

## Transmodalising for Equitable Mathematics Instruction for Multilingual Classroom

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### Abstract

This paper introduces a repertoire of practice called *transmodalising* to support discursive practices in the multilingual mathematics classroom. Using the transmodal framework, we describe a classroom vignette of a mathematics classroom using translanguaging and transmodalising that promoted discursive practices and equitable access to rigorous mathematics for emergent bilingual learners. Our discussion highlights the ways in which transmodalising practices align with research-based recommendations for mathematics instruction for English learners (ELs) by treating language as a resource, supporting ELs' participation in mathematical discussions while learning English, and drawing on all meaning-making resources, including home languages, multimodal tools, and out-of-school experiences.

### Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. What do you know about translanguaging or transmodalising pedagogy that draws on students' home language and other meaning-making modes for classroom instruction?
2. What kinds of instructional supports have you used to enhance your English learners' access to the mathematics concepts, as well as their participation in mathematics discussion?

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## Transmodalising for Equitable Mathematics Instruction for Multilingual Classroom

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The increasing diversity of classrooms offers opportunities for classroom teachers to draw on the diverse capacities of their students for classroom instruction and interaction. For example, an English-speaking teacher might teach a class of 19 students, among which 18 students are English learners (ELs) or who we prefer calling emergent bilingual learners (EBLs) from an asset-based orientation<sup>1</sup> whose different national, ethno-racial, cultural, and linguistic backgrounds can build a wealth of cultural and linguistic knowledge and experiences. However, such classroom diversity, often called *superdiversity* (Vertovec, 2007), has also generated numerous challenges for teachers without specialized preparation in serving EBLs. Challenges persist partly due to the misconception among content teachers that language development and content learning are two separate areas, and it is the English as a second language (ESL) specialist's job to support ELs' language and content learning. Many teachers, while endorsing cognitive skills such as reasoning, inferencing, and critiquing, have not attended to the critical role of language in conducting these cognitive tasks (Zwiers, 2014). Mathematics is one such content area where many conceive that language does not play as big of a role as in language arts or social studies (Gunderson, 2000; Wright & Li, 2008). The language of mathematics, however, is highly complex and necessary to access and comprehend mathematical concepts (Moschkovich, 2012; Veel, 1999). In fact, the Common Core Standards for Mathematical Practices (CCSSM, 2010) heavily rely on discursive skills to make sense of problems, construct viable arguments, and critique the reasoning of others (Moschkovich, 2012).

Mathematical content knowledge is accessed, constructed, and acquired through participating in mathematical discourse practices composed of both verbal and non-verbal activities (Moschkovich, 2015). This requires a broader participation of the learner in an

environment that is rich with the specialized language or discourse of mathematics that Turkan et al. (2014) referred to as Disciplinary Linguistic Knowledge (DLK). An inviting classroom culture promotes participation in such academic discourse practices and increases students' access to rich curricular opportunities, which in turn contributes to students' academic achievement (Zwiers, 2014).

We propose that the pedagogy of translanguaging and transmodalising is an essential feature for equitable mathematics instruction for multilingual classrooms and has the potential to transform power of participation in the mathematics classroom. Drawing on Gutiérrez's (2009) equity framework of access, achievement, power, and identity, we see that teachers have a pivotal role in how *power* transformation can occur by measuring the "voice in the classroom" (p. 6), who gets to talk in the classroom. The shifted power distribution recognizes what students already know, provides students *access*, and engages every student as a creator of mathematical knowledge, while constructing what "competent mathematical behavior" looks and sounds like in the mathematics classroom (Gresalfi, Martin, Hand, & Greeno, 2008, p. 68). In other words, by allowing all students to have voice, teachers can ensure equitable ownership of ideas and opportunities to learn about mathematics, and thus increase *achievement* by encouraging mathematical justification. By using different modalities (i.e., concrete/digital manipulatives, pictures, and gesture) and drawing on multiple resources of knowledge including linguistic resources, we posit that transmodalising and translanguaging supports the equity-based mathematics teaching practices as described by Aguirre et al. (2017) to enhance learners' *identity* by leveraging multiple mathematical competencies and has the potential to invite participation of ELs who typically are marginalized in the mathematics classroom.

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<sup>1</sup> We use both terms, English learners (ELs) and Emergent Bilingual Learners (EBLs), for different contexts but mainly to refer to students from families of non-English speaking

backgrounds. We kept the less asset-oriented term "ELs" for the context in which students are officially designated with the term through school assessment system.

