module, Community Math Exploration, consisting of three activities: a community walk, a

mathematics lesson, and a final writeup and reflection where PSTs typically work in groups to design a problem-based task or lesson that connects to the communities where they would teach (Turner et al., 2015). These modules have been used and adapted in many mathematics methods courses around the country (Krause & Maldonado, 2019).

Research exists on how PSTs learn to make mathematics connections to children's home and community (Foote et al., 2013; Turner et al., 2012). Turner et al. (2012) make the point that despite this common practice, PSTs nevertheless spent limited time in their classrooms learning about how to make these connections and had limited exposure to the communities where they would teach. Moreover, even after identifying mathematical practices in students' homes, research has found it difficult for in-service teachers to link those practices directly to school mathematics (Civil et al., 2005a). From our own experiences as teacher educators and researchers, we agree with Turner et al. (2012) that teacher preparation programs devote too little class time to making connections between parents and school and to preparing teachers to work in meaningful ways with parents. The dilemma, then, is how to incorporate mathematical practices into teacher preparation programs in ways that are meaningful to students in school classrooms and which do not trivialize the mathematical ideas inherent in those practices. This issue remains a significant one for mathematics education research (Wager, 2012).

The research cited above refers to PSTs, not BPSTs. This is an important distinction. Research shows that bilingual teachers are more prepared to support the learning of students whose first language is not English, not only because they can make connections with the cultural resources in themselves and their students, but also because – to a greater degree than non-bilingual teachers – they position bilingual learners as contributors of knowledge and ideas in the classroom, valuing their expertise and ways of knowing and learning (Celedón-Pattichis et al., 2010; Musanti et al., 2009; Sleeter et al., 2015; Turner et al., 2013). Unfortunately, while this list of empirical work is significant, the research community has not yet focused on the experiences of BPSTs learning to teach mathematics.

Krause and Maldonado (2019) presented findings from their study of 28 BPSTs, in which they identified common experiences within this group of BPSTs around growing up and learning mathematics. The stories shared helped to illuminate how these experiences shaped the BPSTs' identities as mathematics teachers, and the depth of their educational insights. Their findings, though specific to the situation in which the BPSTs' linguistic and cultural backgrounds parallel those of their bilingual students, align with what a large body of research has also found about bilingual teachers. Based on the literature, the fact that BPSTs share the experience of moving between cultures, whether they be the same two cultures as their students, allows them to better imagine themselves in their students' shoes. In the specific case of Spanish-English BPSTs, which our study treats specifically, they often enter and remain in teaching, driven by a commitment to give back to their own communities and to challenge the inequities and injustices they themselves experienced in schools for students who share their cultural backgrounds (Achinstein & Aguirre, 2008; Achinstein & Ogawa, 2011; Krause, 2014). This might suggest that BPSTs who share the linguistic and cultural backgrounds of their students find themselves in a more advantageous situation for teaching than PSTs who do not share this linguistic and cultural background.

In this article, we build on the BPSTs own experiences learning how to teach mathematics learners. We describe the design of a Problem Solving unit that was implemented in the first author's bilingual mathematics methods courses, and what we learned from it in order to support BPSTs to start building a bridge of reciprocal communication with Latinx parents.

The BPSTs in our Mathematics Methods Course

Participants in the analysis we present here are 22 BPSTs enrolled in two bilingual mathematics methods courses in the third year of their teaching preparation program at a university in the southern United States. All BPSTs were English-Spanish bilinguals receiving instruction in Spanish.

The Assignment: Problem Solving Unit

Throughout the semester in this mathematics methods course BPSTs worked on a series of assignments designed to assess their learning experiences in the classroom and their field experiences. The textbook required for the course was *Children's Mathematics: Cognitively Guided Instruction* (Carpenter et al., 2014). We also used excerpts from *The Impact of Identity in K-8 Mathematics* (Aguirre et al., 2013), *Teaching Developmentally* (Van de Walle et al., 2013), *Beyond Good Teaching* (Celedón-Pattichis & Ramirez, 2012), and articles from different authors (e.g., Dominguez & Adams, 2013; Karp et al., 2014; Martínez & Ramírez, 2018; Torres-Velasquez & Lobo, 2004). The course placed a strong emphasis on parents and communities. Our approach to mathematics education is grounded on the concept of parents as intellectual resources (Civil & Andrade, 2003) and parents were positioned as contributors and we sought to learn from them. Through this lens, we worked to challenge the rhetoric of lack of parent involvement (Delgado-Gaitan, 2001). We purposefully focused on the strengths and assets of the families and communities with which the BPSTs in our class worked in order to change the focus from *needs of* the communities to the *possibilities presented within* the communities (Guajardo & Guajardo, 2002).

