Student Achievement Partners

Bridging Language and Mathematics:

Best Practices for Multilingual Learners

Odalis Amparo

Acknowledgements

About Odalis Amparo

Odalis Amparo is a Specialist in Math and Multilingual Learners at Student Achievement Partners. With deep experience in teaching, mathematics coaching, and dual language education at the elementary level, she is dedicated to re-humanizing the mathematics experience for multilingual students. A skilled educator and servant leader, Odalis is highly committed to elevating the voices of students and teachers in historically marginalized communities. She is fiercely passionate about the intersection of language learning, equitable mathematics instruction, and linguistically sustaining pedagogy.

About Student Achievement Partners

For over a decade, Student Achievement Partners (SAP) has provided educators with guidance and tools grounded in research and evidence. SAP has had an outsized impact on the increased availability of K-12, standards-aligned instructional resources in ELA/literacy and mathematics and continues to offer unmatched expertise on how high-quality instruction can unlock student potential. SAP is trusted by those at all levels in the field—from classroom teachers to state-level policy leaders—and we are committed collaborators in service of the educational sector in applying a vision of rigorous, joyful, and asset-based teaching and learning. We do this because we believe that our educational system can and should be a place that builds community, knowledge, and opens opportunity for each and every student.

Abstract

This paper explores the intersection of language and mathematics, emphasizing the need for linguistically centered mathematics instruction to support multilingual learners (MLLs). It highlights how early number sense, a natural ability in all children, can be leveraged to deepen mathematical understanding, particularly through linguistically responsive teaching strategies. The linguistic demands of mathematics are discussed as significant challenges for MLLs. Research-based strategies such as the intentional use of sentence stems and frames are presented as effective tools for supporting both language and mathematical development. In alignment with the evidence base, the importance of fostering an interconnected approach to content and language development is emphasized, advocating for linguistically sustaining practices that recognize home languages as assets. This approach is further supported by educational policies, as it aligns with the California (CA) Mathematics Framework and the California (CA) ELA/ELD Framework—specifically the ELD Standards, which stress the importance of linguistically responsive instruction to ensure all students can access and engage with mathematical content equitably.

Introduction

Mathematics is often regarded as a universal language, but nobody is born knowing how to speak the language of numbers. While the core concepts of math are universal, its formal structure—consisting of specific language, concepts, and processes—must be learned. Despite this, everyone, regardless of their background, has an innate ability to think mathematically from a very young age. The National Council of Teachers of Mathematics (NCTM) emphasizes that mathematics is a human endeavor (NCTM, 2020). Integrating human-centered mathematics aligns with the natural ways children develop mathematical thinking by building on their everyday experiences and innate number sense. This approach emphasizes the importance of understanding and leveraging children's existing mathematical reasoning to enhance instruction (Philipp, Siegfried, & Thanheiser, 2020). Children display early number sense in a variety of ways—whether they are sorting objects, estimating quantities, or navigating the world in space and time. The challenge then becomes how to harness this natural intuition to support students' understanding. Traditional math instruction often focuses on procedural accuracy, neglecting the linguistic richness and varied experiences students bring to the classroom. This issue is particularly evident for multilingual learners (MLLs), who face unique barriers in math and language learning. Research shows that MLLs experience disproportionately lower academic achievement (García & Solorza, 2020), emphasizing the need for a paradigm shift in how mathematics is taught to support all students, MLLs in particular.

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In light of this, some key questions arise:

- How can we unpack the linguistic density of mathematics in ways that support all students in the sensemaking process?
- How can we welcome, nurture, and sustain a student's entire linguistic repertoire in mathematical spaces?
- How can we simultaneously support MLLs with both their language and mathematical development?

While these questions may not all have simple answers, research and evidence-based practices provide ample starting points to catalyze meaningful change in the classroom.

The Linguistic Demands of Math

Mathematics is linguistically demanding, especially for MLLs, requiring precise language and specialized vocabulary. Terms like “set” and “expression” can hold multiple meanings, with different definitions in mathematics and everyday language that create confusion. For example, in mathematics, a "set" refers to a collection of objects, like the set of odd numbers. In everyday language, "set" can refer to a group of items, such as a set of dishes. For MLLs, the challenge is greater as they must decode academic language while mastering mathematical concepts. Attending to language in math also involves supporting metalinguistic awareness by helping students reflect on the nature of language in mathematics, as this enables them to better understand how mathematical terms and concepts are used differently across contexts, fostering deeper comprehension and more effective communication of their mathematical reasoning (Schleppegrell, 2007).