Attending to the call for more equitable mathematics education for EBLs, in this paper we share a case study of an elementary classroom teacher who incorporated the pedagogy of translanguaging and transmodalising to address her EBLs' needs to learn language and content at the same time. The guiding research question was: How can an elementary mathematics teacher enhance equitable learning experiences of EBLs through the translanguaging and transmodalising mathematics pedagogy? In the following sections, we first provide a brief review of translanguaging and transmodalising pedagogy and description of the graduate TESOL (Teachers of English to Speakers of Other Languages) course context in which the teacher participated. Then, we examine how the teacher responded to the pedagogy, reflected in her lesson planning and implementation.

### **Defining Core Practices around Translanguaging and Transmodalising Pedagogy**

Translanguaging pedagogy prioritizes instructional practices that build on students' entire meaning-making repertoires (García, 2009). It views students' communicative repertoires and practices as fluid and flexible without dichotomizing one's language of home/community and language of school. For example, a translanguaging classroom allows students to flexibly use both English and their home language(s) in order to access the content, brainstorm and share ideas, and express their learning (Cellic & Seltzer, 2011). Such linguistically inclusive pedagogy needs teachers to forgo the idea of teacher control over students' talk and to adopt the collaborative instructional model that acknowledges student agency in drawing from a broader set of funds of knowledge, and ways of thinking, viewing, and expressing their learning and identity (Moll et al., 1992).

Transmodalising pedagogy is an extended translanguaging pedagogy that includes all meaning-making modes such as linguistic, audiovisual, gestural, and digital modes (Hawkins, 2018; Kress, 2011). All modes, separately or combined, contribute to classroom learning. Extending from the *multimodal pedagogy* as providing multiple modes for students' meaning-making and express, *transmodalising pedagogy* (Newfield, 2014) engages both the teacher and students in a cognitive process of choosing and translating messages from one

mode to another, or combined modes. As such, transmodal translation occurs as active and ongoing meaning-making processes, rather than as a one-time event using one or the other mode (Kress, 2000). Such coordination of meaning across different modes is a powerful stimulus to learning. For example, a teacher can verbally introduce key mathematics vocabulary words using a visual dictionary accompanied by gestures for students whose English proficiency may not support understanding of key concepts if delivered in English only (Shein, 2012). Total Physical Response, sing-aloud, gallery walk, and smart board, for example, are multimodal tools to transform a message in one mode into another or a combined modal status with increased potential of getting the message across.

In our study, teachers were first provided with opportunities to understand and practice the frame of translanguaging pedagogy as a means of allowing students to draw on their full set of linguistic resources, including their home language. Then the transmodalising pedagogy was highlighted to expand teachers' understanding of discursive practices to include how language and other modes can work together to increase comprehensible input (Krashen, 1985) for EBLs. In this paper, we present a detailed vignette of *transmodalising* moments as an example of how a teacher and her students can shift from one mode to another and combine diverse modes in order to teach, learn, and communicate key content concepts (Kress, 2000; Newfield, 2014).

### **Study Context and Data**

The case teacher, Lydia, took a 16-week Spring 2019 graduate course, *Methods of Teaching Culturally and Linguistically Diverse Learners*. Students in this course were a cohort group of 15 in-service teachers in an increasingly diverse school district. For our case study, Lydia (pseudonym) was selected for the following reasons: (1) her class was a superdiverse classroom, where more than 50% of students were EBLs, and (2) Lydia was responsive to the transmodalising and translanguaging pedagogy evidenced in her lessons, providing a good model for teachers to adopt for their mathematics lesson with diverse students.

Lydia was a first-grade classroom teacher with 11 years of teaching experiences in a school, where 65% of students were classified as ELs. In her classroom, just one

of her 19 students was a native English speaker; the rest were all EBLs from diverse immigrant backgrounds, such as Mexico, El Salvador, Guatemala, Honduras, India, Vietnam, and Morocco. Two students were former ELs, who were at the monitoring stage before exiting the English as a Second Language (ESL) service, and one started school fully proficient in English and spoke Vietnamese at home. Fifteen students were ELs with 10 student at WIDA (World-Class Instructional Design and Assessment test) English proficiency level 1 (entering stage), one at level 2 (developing stage), three at level 3 (developing stage), and one at level 4 (expanding stage).

