2019

# A Framework for Improving the Teaching of Mathematics to Bi/Multilingual Learners

Kara Mitchell Viesca
*University of Nebraska - Lincoln*, kara.viesca@unl.edu

Nicole M. Joseph
*Vanderbilt University*, nicole.m.joseph@vanderbilt.edu

Nancy L. Commins
*University of Colorado, Denver*, nancy.commins@ucdenver.edu

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Kara Mitchell Viesca,[1] Nicole M. Joseph,[2] and Nancy L. Commins[3]

1 University of Nebraska–Lincoln, Lincoln, NE, USA;
*email* kara.viesca@unl.edu [*Corresponding author*]

2 Vanderbilt University, Nashville, TN, USA;
*email* nicole.m.joseph@vanderbilt.edu

3 University of Colorado, Denver, CO, USA

**Abstract**

To teach mathematics well to bi/multilingual learners, we propose that mathematics teachers should consider the following five elements: know the content, know the language, know the learner, engage the community and assess meaningfully. This chapter defines each of these elements, explores how they are put into practice, and shares the responses of teachers who have participated in online professional development organized around each element. By approaching mathematics teaching with these elements in mind, teachers can more effectively support high levels of learning and achievement for bi/multilingual learners across levels of English proficiency and grade levels.

Published in L. C. de Oliveira et al. (eds.), *Teaching the Content Areas to English Language Learners in Secondary Schools*, English Language Education 17,
https://doi.org/10.1007/978-3-030-02245-7_9

## 1 Introduction

The framework for effective teaching and learning in mathematics classrooms presented in this chapter grows out of our work[1] to improve instruction for bi/multilingual students in the process of learning English. An essential component of the framework is an asset orientation to students, their linguistic repertoires, their cultural orientations and their background knowledge. Though these students are often referred to as English language learners (ELLs) by schools and districts, we deliberately refer to these students as bi/multilingual learners due to the bi/multilingual nature of their lives. Our intention is to push back against the deficit labeling of students according to a perceived or real deficiency in English rather than according to who they are: bi/multilingual. We also strive with this label to help all teachers view the possibilities rather than the challenges these students present.

## 2 Approach to Teaching Mathematics to Bi/Multilingual Learners: Our Framework

Our framework focuses on five important aspects that teachers need to think about and develop the related expertise: Know the Content, Know the Language, Know the Learner, Engage with the Community, and Assess Meaningfully. Each of the areas is defined and discussed below.

1 In 2011, the Department of Education Office of English Language Acquisition National Development Program funded eLearning Communities for Academic Language Learning in Mathematics and Science, or eCALLMS (PR Award # T365Z110177), focused on improving the preparation and education of content teachers to work with students in the processes of learning English. One of the major initiatives was to develop eWorkshops for practicing teachers to learn to work more effectively with the bi/multilingual students in their content classrooms. Our eWorkshops were developed to be inquiry-oriented, practiced based, multimedia online resources for collaborative professional learning communities of teachers (Viesca, Hamilton, Davidson, & The eCALLMS Team, 2016). This effort (now the ICMEE project: http://cehs.unl.edu/icmee/) produced over 30 eWorkshops, several specifically for mathematics teachers. The quotes from teachers in this chapter are drawn from online discussions among teachers engaged in the eWorkshops.

### *2.1 Know the Content*

The first step in being an effective mathematics teacher of bi/multilingual students is having strong content understandings. Generally, secondary mathematics teachers have strong content expertise; however, with new standards in place via the Common Core and other initiatives related to mathematics reform, most teachers are being asked to think about mathematics and teach it in ways that are potentially unfamiliar. For example, the Common Core Standards asks teachers to use the Standards for Mathematical Practice (SMPs) for teaching more conceptually, rather than procedurally. These standards focus more on "processes" such as connections, reasoning, communication, and representation. Consequently, we see it as important for teachers to deepen their understanding of content they are teaching multilingual students. To do this, mathematics teachers should examine standards, break them down and use a variety of resources to deepen, enhance and further their understandings. Teachers should also discuss and explore common student misconceptions.

