

Creating Inclusive and Equitable Mathematics Classrooms for Multilingual Learners Through Professional Development

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Multilingual learners (MLs) are the fastest growing population within US public schools yet remain underrepresented in accelerated math courses and overrepresented in lower track courses. Mathematics educators often lack the support and training needed to help MLs reach their full potential in mathematics. This article focuses on the work of one linguistically diverse district who paired with a mathematics and language expert from a university to provide this training through a two-prong approach. First, create a district class focusing on MLs in mathematics, and second, provide intentional coaching. This article outlines the topics covered within the training as aligned with research and provides a framework to create professional development opportunities that build more equitable and inclusive mathematical spaces for MLs.

Keywords: multilingual education, STEM, math education, ESL, ELL, professional development, bilingual education, equity

It is well established that US schools continue to become more linguistically diverse (National Education Association, 2020). In 2021, 21% of students spoke a language other than English at home (Child's Statistics, 2024), and 10.6% of students received English language development services (National Center for Education Statistics, 2024). These linguistically diverse students, multilingual learners (MLs), bring rich cultural, linguistic, academic, and diverse assets and perspectives to schools, and they represent the fastest growing school population subgroup. However, despite this growth in population and the assets they bring, MLs remain disproportionately underrepresented in higher level math courses and math fields while being overrepresented in the lower level tracks (Roo et al., 2020; Umansky, 2016).

Additionally, gaps in achievement scores between emergent-MLs (see Authors' note) and their monolingual peers continue to persist (McFarland et

al., 2019), which are often the result of structural inequalities in schools (Johnson, 2023) rather than their academic ability and capabilities in mathematics. The focus on language diversity and inclusion is critical in equity-conversations about public education as the predominantly monolingual English teacher workforce services an increasingly linguistically diverse student population (Barros et al., 2021; de Jong et al., 2013). To elevate MLs in mathematics, there must be a focus on diversity and inclusion within mathematics' spaces by creating professional development opportunities aligned to their needs and assets in mathematics.

Problem

Multilingual learners (MLs) need specific support for both language and content in math classes to reach their full potential both mathematically and linguistically. However, many math teachers do not feel equipped to meet the needs of nor feel confident to build upon MLs' linguistic resources to fully support both their mathematics and their English language development (de Araujo et al., 2018). Moreover, while the number of MLs in schools continues to increase, the number of educators who are certified English language development (ELD) educators has decreased (Najarro, 2023), meaning that there are less educators to service the growing number of multilingual learners in schools. Hence, MLs are more likely to find themselves in classrooms with teachers who are not trained to meet their needs and build upon their assets.

Compounding the problem is a lack of effective professional development for educators focusing on MLs (Giles & Yazan, 2020; Vera et al., 2022). Because effective educators of MLs must learn specific strategies alongside developing specific skills, knowledges, values, and mindsets (Vera et al., 2022), there is an even greater need to focus on the development of high quality professional development focusing on MLs for all educators, especially aligned with their content areas. Without specific training for multilingual learners specifically in the area of mathematics, educators may underestimate their MLs' abilities and may not push them to their full potential (Neumayer DePiper et al., 2021); thus, highlighting the need to develop such opportunities for this training. In contrast, when provided with specific training focused on MLs in mathematics, educators are more likely to see their students through an asset-based lens and provide appropriate supports for both math and language (Brandon, 2021). Failure to provide this type of training in the form of professional development for in-service math teachers and coursework for pre-service math teachers puts MLs at risk for inequitable math spaces.

One linguistically diverse district sought to address this need through professional development focusing on multilingual learners in mathematics to both elevate MLs in the math classroom and develop an asset-based math experience, K-12, for all MLs. While this plan was specific for this district, the structure and class topics can be used as a framework for other districts and for

math pre-service education programs seeking to take an active role in providing PD specifically focused on mathematics and language to create more equitable math experiences for MLs.

Professional Development Plan

Background and Involved School District

This professional development plan took place in an urban school district in the Midwest. It is the second most diverse school district in the state, and their students and families speak over 37 languages. Like many school districts in the country, the district has experienced an influx of multilingual learners (20% increase from 2023-2024), predominantly students with a native language of Spanish. The school district has students representing a range of Spanish speaking countries, including but not limited to Venezuela, Guatemala, El Salvador, Mexico, and Honduras. 12% percent of the total student population within the district receive English language development (ELD) services; however, this percentage does not include the students who formerly received ELD services, meaning that the percentage of MLs is a higher percentage.

