

“THIS IS YOU. THIS IS YOUR FAMILY” : CASE STUDY ON ATTENDING TO MATHEMATICAL LANGUAGE DEVELOPMENT

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Language is a vital component in mathematics classrooms and researchers have thoroughly examined how language functions in instruction. However, less is known about how teachers think about language enacted in their own classrooms. In this report, we describe how a teacher, Olivia, explicitly attended to language, particularly with emergent bilinguals. We describe affordances and tensions as she thought through language in the context of a professional development and in video-stimulated recall interviews.

Keywords: Classroom Discourse, Elementary School Education, Teacher Education - Inservice / Professional Development

There is a large amount of research on the role of language in mathematics classrooms. Scholars characterized language as a high need area for research given the growing diversity in the United States, diversity of language in the classroom and its impact on mathematics education (e.g., Barwell et al., 2017). Language supports constructing mathematical concepts, positioning of individuals and groups, developing mathematical argumentation, and shaping mathematical communities (Herbel-Eisenmann et al., 2017). Even with such a rich connection between language and mathematics, there is little research on teachers' thinking about language in their own instruction (Hajer & Norén, 2017). This dearth reflects how researchers' voices and interpretations, not teachers, are elevated in the research on language in mathematics classrooms. In this report, we add to this work by conducting a case study on Olivia, a third-grade teacher, and how she made sense of language in her instruction. We ask: *What are affordances and tensions Olivia perceived as she attended to mathematical language development?* We describe how Olivia's attention to both heritage (i.e., Spanish) and mathematical language was tied to mathematical development and participation and access, particularly for Latinx students.

Theoretical Framework & Professional Development Model

In order to explore how Olivia made sense of the language in her classroom through tensions and affordances, we frame our understanding of language and teacher knowledge. We view language similarly to how Gee (2005) described small-d and big-D discourse (which we will write as discourse and Discourse, respectively). First, he described discourse as “language-in-use” or the material of communication such as words and gestures in order to “design or build things.” In this report, we use “language” at times to describe mathematical language but also as heritage languages (e.g., Spanish, English). Second, Gee described Discourse as other “language stuff” that enact specific identities and activities such as ways of acting and believing. We see Discourse bearing on how Olivia thinks about her language use as a marker of not only doing mathematics but also enacting a particular identity.

We view the nature of teacher knowledge as embedded in practice as opposed to an outside body of knowledge (e.g., contained within academia) that needs to be “learned” by teachers. Cochran-Smith

and Lytle (1999) described teaching as “an uncertain and spontaneous craft situated and constructed in response to the particularities of everyday life in schools and classrooms” (p. 262) and thus, teacher knowledge draws from “their own reasoning and decisions, and their own inventions of new knowledge to fit unique and shifting classroom situations” (p. 267). This knowledge is highly sensitive to time and space. Based on this view of teacher knowledge, we co-designed and facilitated a professional development environment for elementary teachers called Learning Labs (LLs) (see Kazemi et al., 2018 for an elaboration of the model) focused on developing practices of mathematical argumentation. Additionally, this model aligns with Cochran-Smith and Lytle’s (1999) description of teacher knowledge as generated by teachers and based on their own actions.

Context, Data, and Analysis

Lockwood Elementary is situated in an urban area in the United States Midwest. In 2018-2019, the school served 443 students including 40% Latinx students. We began our LLs in January of 2019, having completed 8 LLs to date. Olivia, a 14-year bilingual Latina teacher participating in the LLs, taught at Lockwood Elementary for eight years by the time of the LLs. She taught in a third-grade Dual Language Immersion program (DLI) where native Spanish and native English speakers were placed in the same class with instruction in both Spanish and English. We conducted a case study (Merriam, 1998) in order to “develop an intensive, holistic description and analysis of a single, bounded unit” (p. 232-233). Olivia’s central belief is supporting language and empowering students, making her participation an important case to study. We reviewed materials from 2 interviews, written artifacts and verbal contributions in the 8 LLs, and 2 video-stimulated recall interviews (VSRs) from filmed classroom lessons with Olivia. Because Olivia frequently made statements about mathematical language development across data sources, through analysis we used the sensitizing question, “When Olivia talks about mathematical language development, what does this allow her to know about her students and do as a teacher?” and, “When Olivia talks about language development, does she perceive an opposing concept?” to identify affordances and tensions, respectively.

Results

In this section, we describe the affordances and tensions Olivia experienced as she considered supporting her students’ language development. We provide examples from written work during the LLs and one VSR lesson, where Olivia facilitated a choral count by fourths.

Affordances

Mathematical connections. Olivia’s focus on precise language (i.e. discourse) afforded her to challenge students’ thinking and help foster connections. For instance, during the VSR, she wanted to know how students would describe the count after three-fourths. She wanted students to “verbalize specific fractions where we’ve specifically been talking about how to simplify and making connections to the wholes.” As she expected, students had varied responses after three-fourths including “four-fourths” and “one.” Olivia facilitated a conversation asking students to prove the connection between them with a drawing. Additionally, Olivia said the task “opened up another conversation and then they were making connections to money and then we ended it where we made a connection to the clock and looking at a quarter and how we say the time.”