### *2.2 Know the Language*

In order for mathematics teachers to understand the language of mathematics and the linguistic demands mathematics tasks put on students, it is important to become familiar with the ways in which students are expected to use language to interact with and understand mathematical concepts. This means looking closely at the aspects of language that students use in the mathematics classrooms (structures, functions & vocabulary) and analyzing the language of the mathematics texts in use, as well as the language students are expected to produce.

### *2.3 Know the Learner*

Lucas and Villegas (2011) argue that teachers of bi/multilingual learners need to know their learner's academic, cultural and linguistic backgrounds. We concur and suggest that teachers engage in a variety of approaches to accomplish this. For instance, we recommend interviewing one or two multilingual students about a mathematics

problem. This provides an avenue to learn about the students' mathematical thinking, as well as their language abilities to express their underlying thinking. Specifically, after such an interview with a multilingual learner, consider:

- Did the student(s) have any mathematical misconceptions that need to be addressed?
- Are the misconceptions common to all students or specific to multilingual students?
- Could misconceptions be related to cultural differences rather than language differences?
- What language structures and vocabulary did the multilingual student(s) use to express understanding?
- What languages structures or vocabulary were missing? How can these be addressed?

Engaging in an interview and reflecting on it with these questions offers important insights about the learner. One teacher who took this approach shared, "I've learned over the years and with working with my ELL students now in 6th grade, to listen to what they say about the lesson being taught, and hear what they do know and do not know." Listening to students can have profound impacts in assisting your efforts to make strong instructional and curriculum decisions.

Get to know learners in a variety of ways: via interviews, questionnaires, conversations with families, etc. Equally important is knowing how to put that knowledge about learners into practice via strong planning, curriculum and instruction.

### *2.4 Engage with the Community*

Engaging with students' families and communities is an important way to help contextualize mathematics learning as well as draw on local assets and resources that will support high levels of student learning. Students and their families and communities use mathematical concepts every day. Thus, teachers need opportunities to become familiar with students' every-day experiences. Considering the oral history traditions of many cultures, inviting a member of a student's family or community (potentially a church pastor, a storeowner, a youth

coach, etc.) to tell their own life story as a foundation for exploring mathematics principles is an excellent method of engaging with the community. This can also provide opportunities to bring languages other than English into the classroom.

### *2.5 Assess Meaningfully*

Assessing students meaningfully in a mathematics classroom where students have varying levels of English proficiency can be a challenge for many teachers. It is often easy to forget the way that language development intertwines with opportunities to express mathematical knowledge. Meaningful assessment practices are built on all of the other facets of the framework presented in this chapter about effective instruction for bi/multilingual students. By knowing the content, the language, and the learner and finding ways to connect with the community, it is easier to design both formative and summative assessments that will allow students to demonstrate what they know about the mathematics content whatever their level of English proficiency. When you have a clear sense of the distinction between the language demand and the mathematics content, you can see how students' content knowledge can remain hidden without language supports. Formative, linguistically responsive assessments allow teachers to learn more about students' mathematical thinking as well as language skills.

WIDA, a national consortium of states that provides resources for the instruction and assessment of bi/multilingual learners, has created English language development standards, assessments and resources to assist teachers in planning meaningful assessment. These WIDA resources help teachers learn about what students can do at various levels of English proficiency across grade levels and specifically in mathematics. The Can Dos descriptors explain how multilingual students process and use language for each language domain and level of language proficiency by grade level cluster. They also assist teachers in thinking about the cognitive challenge of tasks/assessments and how to design assessments with meaningful language supports. **Table 1** provides an example of some (but not all) of the writing Can Do's for the 9th–12th grade cluster.