The district has a thriving one-way developmental dual language (Spanish/English) program in PreK-8 and a transitional one-way dual language program 9-12. This means that students receive instruction in both Spanish and English, and all learners in the program are native language Spanish speakers. They currently service 590 students within these programs. The district leadership has placed an emphasis on providing professional development for educators to help support and enrich the educational experiences of their multilingual population. For the last few years, the district has been focusing on developing language objectives, developing meaningful support in both classroom materials and educators' pedagogical practices, and incorporating biliteracy frameworks into intentional lesson plan design for multilingual learners. As the focus of much of the professional development has been focused on biliteracy within language arts specifically, the district has seen significant gains in the growth of their multilingual learners in reading and writing in both languages. The district is now turning their focus to enhancing and enriching their multilingual math programming. The district houses their bilingual program in one pre-school, one elementary school, one junior high, and one high school.

Three years ago, the district added a bilingual math track, taught by a teacher with both math and bilingual endorsements, for 6th and 7th graders to elevate and support mathematics for multilingual learners in the middle grades, and this has correlated with more multilingual learners in advanced math classes in 8th grade and high school as well as higher scores on state standardized testing in mathematics. The district wants to continue their work to improve their multilingual math programming, specifically targeting K-8 math instruction. The district purchased a new math curriculum, which is available

in both Spanish and English, for all math classrooms. However, professional development aligned with the curriculum was primarily designed through a monolingual math lens.

Structure of the Professional Development

To elevate their mathematical programming for multilingual learners, the district paired with an assistant professor of STEM (science, technology, engineering, and mathematics) and multilingual education from a state university to serve as a consultant and to provide training on how to intentionally weave together best practices of both language and mathematics learning and teaching. Following conversations about the district and its strengths and needs, the Director of Multilingual/Multicultural Programs for the district and the consultant developed a professional learning plan. This training plan took a two-pronged approach. First, teach a series of afterschool professional development (PD) classes for educators who teach/support mathematics for multilingual learners, and second, provide intentional coaching to a new bilingual mathematics teacher.

Prong One – Professional Development Course

The consultant provided seven 2-hour afterschool classes that made up a professional development (PD) course. This course was aligned with linguistic and mathematics research and covered a range of topics, including but not limited to Funds of Knowledge, language objectives, mathematical belonging, inclusive and rigorous math practices/activities, language inclusion, identity in math, dually identified learners in mathematics, collaboration, lesson and unit planning, etc. The consultant centered these seven classes around specific driving questions as shown in Table 1.

The consultant and the director of the district's multilingual/multicultural programming developed goals for the PD classes as aligned with research in both math and language development.

The goals for the classes included:

1. Improve the mathematical experiences for multilingual learners by providing targeted PD to educators.
2. Build the capacity of the involved educators to support others in order to pave the way for more inclusive and rigorous math spaces for all multilingual learners.
3. Develop lesson plans that included the mathematical, linguistic, and cultural elements taught within the professional development courses.
4. Develop common practices that would be used for the math courses with multilingual learners enrolled (bilingual, ELD math, etc.) whether their teacher participated in the class or not and that will drive further PD.

Within each class, the consultant provided opportunities to learn about each topic as layered in with research, time for discussion, and workshop time where

the participants connected the topics to their own experiences in their classrooms, schools, and district. A more detailed list of topics covered in each class session is described in Appendix A. Due to the classes involving educators from all three grade bands (elementary, junior high, and high school), the participants were able to discuss the concepts holistically as it applied to the district.

Table 1

Class Topics and Driving Questions

Class Number and Topic	Driving Question
1 – Identity	Who are we, and who are our students as multilingual mathematicians?
2 – Data with Multilingual Learners	How does our data inform our decisions with multilingual mathematicians?
3 – Asset-Based Pedagogical Practices	How do we build upon our students' languages and culture in mathematics?
4 – Lesson Planning	How do we develop lesson plans with language development and mathematical practices for math while centering belonging, identity, and positioning?
5 – Collaboration	How do we collaborate with one another, our students, and their families for our growth and the growth of our multilingual learners?
6 – Consistent Practices and Intentional Program Planning	What is our vision for all ML mathematicians? How do we layer in consistent practices?

Note. A more detailed breakdown of the classes with topics is in Appendix.