In this paper, we are only presenting and describing the Problem Solving unit we developed. In preparation for developing the unit, BPSTs viewed video examples of clinical interviews, read the Ginsburg (1997) chapter on conducting clinical interviews, and had substantial conversations about mathematical problem types, students' mathematical strategies, and how teachers can elicit mathematical thinking through questioning.

The Problem Solving unit consisted of three parts: the first derived from an instructional task within Teach Math (Turner et al., 2015), the second a modification of the existing Teach Math protocol, and the third an addition created for the specific contexts of the first author's mathematics methods course. (1) A Getting to Know You Interview. Here BPSTs choose a focal student from their placement who was different from them in one or more socio-cultural aspects (e.g., gender, race, home language). (2) A second interview for which the BPSTs were required to design their own word problem for their focal student. They were asked to explain why they chose the problem type for the student, the context, and the problem's numbers. In addition, BPSTs were asked to write the problem in English and Spanish and choose their language of preference to conduct the interview. The purpose of this interview was for the BPSTs to assess how a child solved mathematics problems that included addition, subtraction, multiplication, division, or base-ten concepts and to examine their role in supporting and extending their focal student's mathematical thinking. For this part of the unit, the BPSTs were also asked to write a follow-up problem informed by what they learned on the two interviews, and conduct a third interview. (3) The last part of the unit consisted of BPSTs examining and assessing what they learned from their student's mathematics understanding and sharing their documentation and observations with the student's parents. For this part of the unit, BPSTs were free to select the format of the information compiled for the parents. However, they needed to ensure the content addressed the following: (a) What their immediate goal was in giving the student the specific problems selected; (b) What the student knew; and (c) What their overarching goal was for their focal student's mathematical development.

Findings

The BPSTs in our study communicated their knowledge of children's mathematical ideas to parents in different ways. BPSTs often focused on communicating aspects of mathematics instruction and curriculum, which is not surprising given the emphasis we placed on children's mathematical thinking over the course of the semester. BPSTs also foregrounded two other aspects in their communication with parents: bilingualism and culture, and parent involvement in supporting children's work on mathematics. We report below on BPSTs' attention to the three aspects they focused on in their communication to parents. All names used in reporting the findings are pseudonyms.

Focus on Content: Mathematics and Children's Mathematical Thinking

Most BPSTs chose the format of a letter to communicate with parents. Regardless of format, in all assignments

BPSTs started by focusing on positive aspects of the students, and to begin the conversation with parents they overwhelmingly focused on the mathematics that the students knew and understood. Benito, a BPST placed in a fourth-grade classroom, wrote:

> Throughout this semester I have been working on math with Elena, specifically division problems. I took an interest in her division because she expressed to me that it gave her the most trouble. I know that Elena is very smart and she is very capable of solving division problems, so I sat down with her to see how she practiced solving these types of problems. I designed a math problem to see how she divides different combination of numbers. I made sure the context of the problem was relevant to her.

Above we notice how Benito describes his interest in what Elena can show him about her understanding of division before he makes any statement regarding whether she understands division or not. Benito wrote a partitive division problem (Empson & Levi, 2011) (Problem 1 in Figure 1), a type of problem we introduced in our course while learning about the different strategies children typically use to solve them.

Figure 1

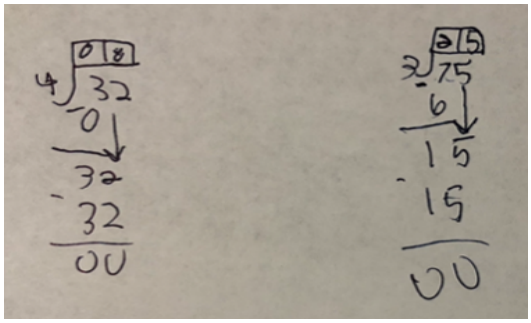
Partitive division problems Benito wrote