Mathematics is present in daily life, from shopping to measurements in cooking, budgeting, creating artwork, and recognizing patterns in nature—illustrating its universal nature. These experiences show that mathematical thinking transcends linguistic barriers. However, despite entering classrooms with naturally rich mathematical backgrounds, MLLs often struggle to engage fully in mathematical discourse. Linguistic barriers are a major factor; language is key to expressing mathematical reasoning, and without adequate support, students cannot fully engage or demonstrate understanding (TODOS & NCSM, 2021). Every mathematics teacher is also a language teacher, particularly when it comes to supporting students' use and understanding of academic language (Lager, 2006). While subject-area teachers aren't expected to become language experts, they can learn to recognize and explain their discipline's unique language features (Lucas, Villegas, & Freedson-Gonzalez, 2008). Making it further evident how critical it is for educators to address language in the math classroom, especially for MLLs, to ensure they can access content and authentically express their thoughts and ideas.

Linguistically Sustaining Practices

Linguistically sustaining practices honor and leverage the linguistic resources that students bring into the classroom, recognizing that their home languages are an asset in learning academic content. Additionally, these practices support the development of a student’s full language abilities, including home languages, ensuring language preservation (Cummins, 2001). The California (CA) Mathematics Framework emphasizes the importance of “positioning all learners as thinkers and as members of the same community”, affirming that students who are marginalized in mathematical discussions are positioned as contributors alongside their monolingual English speaking peers (California Department of Education, 2023,

Chapter 2). By incorporating multiple languages into content instruction, students are able to engage with material in a way that feels natural to them. For example, students may discuss mathematical problems in their home language with peers and then, with support from intentional scaffolds, switch to English for written explanations or formal assessments. This approach supports language development in both languages while reinforcing mathematical understanding (García & Li, 2014).

It is important to consider providing activities with structures that encourage the use of students' full linguistic repertoires, such as cooperative learning tasks and structured discourse (TODOS & NCSM, 2021; Zwiers et al., 2017). When engaging in these activities students are welcome to fluidly switch between languages in order to express ideas and negotiate meaning. These activities incorporate sentence stems and phrases as scaffolds, enabling students to solve problems and engage in meaningful mathematical discourse. By engaging in peer-to-peer learning, students not only deepen their understanding of mathematical concepts but can also build academic vocabulary in both their home language and English. This process fosters collaboration, ensuring students can express and deepen their thinking through language in both informal and formal contexts. Discourse is essential for MLLs, since they make meaning through talking, particularly when content is cognitively and linguistically demanding. Embedding intentional opportunities for students to engage in discourse in math classrooms supports both language development and content understanding (Soto, 2023).

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Translanguaging is a critical aspect of linguistically sustaining practices, and Dr. Ofelia García, widely recognized as one of the pioneering scholars in the field of bilingual education, stresses its importance in teaching and learning. In her 2024 presentation at the NC State College of Education's Linguistics Diversity Series, García emphasized that translanguaging pedagogical practices are *not* strategies, and highlighted the importance of designing translanguaging spaces in order to clearly assess and document what they [MLLs] know and can do, specifically in the target language, and to acknowledge and "make visible the lives and languaging entre mundos [in-between worlds]" (García, 2024, 1:24:28–1:27:17). Although complex and ever-evolving, translanguaging practices play a crucial role in linguistically sustaining instruction. This is particularly important in mathematics, as it helps educators distinguish between what students understand about the content and the linguistic barriers that may prevent them from fully demonstrating their knowledge.

By leveraging the full linguistic repertoire of students, including all variations of vernacular, and incorporating environmental print that reflects students' home language, dialect, and register (social or academic) into the classroom environment, these practices enhance academic growth (Neumann, 2021). These practices also foster a sense of belonging and validation in the classroom and ultimately, create an inclusive, asset-based environment where multilingual learners can thrive academically while retaining and expanding their linguistic identities.

Linguistically Sustaining Practices and English Language Development

Linguistically sustaining practices and English Language Development (ELD) are essential yet distinct components of language acquisition for MLLs. Linguistically sustaining practices leverage students' existing linguistic knowledge to enhance their understanding of academic content, including mathematics (Massachusetts Department of Elementary and Secondary Education, n.d.). Alternatively, ELD focuses on developing proficiency in English, emphasizing grammar, vocabulary, and syntax (California Department of Education, 2014). While these approaches are not interchangeable, they are complementary; ELD provides foundational language skills for academic content, whereas linguistically sustaining practices contextualize learning in ways that are responsive and relevant (García & Solorza, 2020).

