Positioning Multilingual Learners for Success in Mathematics

A joint position statement from NCSM: Leadership in Mathematics in Education and TODOS: Mathematics for ALL (Fall, 2021)

Our Position

NCSM: Leadership in Mathematics Education and TODOS: Mathematics for ALL (TODOS) prioritize policies and practices that position multilingual learners (i.e., children learning mathematics in languages that differ from their students' first languages) so that they can access, engage, and thrive in mathematics education. Accomplishing this will require a systemic approach and investments that influence policies and practices. These include professional development, infrastructure, curriculum, family/community engagement, language development, and mathematics teaching, learning and assessment.

We acknowledge that:

- The use of students' first language is a human right (Skutnabb-Kangas, 2000) and should be promoted in the mathematics classroom;
- Mathematics is a human activity;
- Race, class, culture, language, and their intersections play key roles in the teaching and learning of mathematics (see The Mo(ve)ment to Prioritize Antiracist Mathematics: Planning for This and Every School Year);
- Multilingual learners should be viewed as students who possess knowledge, strengths, and resources (i.e., asset-based rather than deficit-based lens);
- Every mathematics teacher is a language teacher — particularly the academic language used to formulate and communicate mathematics learning (Lager, 2006); and
- Leaders and teachers from mathematics and second-language acquisition should work collaboratively to accomplish this work, in cooperation with families.

Research that Informs This Position

We draw on earlier position statements from NCSM, TODOS, and NCTM; National Academy Consensus Studies (e.g., English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives); research in the field; and recent advocacy efforts such as the English Learner Success Forum and the Coalition for English Learner Equity.

Recognizing the Complexity of Our Current System
Positioning (Harré & Moghaddam, 2003) multilingual learners in mathematics must

involve an acknowledgement that the current system is inequitable (Gutstein & Petersen, 2013). Learning new approaches can be useful; however, teaching strategies will not address some of the larger issues that multilingual learners and their families encounter. Educators must understand the complexities of the current systems as well as advocate for eliminating injustices that may occur in mathematics classrooms (de Araujo et al., 2018; Gutiérrez, 2013).

Multilingual learners should be intellectual leaders in their classrooms. When we acknowledge that multilingual learners already speak at least one language and are learning another in addition to other content, we begin to recognize multilingual learners' capabilities (Ewing, 2020). Everyone can learn from multilingual learners' complex knowledge and experiences when we position languages and cultures as valuable assets (Ladson-Billings, 2014; Orellana, 2016). Accomplishing this vision will require a focus on practices and policies in relation to different components of the system as outlined below.

Professional Development

Teaching mathematics to multilingual learners in today's context is challenging and complex, requiring teachers who have developed specialized knowledge and competencies (Chval & Pinnow, 2010). Certification requirements within teacher preparation programs limit opportunities to learn about teaching mathematics to multilingual learners. As a result, states/territories/provinces and communities need to make investments in professional development to equip teachers throughout their careers.

Professional development must be designed so that it is active, sustained, coherent, collaborative, and reflective (Garet et al., 2001). Furthermore, learning opportunities must be situated so that teachers have opportunities to learn from practice (Kazemi & Franke, 2004; Whitcomb et al., 2009) and develop productive beliefs about multilingual learners.

The National Academies' Consensus Study, *English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives*, identifies themes from research that show promise for equipping mathematics teachers, coaches, and professional development facilitators to work with multilingual learners including:

1. Explicit integration of mathematics and language (Khisty, 1995; Moschkovich, 2015);
2. Use and adaptation of innovative curriculum (Chval & Chávez, 2011; Sandoval-Taylor, 2005; Pitvorec et al., 2011);
3. Shared professional learning experiences for TESOL and content teachers;
4. Facilitation of multilingual instructional approaches (Celedón-Pattichis & Ramirez, 2012; Chval et al., 2021; Turner, et al., 2013);
5. Engagement with families (Civil & Andrade, 2003; Civil, Bratton, & Quintos, 2005; Civil & Menendez, 2010);
6. Use of culturally-sustaining pedagogies (Paris, 2012) and explicit attention to equity (Gutiérrez, 2012; Aguirre & Civil, 2016); and
7. Targeted teacher learning around common societal biases and deficit beliefs (Bianchini, 2018; de Araujo, 2017; de Araujo et al., 2016; Gándara et al., 2005; Ogbu & Simon, 1998).

Infrastructure

A number of factors influence multilingual learners' access and inclusion in rigorous mathematics. For example, policies and requirements related to course taking, funding, staffing, graduation, and teacher certification at the federal, state/territory/province, and local levels can either facilitate or hinder multilingual learners' access to and success in mathematics.