Problem 1	Elena just received a letter from her aunt in Germany! She was so excited about receiving a letter that she decided to write back to her aunt and to all her family members still living in Germany. After writing all the letters, Elena also decided to include photos in them. Elena wants to send ____ letters and include the same number of photos in each letter. She has a total of _____ photos that she wants to mail. How many photos are in each letter? (4, 32) (3, 75)
Problem 2	Elena enjoyed mailing her family in Germany very much. She thinks it will be really fun to send her friends pictures of what she did over spring break. Elena wants to mail her friends ____ pictures. How many pictures will each friend get if Elena is going to send ___ friends mail? (28, 6) (30, 11) (344, 8)

Benito provided two number choices for the problem. These number choices were also part of the Problem Solving interview assignment: BPSTs are asked to make instructional decisions and justify why they selected the numbers for the specific problem they gave to the student (Krause et al., 2017). Benito continued his letter, saying: "I asked her to solve this problem using the following number pairs: (4, 32) and (3, 75). She was able to solve the problem without any problems. So I wanted to push her some more to get to the root of why she thought she struggled with division." (Figure 2)

Figure 2

Elena's division strategies



Benito continues to explain his instructional decisions to the parents, showing them how he changed the problem and number choices for Elena (Problem 2 in Figure 1).

> I altered the original problem and number options to push Elena to show me more of what she knows. The context of the question remained the same, but the order of the wording was changed to get her to think of the problem in a different way. This time, Elena had some trouble solving the problem using the number set (30, 11). She tried but could not solve it using the standard algorithm. I asked her to try it one more time and she said she could solve it using the spider method. The spider method involves placing the number that is being divided in the center, and then draw legs equal to the number that it is being divided by. She then used the spider method to solve the problem correctly.

Benito's instructional decisions were informed by Elena's own thinking, and he was able to identify the root of her struggle with division: when she tried using the standard algorithm for division with two-digit numbers (traditional "long division" in the United States system), it did not work for her. However, Benito let her use a method that worked for her, and she solved the problem. It appears that Elena's struggle was not with the concept of division, but with the method employed to solve the problem.

It is also important to highlight that BPSTs used positive language and identified areas of strength, instead of using deficit language or focusing on what students did not understand or lacked.

Focus on Language: Bilingualism and Culture

Olivia, a BPST placed in a second-grade classroom, shared this reflection (in Spanish) on how she decided to approach the use of language while working with her student:

> *Cuando le dí el primer problema, hablamos en "Spanglish" porque así es como habla él en el salón. Quise que él se sintiera cómodo y que el lenguaje no fuera una barrera para resolver el problema. El problema estaba escrito en Inglés y Español.*
> [When I gave him the first problem, we spoke in "Spanglish", because that is how he speaks in the classroom. I wanted to make sure he felt comfortable and that the language was not going to be an impediment to solving the problem. The problem was written in English and Spanish.]

Gabby, another BPST also placed in a second-grade classroom, shared this reflection with a parent:

> *A diferencia de Misha, yo crecí en una familia que sólo hablaba Inglés, mientras que Misha tiene muchas exposiciones de idiomas en casa, lo que beneficiará su trabajo escolar. Me ha comentado que sus abuelos son de la República Checa y esto le hace sentir orgulloso. Él me ha dicho que usted le habla tanto en Inglés como en Español en casa.*
> [Unlike Misha, I grew up in a family that only spoke English, while Misha has exposure to many languages at home, which will benefit his school work. He has mentioned that his grandparents are from the Czech Republic and that makes him proud. He told me that you speak to him as much in English as in Spanish at home.]

In both cases, the BPSTs refer to the use of language. Olivia references the use of *Spanglish*, recognizing this linguistic practice as important for having access to her students' mathematical ideas. Gabby acknowledges the diverse use of languages and recognizes the advantage Misha has compared to her own experience growing up in a monolingual home. Both BPSTs wrote the letter in Spanish, favoring and acknowledging the language used by the parents at home.

Focus on Parents: Welcoming Parents to the Classroom

We found a few instances in which BPSTs directly invited the parents into the classroom, and we believe the explicit invitations are necessary. But most importantly, teachers should maintain a welcoming environment, fostering open and clear communication between home and school. Our aim with this assignment was for the BPSTs to understand that this was the type of relationship that we were hoping for them to create in their classrooms.