Interdependence of Content and Language Development

The relationship between content and language development is deeply intertwined. Academic language—the formal language used for content-based communication—is critical for higher-order thinking and learning. Proficiency in academic language enables students to access complex concepts, participate in discussions, and succeed equitably across disciplines (NCTM, n.d.; California Department of Education, 2014). In mathematics, academic language facilitates understanding, reasoning, and discourse. Instructional practices that integrate content and language development are pivotal for multilingual learners to achieve success (Gibbons, 2002).

The following table outlines strategies and practices that support both language and mathematical proficiency.

Strategy or Practice	Description	Citation
Multilingual Education (MLE)	Multilingual programs are based on research that demonstrates effectiveness at leading students toward linguistic fluency and academic achievement in more than one language.	*California Department of Education (2023)*

Translanguaging	Encourage students to use their full linguistic repertoire to make their thinking visible and solve tasks.	*García & Wei (2014); Cenoz & Gorter (2017)*
Sentence Stems and Frames	Use structured sentence starters and frames to scaffold students' mathematical reasoning and academic language development. Consider your desired outcome and choose accordingly; not all stems and frames serve the same purpose.	*Colorín Colorado (n.d.); Zwiers et al. (2017)*
Word and Phrase Walls	Display key vocabulary and phrases, in multiple languages, with visuals and examples to support understanding in context. Consider co-creating with students to increase relevance.	*Chamot & O'Malley (1994); Lindholm-Leary (2014)*
Multimodal Teaching	Instructional approach that engages students through multiple modes of learning, such as visual, auditory, kinesthetic, and linguistic methods, to enhance mathematical understanding and problem-solving.	*(Hiebert, 1999); (Dominguez, 2024)*
Linguistically Relevant Problems	Design math problems based on students' linguistic backgrounds and real-life experiences to make learning meaningful and relatable.	*TODOS & NCSM (2021)*
Math Language Routines (MLRs)	Consistently implement the eight structured routines (e.g., "Compare and Connect," "Three Reads") to build reasoning and academic discourse skills.	*Aguirre et al. (2013); Zwiers et al. (2017)*
Total Physical Response (TPR)	Use physical gestures or activities to help students understand and remember math concepts and vocabulary.	*Asher (2009); Gibbons (2002)*
Visual Supports	Incorporate diagrams, models, and illustrations labeled in English and home languages to bridge abstract and concrete math concepts.	*Chamot & O'Malley (1994); Lindholm-Leary (2014)*
Use of Cognates	Highlight, and provide access to, words with similar meanings in students' home languages and English (e.g., "triangle" and "triángulo").	*Lindholm-Leary (2014); García & Wei (2014)*
Collaborative Group Work	Arrange diverse groups to encourage peer learning and allow the use of home languages to clarify understanding.	*Martínez & I (2020); García (2009)*
Scaffolded Questioning	Use open-ended questions with wait time and peer discussion to deepen understanding and language development.	*Zwiers et al. (2017); Chamot & O'Malley (1994)*
Oral and Written Communication	Provide opportunities for students to explain their thinking verbally and in writing using structured formats like journals or presentations.	*Zwiers et al. (2017); NCTM (n.d.)*
Language Functions	Identify the content and language focus of the learning task represented by the active verbs within the learning outcomes.	*Galante (2015, p. 4)*
Language Objectives	Use language objectives that specifically outline the type of language students will need to learn and use in order to accomplish the mathematical goals of the lesson.	*Echevarria & Short, 2010*

The use of sentence stems and frames, for example, is a high-leverage strategy that supports MLLs in accessing academic content while simultaneously building their language skills (Colorín Colorado, n.d.). Sentence *stems* serve as open-ended sentence starters that provide structure for students at varying levels of English proficiency, helping them organize and express their thoughts more effectively (Zwiers et al., 2017). Meanwhile, sentence *frames* act as fill-in-the-blank structures, scaffolding students' understanding of language patterns and enabling them to engage in academic discourse with greater confidence (Chamot & O'Malley, 1994). Together, these scaffolds address critical language demands and ensure that students can participate fully in mathematical discussions, furthering their fluency in both content and language (Zwiers et al., 2017).