For our case study, we analyzed Lydia's online discussion posts on Blackboard, teaching videos, simulated teaching demonstration, reflection papers, and final unit plan. Written data were analyzed using the constructive grounded theory approach of open and axial coding, constant comparison, and memo writing (Charmaz, 2010), yielding main categories such as linguistically and culturally responsive teaching strategies, teacher perception of translanguaging pedagogy, transmodalising moments, and remaining challenges. Secondly, Lydia's teaching video was analyzed using the multimodal discourse analysis approach (Kress, 2009) to capture how the mathematical discourse has taken place and evolved in her lesson, especially attending to the transmodal moments of how the teacher employed and transitioned across multiple modes to facilitate EBLs' mathematical discourse practices.

### **Translanguaging and Transmodalising Mathematics Classroom in Action**

In this section, we present how Lydia's understanding of translanguaging and transmodalising pedagogy has evolved and manifested in actual lessons, particularly through a detailed sketch of one mathematics lesson in her classroom.

#### **Emerging Translanguaging Practice**

My concept of translanguaging has been improved throughout the semester... It is extremely useful and students should be allowed to use their native languages. I do think that I'd like to learn even more

about strategies for implementing it with young children... I use Spanish labels in my classroom. My students often work with a partner to talk out what they are going to write about and plan for writing. This is extremely useful as they can talk through in whatever language they are most comfortable (most of my students speak Spanish) and they can help each other come up with the word/phrase they want to use... I read books that are bilingual. I also sometimes give directions using my rudimentary Spanish skills if I have students who are newly arrived to the country.

This excerpt, from Lydia's unit plan analysis paper, illustrates how she viewed her perspective and practice of translanguaging change during the course. Lydia had adopted a number of strategies for supporting students in fluidly moving between languages. For mathematics instruction, for example, Lydia employed a range of translanguaging strategies to facilitate students' mathematical discourse practices. She expressed that she might better facilitate translanguaging if she were a bilingual or had better proficiency in Spanish. However, her practice demonstrated how even a monolingual teacher with limited multilingual experiences can promote translanguaging in the classroom using such strategies as sharing bilingual (English-Spanish) content and language objectives (LOs) (see Figure 1), reading bilingual books, providing key vocabulary words in both English and Spanish as well as translated directions for class materials, and allowing students to brainstorm and discuss in their home language. She also shared how the use of translanguaging strategies enhanced students' performance across content areas: "I allow my students to speak in their preferred language. This allows students to communicate their ideas effectively, and to understand the directions which leads to higher performance on assessments." Connecting to the students' extended linguistic repertoires, and thus, their ways of thinking and communicating beyond what monolingual English classrooms normally allow, is to recognize students' abilities to make sense of the concepts and discourses through their expert language and identity resources. This, in turn, increases students' motivation and engagement with the content learning and discourse practices even when the teacher does not share students' languages and knows only one or two languages at best (Celic & Seltzer, 2011).

## Figure 1

English-Spanish Bilingual Learning Objective (Final Unit Plan of Lydia)

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Content Objectives – **As a result of this lesson, students will be able to:**

- 1. Identify a penny and its value as 1 cent.**
- 2. Count a collection of pennies and identify their value.**

Objetivos de contenido- **Como resultado de esta lección, los estudiantes podrán:**

- 1. Identificar un centavo y su valor como 1 centavo.**
- 2. Cuente una colección de centavos e identifique su valor.**

Language Objectives – **As a result of this lesson, students will be able to:**

- 1. Identify a penny and name the value as 1 cent orally and in writing using anchor charts and their money book.**
- 2. Count pennies using real pennies and pictures and orally name and write the value.**

Objetivos del lenguaje- **Como resultado de esta lección, los estudiantes podrán:**

- 1. Identifique un centavo y nombre el valor como 1 centavo oralmente y por escrito utilizando tablas de anclaje y su libro de dinero.**
  - 2. Cuente los centavos usando centavos reales e imágenes y nombre y escriba oralmente el valor.**
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## Strengthening Transmodalising Pedagogy

Throughout the course, Lydia’s use of multimodal instructional tools became more purposeful and tailored for EBLs with increased transmodalising moments across written, spoken, audiovisual, and gestural modes of communication. Lydia reflected on the practice and effect of her transmodalising pedagogy:

I also use a lot of visuals and realia, and explicitly teach vocabulary. This allows my students to connect with the words being spoken. I also use a lot of total physical response which allows students to connect a gesture to a concept. Similarly to translanguaging, I often see a stronger performance from my students when I do these things.