School districts need leaders who create structures that promote a culture of shared responsibility for teaching multilingual learners (Brooks et al., 2010; Theoharis & O'Toole, 2011). It is also important to integrate language and content within and between state/territory/province, district, and school levels. This includes integration within system components — including instruction, curriculum, assessment, professional development, and policies

for categorizing multilingual learners (National Academies, 2018).

Durán (2008) argued that the use of large-scale assessments as accountability tools for multilingual learners may be misleading about informing schools about the learning capabilities of students (National Academies, 2018). Educators must use care in using them for placement of their multilingual learners.

Every level of the system needs investment and intentional strategy in building capacity and infrastructure to ensure success of multilingual learners in mathematics, and everyone involved must be part of the solution.

Multilingual Learners' Language Development
Using students' first language is a human right (Skutnabb-Kangas, 2000) in the mathematics classroom. Some students enter schools with well-developed home language literacy skills in speaking, listening, writing, and reading, and can transfer mathematical concepts from their home language to English by adding new labels for these concepts. Multilingual learners who have had incomplete or interrupted formal schooling will need "…to develop a foundation of literacy in any language, as well as an understanding of cultural norms of schooling" (García et al., 2017, p. 129).

There is ample support in the literature for engaging multilingual learners in mathematics before they have developed English as an additional language—students can learn academic language and mathematics concepts simultaneously (Barwell, 2003; Moschkovich, 2013). Teachers can draw from multiple languages spoken in their classrooms to support students as they engage in a mathematics discourse community (Musanti & Celedón-Pattichis, 2013; Willey, 2010). It also helps to create a hybrid space where multilingual learners can use their linguistic repertoires by combining their home language with English. This is called *translanguaging*--the ability to communicate in between languages to facilitate meaning making (García & Wei, 2014) of mathematical concepts (Maldonado et al., 2020).

Being part of a mathematics discourse community requires that students know how to engage in mathematical practices (NCTM, 2014) by learning norms for participation. As multilingual learners add English to their linguistic repertoire, some may be at beginning, intermediate, or advanced stages of English language development. Regardless of what stage multilingual learners are in their language development, teachers can afford opportunities for them to engage in cognitively demanding tasks that provide multiple entry points and leverage bilingualism to facilitate mathematical meaning making (Chval & Khisty, 2009; Khisty, 1995; LópezLeiva, Torres, & Khisty, 2013; Moschkovich, 1999; Turner & Celedón-Pattichis, 2011).

Mathematics Teaching, Learning, and Assessment
When educators have high expectations and engage multilingual learners in rigorous mathematical tasks, students learn concepts and develop mathematical proficiencies (Ramirez & Celedón-Pattichis, 2012). Multilingual learner success requires establishing environments in which teachers and students respect one another, consider agency and identity, value partnerships, and position multilingual learners as leaders (Aguirre, et al., 2013). This can be done by providing opportunities for multilingual learners to listen, speak, read, and write, in conjunction with linguistic scaffolds (Gibbons, 2015; Murrey, 2008). Inviting students to use multimodal representations and resources such as gestures, drawings, diagrams, manipulatives and technology will support them as they represent their mathematical solutions and communicate their thinking. Doing so can enhance multilingual learners' participation (Dominguez, 2005; Fernandes, Kahn, & Civil, 2017; Sorto and Bower, 2017; Zahner et al., 2012; Zahner & Gutiérrez, 2015).

The National Academies' Consensus Study, *English Learners in STEM Subjects: Transforming Classrooms, Schools, and Lives*, identifies promising

instructional strategies to include in professional development such as:

1) Position multilingual learners for success in mathematics classrooms;
2) Engage students in disciplinary practices;
3) Engage students in productive discourse and interactions with others;
4) Utilize and encourage students to use multiple registers and modalities;
5) Leverage multiple meaning-making resources; and
6) Provide explicit focus on how language functions in the discipline.

Not only should educators encourage multilingual learners to use their first language when learning mathematics, educators also should consider their culture (de Araujo et al., 2018). For example, multilingual learners who learned mathematical conventions or algorithms in other countries may use different approaches to calculations (Kersaint, Thompson, & Petkova, 2014). They may write mathematical representations and numerals in different ways from students who have been introduced to them in the United States and Canada.

It is also critical to consider effective formative assessment practices for multilingual learners. For example, students' drawings could reveal their comprehension of mathematics separate from their linguistic challenges (NAS, 2018).