The Can Do resources from which this example is drawn are downloadable in both English and Spanish. Additional resources from WIDA

**Table 1.** Examples of Can Do descriptors (n.d) for 9th–12th grade

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|---|---|---|---|---|
| Label content-related diagrams, pictures from word/phrase banks | Make content-related lists of words, phrases, or expressions | Complete reports from templates | Summarize content-related notes from lectures or text | Produce research reports from multiple sources |
| Provide personal information on forms read orally | Take notes using graphic organizers or models | Compose short narrative and expository pieces | Revise work based on narrative or oral feedback | Create original pieces that represent the use of a variety of genres and discourses |
| Produce short answer responses to oralquestions with visual support | Formulate yes/no, choice and WH-questions from models | Outline ideas and details using graphic organizers | Compose narrative and expository text for a variety of purposes | Critique, peer-edit & make recommendations on others' writing from rubrics |
| Supply missing words in short sentences | Correspond for social purposes (e.g., memos, e-mails, notes) | Compare and reflect on performance against criteria (e.g., rubrics) | Justify or defend ideas and opinions | |

include Speaking and Writing Interpretive Rubrics (2017) that are designed to document how multilingual students process and use language in the domain of speaking or writing for each level of English language proficiency. The rubrics are based on three criteria: linguistic complexity, vocabulary usage, and language control in grades K-12. By reviewing the rubrics and the Can Do descriptors, teachers can not only identify where students are at the moment, but also look ahead to the next level for ideas of where to move students. The Can Do resources are available by grade bands to work across content areas, including mathematics.

## 3 Theoretical Foundations of the Approach

Critical sociocultural theory and related instructional practices (e.g. Teemant, Leland, & Berghoff, 2014; Tharp, Estrada, Dalton, &

Yamauchi, 2000) provide a major foundation for our work. Tharp et al. (2000) described five Standards for Effective Pedagogy based on sociocultural theory as capable of transforming teaching for excellence, fairness, inclusion and harmony. The five standards are:

- Joint Productive Activity (where teaching occurs through assistance and joint production between teachers and students),
- Language and Literacy Development (where language and literacy instruction is attended to across the curriculum),
- Contextualization (where explicit connections are made in teaching and curriculum to students' lives outside of school),
- Teaching Complex Thinking (where students are challenged towards cognitive complexity), and
- Instructional Conversation (where teaching occurs through dialogue).

The research conducted on classrooms where these standards are put into place shows positive learning outcomes for students, particularly bi/multilingual learners (e.g. Doherty & Hilberg, 2007; Doherty, Hilberg, Pinal, & Tharp, 2003). For example, Doherty and Hilberg (2007) found that teacher use of the standards effectively predicted student outcomes in reading, comprehension, vocabulary and spelling and that teachers who used the standards consistently had higher student learning outcomes. Studies in mathematics have shown similarly positive outcomes. For instance, Hilberg, Tharp, and DeGeest (2000) found that students instructed with the Standards for Effective Pedagogy had greater achievement on standardized tests than those who were not and also had an increase in their positive attitude towards mathematics as well as their enjoyment of it. More recently, Teemant et al. (2014) added an additional standard to these five that they termed "critical stance." While the original five Standards for Effective Pedagogy tacitly included elements of critical pedagogy (e.g. dialogic learning, collaboration, etc.), as an instructional model the five standards for effective pedagogy did not overtly focus on power relationships, student agency or exploring multiple perspectives (Teemant et al., 2014). This added standard focuses specifically on teaching to transform inequities and working with students to take leadership in transforming issues of inequity through democracy and civic

engagement. It provides the underpinning of the mindset that mathematics teaching in linguistically and culturally diverse contexts must explicitly seek to connect the instruction to children's lives and address any inequities present in the mathematics classroom.

The rich work regarding culturally responsive/relevant teaching (e.g., Gay, 2002; Ladson-Billings, 1995) also provides a theoretical foundation for the practices shared here. Building on this work, Paris (2012) argued for growth from the stance and terminology of "culturally relevant" to "culturally sustaining." He argues that in order to truly value our multilingual and multicultural students, we should work to "perpetuate and foster—to sustain—linguistic, literate, and cultural pluralism as part of the democratic project of schooling" (p. 93). This perspective can assist you in designing and engaging in pedagogical approaches that value and sustain students' identities as well as assist in making students' in-school learning more relevant for their out-of-school lives.