With 11 years of teaching experience, Lydia’s multimodal instruction and interaction with the students may have already been a routine in her classroom with young learners. What we noticed and highlight in this paper was her awareness of why and how transmodalising (and translanguaging) can help EBLs better understand content concepts that otherwise would be difficult to grasp and express. Below is a vignette of one such transmodalising mathematics lesson Lydia used with her first-graders.

**Lesson on equation.** Lydia started by sharing content and language objectives of how to solve the equations, *written*

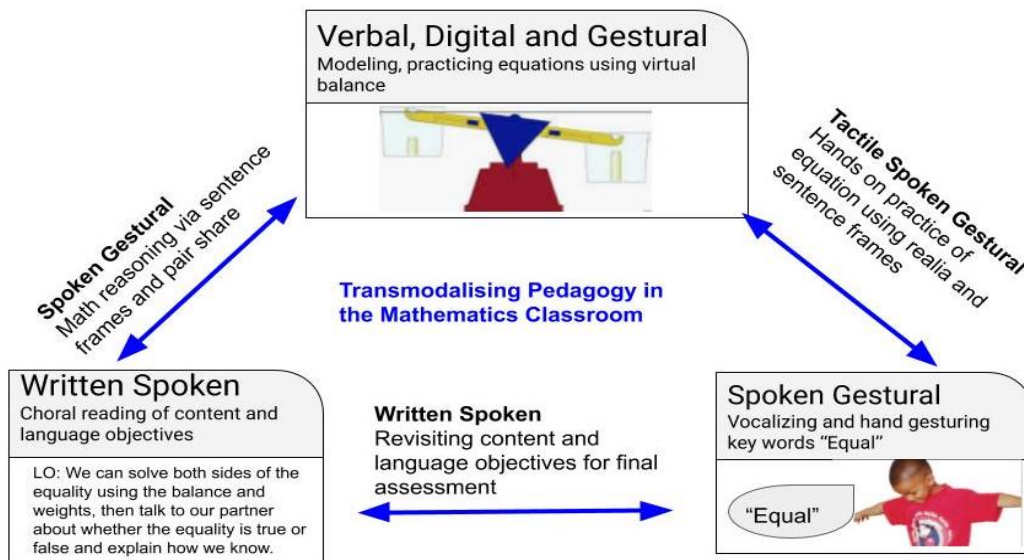
in student-friendly language, voiced using *choral reading* with students. She then *asked* students, “Who can remind me what ‘equal’ means?” Repeating a student’s answer, she then *gestured with her hands* to make a balance to describe how both hands can hold “equal” amounts to reinforce the concept and the meaning of the word “equal,” the key mathematical disciplinary vocabulary and linguistic knowledge (DLK) for this lesson. With her prompt, students all *motioned* to create a body balance following the teacher’s gesture, a brief formative assessment of students’ reception of the concept through gesture. While explaining the definition of ‘equal’ and ‘equality’ through *verbal and gestural modes*, she also added a *digital mode* of showing and solving the equation problems on the smart board. Subsequently, repeated modeling of solving equation problems was accompanied by Lydia’s *hand gesture* and using the *verbal* discourse patterns of “what do we do to make this balanced?” “How do we know?” to enhance students’ mathematical reasoning processes and discourse usage. After the teacher modeling, Lydia introduced a routine called True and False Equation for which she had her students *turn and talk* to justify their reasoning by using *sentence frames* stating, “I think it’s true because...” or “I think it’s false because...” Students’ reasoning came in the form of the full sentence structure, guided by the sentence starter and the modeled hand gesture of balancing on

either side of their hands. Alternating between the *pair-share* and the *whole group discussion*, Lydia provided multiple opportunities for students to produce, express, and share the mathematical discourse using mathematics-specific academic language such as, “equal”, “balance,” and “equality”, as well as expressions to support reasoning, such as “it is true[false] because...” Later in the same week, Lydia hosted a small group session for those who needed additional scaffolding for equations, using manipulatives (a balance scale with weights) for the *hands-on* experience, and making a *verbal reasoning* with the help of modeled sentence starters and teacher prompts asking, “How do we know? We need to decide if this is true or false, and why. *Turn and talk* to your partner.” Finally, Lydia revisited the learning objectives by *orally reading and checking* in with students’ comprehension as the final assessment. Figure 2 illustrates the synergetic collaboration across multiple modes through transmodal mathematical discourse practices in Lydia’s classroom.