Participants

The 12 participants ranged in experience from first year teachers to tenured, veteran teachers, which enabled the participants to learn from each other's experiences and classroom examples. Participants elected to participate in the training and included bilingual math teachers, general education math teachers, English language development/bilingual co-teachers of math, and support staff. The Director of Multilingual and Multicultural Programs attended each session, and the consultant and the director reflected after each class to further design the course toward the needs and assets of the participants and

their students. The breakdown of the participating educators can be seen in Table 2.

In the last classes, the educators shared their lesson plans, developed common practices and routines that they wanted for all multilingual math classes to follow, had a lesson planning template that embedded the concepts and practices covered in the professional development, and developed guiding principles for multilingual mathematics. Additionally, as the educators went through the courses, they had an average of a week in between each class to layer in the covered concepts into their own classes; this gave the educators a chance to connect the theoretical to the practical; the class discussed their K-12 classes as it pertained to the topics of the PD.

Table 2
Participants’ Information

From the elementary school where the bilingual program is housed	From the junior high where the multilingual learners attend 6-8	From the high school where the multilingual learners attend 9-12
• Three Lower Elementary (K-2) Bilingual Teachers • One Upper (3-5) Elementary Bilingual Teacher • One Instructional Coach • One Bilingual Interventionist	• One Bilingual Math Teacher • One General Education Math Teacher • One English Language Development Teacher who supports math • One Advanced Math Teacher • One Bilingual Program Assistant	• One Bilingual Teacher who supports math classes

Prong Two – Coaching of a New Bilingual Math Teacher

A second tier of support involved coaching for a new bilingual math teacher. The teacher, a second-year educator who was new to the district, had experience teaching English as a Second Language classes but had not taught bilingual nor math classes. The consultant worked with the educator to model, co-teach, and co-plan bilingual mathematics lessons at the middle school level. This support allowed the new teacher to not only see the concepts in practice

but also have support in the lesson and unit planning as aligned with the professional development course.

The consultant and the teacher met to discuss language and mathematics and focused on adding in both linguistic and mathematical supports and objectives into the units and lessons. Additionally, the consultant led lessons to model for the teacher, co-taught lessons, observed the educator teaching lessons and then provided feedback to the involved teacher for continued growth and discussion.

Results

Prong One

Throughout and following the professional development classes, the educators were open about their needs, demonstrated the assets that they contributed to the PD, and discussed their growth. The educators voiced their improved comfortability layering in critical elements, such as language and math objectives, cultural, linguistic, and belonging connections, and intentional supports for elevating rather than simplifying mathematics. Furthermore, the educators voiced interest in further professional development ranging from learning more about mathematical belonging and other elements of the Triangle of Affirmation in STEM (Brandon, 2025) to taking a deeper dive into mathematical concepts such as the Concrete, Representative, Abstract (CRA) model through an inclusive linguistic rich lens.

The educators showed a clearer understanding and demonstration of creating lessons that centered mathematics along with intentional linguistic development and meaningful connections to culture, positioning, identity, and mathematical belonging. The involved educators also developed common pedagogical and assessment practices and routines as well as determined guiding principles of multilingual math courses for the district; the educators demonstrated their asset-based views of their learners within mathematics in these recommendations. These guiding principles included:

- Bilingual education is an act of social justice
- Both language and math content need to be valued
- Culturally sustaining/responsive practices must be at the center
- Rigor must be maintained and elevated; must teach with depth vs cover content
- Pacing should be similar to grade level partners
- Culture and identity are at the center of every individual
- Language must be embedded to work with not in place of content – through language objectives
- Positioning and belonging must be a focus

Additionally, they brainstormed future professional development topics for other math teachers who were not involved in the PD; their suggestions further

reflected asset-based thinking and an understanding of the importance of the components taught in the professional development courses.

Prong Two

Through the coaching discussions and co-teaching with the consultant, the bilingual math teacher could more effectively implement the linguistic and cultural connections into mathematics in a supportive space as she voiced that the math coach in the building could help with the math, and she could get help with the ELD (English language development) from the other ELD educators, but the coaching and conversations with the consultant connected both concepts. Furthermore, due to the unique position of being a middle level bilingual math teacher, having an expert in both math and language helped to layer in language standards that built upon the math content and practices. She stated seeing it in practice helped her to layer the discussed mathematical, linguistic, and inclusive practices into her own instruction.