When sentence stems and frames are intentionally incorporated into direct instruction and materials, their impact on promoting language development and support to teachers is profound. It is critical to integrate stems and frames in a way that does not compromise the integrity of the content, but rather facilitates expression for students during the meaning-making process. These tools are adaptable across various content areas, allowing educators to meet the diverse proficiency levels of their students (Colorín Colorado, n.d.). In addition, preparing two-way conversational sentence stems can significantly enhance students' ability to navigate the natural rhythm of academic conversations during sensemaking (Zwiers et al., 2017). By providing this structured yet flexible support, teachers create opportunities for students to engage meaningfully in dialogue, ensuring they can articulate their ideas and respond thoughtfully to their peers (Chamot & O'Malley, 1994).

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Whether these scaffolds are designed to be content-agnostic or tailored to specific subject areas, they remain versatile tools for cultivating collaborative learning environments. It is important to note that sentence frames and stems can also be translated and provided to students in their home language, prioritizing and supporting mathematical sensemaking. This flexibility not only helps students build the conversational skills necessary for group interactions but also deepens their academic language development and mathematical reasoning (Zwiers et al., 2017; García & Solorza, 2020). As a result, sentence stems and frames emerge as multifaceted and essential strategies for educators striving to support MLLs.

Connecting to the California Math and ELA/ELD Frameworks

Among the many frameworks available, the California (CA) Mathematics Framework and the California (CA) ELA/ELD Framework—specifically the ELD Standards—stand out as particularly comprehensive, providing clear and detailed guidance to support both language development and academic achievement for MLLs. These frameworks advocate for linguistically responsive instruction, integrating language development into mathematical learning (California Department of Education, 2014). The ELD Standards provide research-based guidance on scaffolding language acquisition, fostering an environment where MLLs can engage deeply with rigorous content (Zwiers et al., 2017).

The California Department of Education (2014a) highlights the importance of students being able to "use language purposefully to make sense of mathematics and to express their mathematical thinking in both written and oral forms." This emphasizes the need to integrate language and content instruction, supporting functions like reasoning, explaining, and justifying to ensure equity for MLLs. While the CA Math Framework and CA ELA/ELD Framework are valuable resources to engage in fully, captured below is a high-level synthesis of each's objective, instructional purpose, and language focus.

CA Mathematics Framework		
Objective	***Instructional Purpose***	***Language Focus***
Provides guidance on effective mathematics instruction, emphasizing conceptual understanding, problem-solving, and equity in math education *(California Department of Education [CDE], 2023).*	Encourages student discourse, multiple representations, and problem-solving strategies that help all learners, including multilingual students, engage in math meaningfully *(CDE, 2023).*	Recognizes language as a tool for mathematical reasoning and promotes strategies to support MLLs in engaging with math content *(CDE, 2023).*
CA ELA/ELD Framework		
Objective	***Instructional Purpose***	***Language Focus***
Specifically designed to support English learners (ELs) in developing language proficiency while accessing academic content *(CDE, 2014).*	Emphasizes academic language, communication skills, and language scaffolds that support ELs in all subject areas, ensuring access to rigorous content while they develop English proficiency *(CDE, 2014).*	Centers on language development and how students acquire English in different contexts, including designated (explicit language instruction) and integrated (content-based) ELD approaches *(CDE, 2014).*

Although serving distinct purposes, both frameworks work in tandem to best support educators in providing high-quality, equitable instruction.

Call to Action

Using the prompts below, consider the previously outlined practices and reflect on how they can be applied or adapted to your own context to better support MLLs in mathematics.

- How does your current practice—whether in a classroom, coaching role, or leadership position—support or hinder linguistically sustaining learning experiences?
- What concrete strategies can you implement to promote linguistically sustaining practices, whether in direct instruction, curriculum development, or professional learning?
- How do you currently integrate language development into content learning? What shifts could be made to strengthen this connection?
- In what ways do you create opportunities for multilingual learners to authentically express their thinking?
- How can practices that uplift multilingual learners enhance engagement and understanding for *all* students, educators, or community members you work with?

Closing Thoughts

Authentically empowering MLLs in mathematics requires a commitment to linguistically sustaining practices and equitable language development. It is critical to integrate linguistic support in ways that honor the depth and complexity of mathematical learning. By addressing the linguistic demands of the content without compromising mathematical integrity, educators can create inclusive environments where students' language and content knowledge develop simultaneously. Supporting all MLLs to leverage the power of their home language(s) and harness a deeper understanding of academic language in mathematics ensures they have the tools they need to thrive and achieve their full potential within the discipline.

What is one concrete step you will take to advocate for and implement linguistically sustaining practices in your sphere of influence?

Suggested Citation

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