In this written vignette and the multimodal teaching video, one can see and hear how Lydia strives to work on shifting the *power* by inviting her students, most of whom were EBLs (those who are typically marginalized), to

have voice through reading, speaking, watching, listening, and gesturing, and to collaborate using academic mathematical discourses to comprehend concepts of equation and express their reasoning linguistically and multimodally. Lydia’s transmodalising instruction provided multiple entry points into mathematics concepts that were being taught. Along with the increased *access* to the mathematics concept of equation, transmodalising also enabled students to express their learning in more than one way, which in turn promoted opportunities for students to actually use mathematical DLK and mathematics-specific language for their reasoning and problem solving as evidenced in Lydia’s lesson. For example, in her teaching video, Lydia did not dominate the classroom talk, but facilitated teacher-student dyads, as well as student-to-student conversation using combined modes of academic sentence starters, gestures, and realia. In this transmodalising lesson, all EBLs actively participated in mathematical discourse practices for greater *achievement* in understanding the mathematics concept and acquiring mathematics DLK, fostering their *identity* as competent mathematics learners at the same time.

**Figure 2**  
*Transmodalising Moments in Lydia’s Mathematics Classroom*



**Interactive Mode:** Whole Group → Pair-Share → Whole Group

## Implications

As teacher educators in mathematics education and TESOL, we provided an example transmodalising mathematics lesson in which students' funds of knowledge, ways of communicating and interacting outside of school, and other semiotic modes were incorporated to increase students' mathematical discourse practice. Despite potential challenges from the highly diverse context and the district policy of English-only instruction, Lydia went beyond her comfort zone to establish a more equitable and effective mathematics classroom where students were invited to a mathematical discourse community and could flexibly draw on all communicative repertoires (Rymes, 2014). The transmodalising moments described in this paper present one such classroom example, where almost all students were EBLs and supported by the classroom teacher with transmodal facilitation of students' mathematical reasoning, problem solving, and discourse practices.

For mathematics lessons with EBLs, we suggest that teachers promote students' engagement in mathematical discourse practices by: (1) drawing from students' full language repertoires including their home language practice, for example, by allowing students to talk, brainstorm, and write in whatever language(s) they feel comfortable, and (2) teaching and reinforcing mathematical concepts through different types of linguistic and multimodal practices including teacher-student dyads, small-group student discussions, teacher modeling, and activities using manual and digital realia. Such purposeful designing of transmodalising lessons can maximize students' access to and output of their mathematics learning. Likewise, the transmodalising approach can help teachers address the often unsupported mandate for ELs to simultaneously acquire a new language and new challenging content within a short window of time (Menken, 2006).

Transmodalising practices align with research-based recommendations for equitable mathematics instruction for EBLs (Gándara & Contreras, 2009; Moschkovich, 2013), supporting the idea of (1) treating language as a resource, not a deficit; (2) addressing much more than vocabulary and support EBLs' participation in mathematical discussions as they learn English; and (3) drawing on multiple resources available in classrooms (i.e., objects, drawings, graphs, and gestures), as well as

home languages and experiences outside of school. Enacting the core practice of translanguageing and transmodalising as one of the instructional repertoire will ensure that the mathematics classroom embodies the four dimensions of equity proposed by Gutiérrez (2009) by increasing *access* to content through rich tasks as well as greater participation in a discursive classroom, which will provide students more ownership in their learning, leading to greater student *achievement*, *empower* students' agency in learning, and provide more opportunities for *identity* work as EBLs.

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### Discussion and Reflection Enhancement (DARE) Post-Reading Questions

1. How does translanguaging and transmodalising help teachers transform the power distribution in the mathematics classroom in ways that enhance EBLs' participation in mathematical discourse practices?
2. How can you draw on different modalities (i.e., concrete/digital manipulatives, pictures, and gestures) and multiple resources of knowledge, including linguistic resources, to foster mathematical competence among all your students?
3. What other challenges and/or benefits do you envision adopting related to translanguaging and transmodalising pedagogy?