Engagement. Olivia predominantly focused on engaging with mathematics and participating in a classroom community (i.e. supporting Discourse) through language support. In LL4, Olivia recalled how conversation can have power and meaning, claiming it is about

listening and trying to understand what someone else is saying. What someone is trying to restate... this goes back to the power piece, where we’d finished turn and talk and there was still [chatting] and [a student] said ‘no no no wait, I want to share something.’ He was trying to make a point.

In interviews, Olivia explained that through a language focus, she wanted more participation for emergent bilingual students (EBs). By trying a new instructional activity called choral counting, she noticed how it could engage EBs, such as her student, Esteban, and how he participated in the conversation about selecting “one” or “four-fourths.” She recounted asking Esteban “who was very, very emergent with his English” what the class should say, “and he raised his hand and very clearly he said four-fourths. So it was such a small moment, but I feel like it was so important for him because he was able to participate.”

Tensions

Content vs. language. In many instances, Olivia viewed developing language as separate from developing mathematical ideas. As Olivia worked to encourage students to have meaningful discussions, she struggled to find a balance between language socialization and mathematical content because she described these two in opposition. In LL6, Olivia reflected on students’ shared mathematical ideas,

It’s been challenging rephrasing or paraphrasing [students’] ideas not because of the math but because of their language development. At the beginning I noticed many students were eager and talking around. But with their vocab and grammar it was really hard to understand the ideas they were trying to get across.

In the VSR, Olivia talked about the same tension while watching a lesson she taught in Spanish. The VSR was also conducted in Spanish. She apologetically reflected,

Yo admito que en la elección me alejé un poco del contenido de matemáticas porque quería enfocar más en aprovechando que los niños estaban tratando de explicar todo lo que podían... Es un proceso. Quizás alejé demasiado a las matemáticas, pero me hizo sentir y pensar que era obvio o es obvio de qué tanto, qué tanto tengo que regresar o repasar acerca de cómo compartir y cómo usar las palabras en matemáticas cuando estamos compartiendo.

I admit my decision to move away from the math content because I wanted to focus more on taking advantage of the fact that the children were trying to explain everything they could... It is a process. Maybe I took math away too much, but it made me feel and think if it was obvious or how obvious how much I have to go back or review how to share and how to use words in math when we are sharing.

Olivia recognized students need time to express their ideas but focusing on Spanish language development can take away from mathematical ideas. Although she saw the importance of language and mathematical content, she struggled with balancing the two.

Speaking Spanish vs. Spanish speakers. Prominent in the interviews, Olivia described a disconnect between the language of instruction, Spanish, and students who spoke Spanish. Olivia felt speaking Spanish as something students do but also something empowering. She saw language as part of one’s identity. In the initial interview, Olivia reflected on the lives of Latinx students and if this has any bearing on their identity and how they participate in school,

I feel is there more privilege, more access to resources outside of school that [White students] are able to partake in that my Latino students aren't able to... do my Latino students—do they feel empowered being native Spanish speakers and being in this program where there's this part where the Spanish, that's their language, that's them, their identity? And I do wonder how they feel as Latino students in [the DLI] program... the students don't want to use their Spanish and I see a lot of my Latino students that they start to because they

are hesitant in Spanish. And that, for me, part of that identity, it's like, ‘But this is you. This is your family.’

After the first set of LLs, Olivia noted an improvement in the quality of student contributions in discussions. However, her Latinx students would still hesitate, “I see so many of my Latino students, even during Spanish when we're having conversations... this is their first language, and they're hiding in the conversations or they're not raising their hands.” Olivia wants “them to be proud of being able to participate in the conversation or even dominate the conversation the way native English speakers may be able to dominate more in English.” In the VSR, Olivia described,

Había un grupo de niños acá, algunas niñas que siempre están compartiendo en español y son muy buenos modelos para el español y el lenguaje, que tenían mucha pena y tienen tanta confianza cuando están hablando en español, pero tienen menos confianza cuando se trata de matemáticas.

There was a group of children here, some girls who are always sharing in Spanish and are very good models for Spanish and language, who get embarrassed but are confident when they are speaking in Spanish, but have less confidence when it comes to math.

Such moments demonstrate a tension Olivia experienced between improving discourse (students speaking) and hesitant Discourse (confident participation). It functioned as an overarching goal of empowering students, particularly Latinx students, their language, and their culture.

Discussion and Implications

We highlighted tensions and affordances an elementary school teacher, Olivia, perceived as she attended to developing language in her mathematics class. Underlying all the affordances and tensions we described, a central belief guided Olivia’s sentiment, “This is you. This is your family.” For Olivia, the lines between discourse and Discourse are blurred. Developing ways of speaking and heritage languages is not just about engaging in mathematical discussions or using appropriate words. Her attention to language is rooted in empowering Latinx students.

Olivia demonstrated attending to language is complex. Researchers have prescribed how teachers should think through and about language diversity in classrooms and confronting English dominance (e.g. Palmer, 2009). Working in a DLI setting affords Olivia to work on this confrontation but still handle tensions of balancing student empowerment, language development, and mathematical content. Due to space constraints, we could not further attend to how affordances and tensions of language impacted Olivia’s instructional considerations around attending to mathematical vocabulary, supporting students to engage in each other’s ideas, and building a math talk community. More work is needed to understand how teachers think through these ideas and how they learn to address this balance. Additionally, research on language should not just pay attention to language as it relates to status, power, or language resources (Barwell et al., 2017), but also how teachers make sense of these ideas inside instruction.

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