Our work has also been grounded in the linguistically responsive teaching framework developed by Lucas and Villegas (2011), something we see as also providing the opportunity to sustain and expand linguistic diversity. This framework suggests the orientations, as well as knowledge and skills teachers of bi/multilingual students should have in mainstream content classrooms. Specifically, Lucas and Villegas argue that teachers need to develop sociolinguistic consciousness that includes the understanding of the connections between language, culture and identity, as well as an awareness of the sociopolitical aspects of language education and use. They also suggest that teachers should value linguistic diversity and have an inclination to advocate for bi/multilingual students. In terms of knowledge and skills, Lucas and Villegas argue that teachers need to know about their bi/multilingual students' backgrounds, experiences and proficiencies, to be able to identify the language demands of classroom tasks, to be able to apply key principles of second language learning and to be able to scaffold instruction to promote bi/multilingual student learning.

Together these theoretical frameworks provide us with a strong base to consider the effective teaching of mathematics to bi/multilingual students that is sociocultural and critical as well as culturally and linguistically responsive/sustaining.

## 4 Implementation of the Approach

Each section below contains examples that highlight both activities that teachers have tried with their students, as well as how understanding and addressing each of the elements of the framework contributed to their growing ability to teach mathematics to bi/multilingual learners. They are drawn from the online collegial discussions of teachers who participated in the eWorkshops that utilized this framework.

### *4.1 Know the Content: Implementation*

The Common Core Standards for Mathematics, when implemented with intentionality, push most mathematics teachers to an authentic place of reflection about their content knowledge. Gone are the days when a math teacher could prepare for class the night before because she was using a standard textbook that probably centered procedural learning. Common Core is asking students to conceptualize mathematical ideas, to make connections, and apply mathematical concepts to real world problems to prepare for twenty-first century careers as well as freshman-level college mathematics courses. The Common Core focuses on developing the critical-thinking, problem-solving, and analytical skills students will need to be successful; consequently teachers are having to acknowledge their own under-developed areas in different math concepts. When given a chance to reflect on her understandings in relation to ratios, one teacher commented:

> After reading the student misconceptions [exercise] I was aware that I myself have some of these issues. I have always struggled with math concepts and that is why I wanted to take this class. I have struggled the most with ratios because my brain has difficulty "seeing" the relationships and I get confused. When I read through the scenarios I was only able to understand the student's issues after reading the answers. I then went back and made my own charts and solved the problems and then I was able to see the problems. For myself, I am going to have to learn to solve the problems before I assign them so I can see where students might make mistakes.

> It is a timely process, but it helps me learn to teach it to students who struggle.

When the teachers we worked with were asked to dig deeply into the new mathematics standards, they all found the activity useful. One teacher commented:

> Coming from a generation of algorithm instruction only, the multiple approaches to learning ratios and proportions is a powerful ah ha. When I was first introduced to these approaches I was very uncomfortable using them for instruction. As I see how powerful these tools can be to struggling students I regret I did not get the same opportunity.

Overall, our work and teachers' responses to it suggest that there is great value in ensuring strong content understandings for teachers in the mathematics classroom as a foundation for their work with bi/multilingual students.

### *4.2 Know the Language: Implementation*

One resource we recommend, grounded in the work of Dutro & Moran (2003), relates to *brick and mortar words*. They define "brick" words as vocabulary that is specific to the content and concepts being taught and "mortar" as words and phrases that are basic and general vocabulary that are useful for constructing sentences. An example of mathematics bricks would be multiply, integer, reciprocal, divisor, ratio and fraction; and mortar words might be explain, evaluate, prove, examine, represent, between, however, compare etc. Examine the following problems below to see if you can identify the brick and mortar words:

1. Of the students in Jonah's class, 1/2 have a pet cat. Of the students who have a cat, 4/5 also have a dog. What fraction of the students in Jonah's class have both a cat and a dog? *Simplify your answer and write it as a proper fraction or as a whole or mixed number.*
2. Dana knit a total of 6 centimeters of scarf over 2 nights. After 6 nights of knitting, how many centimeters of scarf will Dana have knit in total? Solve using unit rates.