Curriculum

Given students' varied cultural, educational, and life experiences, teachers must consider how their curriculum facilitates or restricts access to mathematics and language (Chval et al., 2021; Doerr & Chandler-Olcott, 2009; Drake, et al., 2015). Building on multilingual learners' funds of knowledge leads to engagement of children in problem solving that is both meaningful and mathematically rigorous (Civil & Andrade, 2002; Turner & Bustillos, 2017).

Mathematical contexts that are related or connected to multilingual learners' life experiences can support their language and mathematical learning (Barwell, 2003; Domínguez, 2011; Domínguez et al., 2014; Secada & De la Cruz, 1996); however, there is not one curriculum that is relevant to all students (Gutstein, 2003). Pitvorek, Willey, and Khisty (2011) analyzed the core features of the Finding Out/Descubrimiento curriculum materials, which demonstrated significant improvements for multilingual learners in both development of content and language. They argue that mathematics curriculum should have features that create different types of learning spaces for multilingual learners, capitalize on their resources, and use a principled approach informed by research on bilingual learners. Moreover, teachers need to be strategic in selecting, enhancing, and introducing contexts that can expand multilingual learners' understanding of the world. It is critical to consider the **mathematics** content and **language** as teachers create or adapt contexts from curriculum materials (e.g., see English Learner Success Forum Mathematics Guidelines).

It is not enough to simply change the names in a math task for the context may not be meaningful or familiar to students. One way to identify relevant and meaningful contexts is to draw on students' community and cultural knowledge (Vomvoridi-Ivanovic, 2012). As teachers create or adapt curriculum materials, it is important that the task maintains its mathematical rigor (Chval & Chávez, 2011).

Families and Communities

Civil and Menéndez's 2010 research brief prepared for NCTM emphasizes the importance of (a) learning from parents' and families' experiences and knowledge; (b) offering workshops and short courses in mathematics for parents/guardians and their children; (c) creating spaces for parents [and families] to discuss issues related to teaching and learning mathematics; and (d) conducting classroom visits with parents [and families]. They report "ample evidence" that indicates a positive relationship between culturally and linguistically diverse parents' involvement and their children's achievement in school. Civil and Andrade (2003) talk about a redefinition of parental participation in their children's

education as moving from parent-as-caregivers to parent-as-intellectual to parent-as-teacher.

In one study (Civil, Bratton & Quintos, 2005), mothers of multilingual children participated in a program aimed at expanding the vision of parent/guardian participation in school mathematics. Before the program, the mothers did not feel like they had much power in their children's education. They participated in intellectual activities such as learning algebra from a conceptual perspective in order to help their children with homework. Once the researchers acknowledged parents' ways of knowing and doing math, the parents/guardians felt more confident in their interactions with teachers and more empowered to participate in the academic development of their children.

For multilingual students to experience the full benefit of schooling, we must engage parents/guardians in their children's education in different ways, especially for mathematics. To do this, school personnel must reach out to families in ways that position parents/guardians as "intellectual resources" (Civil & Andrade, 2003). They must approach this work from an asset-based perspective by learning about the knowledge, strengths, and resources that students, families and the community bring to students' learning in mathematics.

How All Stakeholders Can Implement This Position Statement

NCSM and TODOS members must act to create and sustain the conditions and structures that will enable all multilingual learners to fully participate in our classrooms and successfully learn mathematics. Members must act to convince stakeholders that it is time to abandon incidental strategies and implement intentional, systemic approaches to accomplish this charge. In support of this position statement, NCSM and TODOS offer the following recommendations.

1. Advocate in the broader community so that multilingual learners and their families take advantage of networks, pursue opportunities, and access resources.

2. Learn from families; respect what they do, know, and value; and leverage the funds of knowledge in mathematics.

3. Establish, participate in, and sustain professional development communities of mathematics and ESL teachers, preservice teachers, specialists, coaches, and administrators to positively position multilingual learners.

4. Establish district and school-wide structures that promote collaboration among teachers of mathematics, TESOL specialists, staff, administrators, counselors, and other teachers.

5. Provide multilingual learners with opportunities for advancing their learning by examining their mathematical thinking and use of language. For example, observe multilingual learners solve problems in real time to assess their mathematical understandings. Interview multilingual learners to provide greater depth and detail of their mathematical thinking that cannot be garnered from their written work alone (Castellón et al., 2011).

6. Enhance mathematics curricula to leverage multilingual learners' assets.

7. Realize that classroom participation — in the form of discussing, explaining, writing, and presenting — is critical to multilingual learners' success in mathematics.

8. Evaluate and eliminate current policies, practices, and resources that have the potential to negatively affect multilingual learners' access to learning opportunities (e.g., in relation to classification, course-taking, and tracking).

9. Lead discussions with various stakeholders about the research literature and recommendations related to teaching multilingual learners.

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