Gabby explicitly invited Misha's parents:

> *Sería fantástico, por ejemplo, si usted o el padre de Misha puedan venir a la clase y hacer un problema de matemáticas enfocándose en tu trabajo de enfermería o en su compañía de impresión de papel.*
> [It would be fantastic, for example, if you or Misha's dad could come to class and work on mathematics problems focusing on your work in nursing or on his printing company.]

In Gabby's letter, we see that she already knew what Misha's parents did for a living and invited them to share

how their work could relate to mathematics. Another BPST, Charito, provided suggestions for the parents to work with their daughter, Sabrina, and encouraged the use of strategies that make sense to her instead of specific learned procedures.

> I will lend Sabrina her own baggie of base-ten blocks to be used as aids with her homework. Please encourage her to use them, or even come up with other strategies for addition. I will do this in the classroom as well. Please encourage Sabrina to use what works best for her. Thank you so much for your support as always.

Gabby offered an open invitation, while Charito welcomed parents to work with her in a way that made sense to Sabrina and provided familiar manipulatives to take home to support practice and learning with her parents.

Discussion

Our findings suggest that BPSTs can potentially create positive relationships with families in multiple ways. For example, they can establish a communication channel with parents on their children's mathematical understanding, on the curricular and pedagogical practices with which their children were presented during part of their mathematics instruction, and on what parents can do to support their children in learning mathematics. These findings also speak to the important role children's mathematical thinking has in starting an open and equitable dialogue between parents and school about the learning and teaching of mathematics (Civil et al., 2005b). At the end of the day, if a teacher does not know what the student knows or understands, or does not recognize the students' ideas, the teacher will not be able to communicate those understandings or ideas to the student's parents. Access to children's mathematical ideas requires skills in asking questions and in noticing, interpreting, and making sense of students' mathematical ideas (Jacobs & Empson, 2016). In the bilingual classroom, it is also crucial for BPSTs not only to develop these skills but also to recognize the complex dynamics of teaching in a bilingual setting (Barwell et al., 2016; Moschkovich, 2015). The present work revealed the complexity and challenges of the bilingual teaching practice, and therefore the concomitant complexity of preparing BPSTs for this practice. For instance, work with BPSTs should support their development of a teaching practice that permits students to talk, engage in meaningful conversation, and share their mathematical ideas. Second, support of BPSTs should help them add tools for recognizing what these ideas are, and for building on them in their instructional decisions. And third, BPST preparation should include assignments that provide practice assembling all these ideas and communicating them to parents. The recognition of the knowledge-intensive nature of the mathematics teaching practice provides new insight into how to support future teachers, in particular BPSTs who are often particularly well equipped to work with culturally and linguistically diverse students and their families.

Our work presented in this paper focuses on BPSTs and teacher preparation programs. But the findings we describe might also contribute to engaging in-service teachers in a dialogue with immigrant families. Skillful communication can allow parents to become a valuable resource in supporting teachers providing meaningful mathematics instruction. Creating a partnership with the families can broaden the cultural understanding of the teacher and the class.

A final contribution of the present work is the design of the Problem Solving unit, an instructional activity for the mathematics methods course, which further develops the instructional practice of noticing, attending to, and interpreting children's mathematical thinking. More specifically, the Problem Solving unit's emphasis on interviewing as an instructional practice has the potential to support BPSTs' learning by serving as what Grossman et al. (2009) called approximations of practice. The more congruent to and integrated with the actual work of teaching these approximations are, the more authentic they become, and the more likely they are to help BPSTs develop skills useful for their instructional practice. Our findings support the idea that these interviews can serve as a catalyst for classroom dialogue and help develop the expertise needed for responding to children's mathematical ideas.

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Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. As an educator, how do your assignments reflect your commitment to providing equitable mathematics learning opportunities?

2. As a teacher educator, how do your assignments reflect BPSTs' experiences in learning to notice, elicit and interpret children's mathematical thinking?

3. How do you include spaces in your mathematics methods courses to foster real and meaningful connections with bilingual parents?

4. As a teacher educator, do you have opportunities to work with BPSTs? If so, what opportunities do you provide for BPSTs to enact their agency, and to encourage that they make instructional decisions that support the learning of mathematics in a bilingual setting?

5. How can you enhance and develop the ability of BPSTs to communicate the mathematics knowledge of elementary students with the families?