Some of the brick words include half, centimeters, unit rates, and some of the mortar words include simplify and solve. Giving these problems to your students to capture samples of the language they use could give you an idea of the type of brick and mortar words they use to solve such ratio/rate problems. A group of teachers could also scale this activity to have several bi/multilingual students solve these problems from their different classes. Together, teachers could compare and contrast the language students are using to solve the problems and decide how to more effectively plan for re-teaching and future lessons on similar ideas. The results of both of these activities can be used in many different ways to learn about the language demand of mathematics classrooms as well as students' abilities within those demanding tasks.

Teachers could also teach polysemous words, words with multiple meanings inside and outside the math classroom. For instance, the word "table" is a word a bi/multilingual student may be very familiar with outside of mathematics class as a piece of furniture, but inside of the mathematics class, it means something different. You can create a chart that students can fill in with the definitions of common words across different contexts. This could be done as a school-wide effort with teachers from different subject areas posting the chart and adding to it.

Another strategy is to provide sentence stems as students learn to talk about various mathematical concepts. Providing students with stems like, "How did you get _____?." "Why did you do _____?," and "What does _____ mean?" are helpful for students to have more tools to navigate challenging content.

In response to suggestions to analyze the language of the mathematics texts they use, as well as the language students are expected to produce, one teacher did the following:

> One of the things that I tried with the two students I pulled was to have them define and illustrate rate, ratio, unit rate and fraction. Then we used their illustrations and definitions to work on a few of the word problems. They each completed 4 questions and each one of their answers was correct. They discussed them with each other and actually used the language appropriately. We are going to create a math language notebook, where they can define and create

> illustrations and examples to remind them how to figure out problems.

Another approach you can use to help students match mathematical concepts to their vocabulary is graphic organizers (e.g., an adaptation of the Frayer Model, a concept definition model, and a definition model). Below, the teacher describes students' engagement in using graphic organizers designed to assist with the language demand of mathematics:

> I am a fan of breaking material down to its roots. So I enjoyed explaining this project to my [students]. Since they are very familiar with graphic organizers, they showed confidence after my directions. I had 4 groups with 4–5 students in each group. They are grouped so that there was a balance of various ELL proficiency levels and math skills levels. To begin, I let them choose two graphic organizers. I gave them the opportunity to choose two of the words that were in the [materials from our eWorkshop]. I then asked each group why they chose the organizer that they did. There was a fair mixture of the various organizers used. The most popular was the Frayer Model Adaptation graphic organizer. When asked why that was their favorite graphic organizer, the responses were because "it looked simpler," "I thought I could follow it easier," and "It was the easier one."

As you can see, teachers and students reported value in doing this work. Similarly, teachers who utilized sentence stems for the first time reported having the opportunity to understand more about students' conceptual understandings regarding mathematical concepts because students had the necessary linguistic tools to discuss their thinking.

Teachers' felt they gained confidence in implementing some strategies and their abilities in this part of the framework: Know the Language. The teacher above who tried out the activity using different graphic organizers reflected on the lesson as follows:

> As I observed my 18 students, I saw an unfamiliar sight. The stronger ELL/math proficient students were not the only

> ones participating. I had a variety of skill levels participating in the activity. When I refocused the class I asked for them to share their thoughts. The majority of them found this activity "fun and easy." I also asked if it was helpful? The responses I received were that it was helpful. They were able to focus on the vocabulary terms instead of "just numbers." I definitely see myself using these graphic organizers in the future. It was a great way to break down the vocabulary for ELL students as well as low proficient math students. Without knowing the correct vocabulary, it is difficult to grasp the concepts. After the activity, I continued our scheduled lesson and noticed my students using more of the vocabulary words that were part of the activity.