Discussion and Educational Implications

As school leaders and educators continue to grapple with how to best support educators with an increasingly diverse school system, both linguistically and culturally, professional development providers and teacher education programs must look at the intersectionality of mathematics, language, and culture to create equitable learning opportunities for multilingual learners in mathematics. The described two-prong approach to professional development allows the development of the theoretical and practical background knowledge needed to support educators to elevate their MLs in mathematics.

To make a classroom shift to be more inclusive and equitable of MLs in mathematics, educators must have the training to intentionally focus on language, culture, and mathematics; the structure of this course provides the space to have discourse and aid in this shift. In addition, coaching/modelling provides the connection of the theoretical to the practical as the educators see the concepts in practice and to get feedback while implementing what they have learned. This shift is necessary to create equitable experiences for multilingual learners specifically in mathematics.

By creating professional development (PD) experiences that weave together language and mathematics, educators receive training that is unique to the multilingual learner and educator in mathematics and begins to address the lack in training for meeting the needs of multilingual learners, specifically in mathematics. Additionally, by pairing with specialists from universities or other districts, schools with less resources can create opportunities for professional development, including creating online professional development experiences. This pairing opens opportunities for school/university partnerships and reduces the load on multilingual educators and administrators to provide this type of

professional development, especially as many may not be trained to do so. The class structure, driving questions, and class topics described in this article could be used as a framework for such professional development.

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Authors' Note: Emergent multilingual is used to represent a multilingual learner who receives English language development services. This terminology represents asset-based terminology versus using its deficit-based, but more widely used, counterpart, English language learner.

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Appendix

Topics Covered in Each Class (Aligned with Research)

Class 1

Driving Question - Who are we, and who are our students as multilingual mathematicians?

Topics

- Goals and purpose of professional development
- Data about multilingual learners (MLs), historically in the nation, state, and district, in mathematics
- Identification of strengths and challenges within math classes for MLs
- Math Identity - its role in math achievement, development of math identity
- Teacher Identity - its role in teaching (biases, how we teach, etc.)

Class 2

Driving Question – How does our data inform our decisions with multilingual mathematicians?

Topics

- ACCESS testing (English language proficiency assessment)
- Benchmark assessments
- Annual assessments
- What data does the data tell us? What is missing?
- How can these assessments inform our instruction in mathematics?
- What are limitations to this data?
- How can this inform our formative and summative assessment practices with our multilingual learners?

Class 3

Driving Question – How do we build upon our students' languages and culture in mathematics?

Topics

- Culturally Responsive and Sustaining Pedagogical Practices and Teaching
- Identity and culture within mathematics
- Math identity and its role in mathematics
- Culture iceberg
- Translanguaging

Class 4

Driving Question – How do we develop lesson plans with language development and mathematical practices in mind?

Topics

- Elements of lesson planning
- Domains of language – Intentionality within math
- WIDA Language Standards and components
- Alignment of language standards and math standards

- Alignment of language objectives and math objectives
- Meaningful linguistic scaffolds within mathematics
- Mathematical Practices and the Talk Moves
- Unpacking a math lesson through the lens of linguistic and cultural inclusion

Class 5

Driving Question – How do we collaborate with one another, our students, and their families for our growth and the growth of our multilingual learners?

Topics

- Funds of Knowledge and connection to families
- Positioning - teacher to student, student to student, and student to self
- Coteaching
- Affirmation elements - Mathematical Belonging, identity, and positioning
- Dually identified learners and collaborating with special education teachers
- Multilingual professional learning communities (PLCs)
- Introduction to an inclusive lesson plan template
- Workshop model to collaborate on lesson plans

Class 6

Driving Question – What is our vision for all ML mathematicians? How do we layer in consistent practices?

Topics

- Development of Common Practices for math classrooms with multilingual learners
- Discussion of the vision and goals of MLs in math
- Put together the concepts from the earlier PD classes to come up with common practices for multilingual math
- Classroom environment common practices
 - Lesson Planning
 - Curriculum
 - Pedagogical Practices
 - Assessment

Class 7

Driving Question – What did we experience and create, and what steps are important moving forward for continued PD? What is everyone's role moving forward?

Topics

- Present final lesson plans
- Work in groups to analyze lesson plans
- Give feedback on the lesson plan template as aligned to class objectives and research presented
- Reflection on Professional Development (PD)
- Building capacity within the district
- Discussion of future PD for the group
- Discussion of needed PD for all math teachers who work with MLs