### *4.3 Know the Learner: Implementation*

Consistent with the Contextualization standard from the standards for effective pedagogy (Tharp et al., 2000), students and teachers can work together to take their knowledge of one another to situate new mathematical learning in everyday life situations. An example of this is in our work with teachers around teaching Ratios and Proportions to bi/multilingual students. Teachers were asked to explore everyday uses of ratios with their students. One teacher described this work:

> I was running around my house taking pictures on my phone the other night when everyone else was in bed. I'm trying to figure out a way to have my little group take their own pictures so we can make a real-life representation poster for examples of fractions in different contexts.

This teacher recognized the fractions that existed all around her in her home and wanted to help students find a way to recognize this as well. Similarly, another teacher did an activity we suggested related to the use of ratios in everyday life and described the following:

> They were not to [sic] sure what they use everyday that is a ratio, so what I did was I went through a store advertisement, and cut out everyday items most household use, such

> as toilet paper, laundry detergent, soda and cereal. I broke the kids up in 2 groups, they had to ask the members of their group which brands did their families [use] and compare. It was a fun activity, and it was something that the students were familiar with so they were able to catch on fast.

This kind of activity is most successful if you know your students well and know what stores they shop in to be sure to bring in relevant items/brands. This teacher reflected on how many of the students did not use the brands from this particular advertisement—that most of the students reported using "Great Value" from Walmart. Such information can further inform your efforts to contextualize learning and getting to know your students well.

Another way you can get to know your students well and translate that into effective curriculum and instruction is based on the lesson plan template included in Appendix A. This lesson plan template explicitly asks you to consider each element we have identified (know the content, know the language, etc.) and utilizes ideas and resources from WIDA (https://www.wida.us/) and Understanding by Design (Wiggins & McTighe, 2005) to support that work. In order to most successfully utilize this lesson plan, you truly do need to know your students in order to design effective instruction.

### *4.4 Engage with the Community: Implementation*

Seeing connections between the local community and math lessons takes intentional thinking on the part of the teacher—she must know her content, know her students, and know the surrounding communities. One teacher used a community garden grid to help her students think about the importance of fractions for planting in a garden. She described the following:

> I explained to my students that grids are very helpful to portion out fractions. I also explained that in the agriculture fields, grids could be used to portion out the land to plant crops. Toward the end of the video, they said additional ways to use grids. Each group chose 4–5 vegetables to plant. I encouraged them to use vegetables that they were familiar

> with. The group that I recorded chose jalapenos, habanero peppers, cucumbers, corn and tomatoes. I also allowed each group to choose 2 of the 3 garden grids provided. They chose a grid with 12 portions and one with 6 portions. The group then worked together to decided what fraction of each vegetable to shade in their garden grids. After each group portioned out their own vegetable garden grid I had them switch grids with another group to record their fractions.
>
> A success that I am proud of is that no matter what their language or math proficiency was, they all seemed confident with this activity. Each person participated and looked comfortable with the fractions. When they switched grids to record other groups' fractions they all were correct with their answers.
>
> A challenge I observed was that no group chose the more challenging garden grid. This grid was not divided into equal parts, it had some sections that were larger than the others. I intend to do this activity again next week but only allowing them to use the more challenging grid to practice adding fractions to find the [lowest common denominator].

An extension of this activity into the community and with families could include a local gardener talking to the class about how they plan their gardens and potentially doing a more complicated grid collaboratively with the class reflective of their own garden. This could also be an opportunity to include a family or community member in instructional spaces who is not confident in English. They could use their most confident language with students who speak that language if there are opportunities for other students to either engage with a different community member or have some translation opportunities for them to learn from the community member communicating with the students in a language other than English as well. This approach could appear to take a lot of effort and time that may seem to take away from direct math instruction; however, because these activities deepen students' connections and conceptual understandings it is time well spent over the long run. Both contextualizing learning to meaningful contexts outside of school and including the local knowledge and resources like family and community members is an excellent

way to support quality mathematics instruction for bi/multilingual students. Further, in secondary mathematics classrooms where the mathematics is rather complex, at times returning back to basics and building or extending foundational pieces of mathematical conceptual thinking can help students gain the skills, confidence and resources to launch into more complex mathematical practices.

### *4.5 Assess Meaningfully: Implementation*

We have encouraged teachers to use the WIDA Can Do descriptors described above as a pre-assessment to learn about their students. One teacher discussed this saying:

> As I explored pre-assessment for multilingual learners, I was pleased to see that these documents were very positive, focusing on what a pupil 'CAN DO' as opposed to what they have not yet achieved. I feel this kind of assessment would have a positive effect both on pupil and teacher. I think it is important to remember that multilingual children have potentially come from a different background or culture, where there may be different expectations in education. By carrying out a pre-assessment which recognizes this, it is a way of being subjective and inclusive for all learners.

Similarly, another teacher noted the value of using the WIDA Can Dos:

> Also, looking at the WIDA CAN DO descriptors, we are able to adjust some of the ways we assess students, to meet the multilingual learners where they are at in their language development. I may be asking a student who understands the content, to show me that on an assessment that is too difficult for their language level, even though they may have grasped the concept. Using the CAN DO's can help us as educators to meet our multilingual students understanding with the types of ways we should be assessing that understanding.

In addition to the value that thinking about language proficiency offers when working to meaningfully assess bi/multilingual students, we also suggest teachers explore how other aspects of classroom practice

can provide meaningful insights into students' content knowledge and language levels. One teacher discussed this saying:

> What resonated with me the most while going through the [eWorkshop section], in regards to assessing our multilingual learners, for one was how many ways we assess students, but we may not always use those to assess their learning progress. Sometimes a student may show understanding on a formative assessment during a lesson, but may not be able to show that same understanding on a different type of assessment. I think at [name of school], we have many types of formative assessments where students can show their understanding, but we may not look at them as ways of assessing, but more ways of teaching. If I start to look at these different teaching techniques as assessments, it seems like I will have more ways to know where students are at in their understanding of a concept.

In this discussion that followed this teacher's comment, a colleague agreed with him and further discussed ways to expand assessment practices. One teacher focused on differentiation and mentioned:

> It is a good reminder that assessments should be differentiated. I see a lot, in my classroom, that students might be able to verbally explain something, but cannot write it down. It is discouraging to see a student that I know knows the answer, but struggles with the assessments at the end of the units. It is discouraging for both me and the student, and as you said, it lowers their confidence. It is important to assess students at their level of ability.

Finding ways to assess multilingual students via multiple modalities is an important aspect of meaningfully assessing students. This can be accomplished via differentiation, multiple types of assessments as well as multiple formats of assessments demanding different types of language skills (reading, speaking, listening and writing). Teachers can create a fairly comprehensive perspective of students regarding both their content knowledge and English language development.

## 5 Conclusion

The five elements presented in this chapter each provide entryways into strengthening our teaching of bi/multilingual learners. Inclusive learning theories undergird these elements and provide ways to see the strengths of bi/multilingual learners. The five elements' usefulness is borne out by the positive responses of teachers who have sought to integrate them into their teaching. For teachers just beginning this journey it is important not to become overwhelmed with trying to do all five elements at once. For example, you might begin by developing and practicing some strategies in one of the first three areas: know the content, know the language, or know the learner. Overall, by approaching mathematics teaching with these elements in mind, you can more effectively support high levels of learning and achievement for bi/multilingual learners across levels of English proficiency and grade levels.

### Reflection Questions

1. How do these five elements relate to your current approach in teaching mathematics to bi/multilingual students?
2. What strengths do you already have in these five areas?
3. What are potential areas of personal growth in these five areas?

## Appendix

### Mathematics Unit/Lesson Plan Template

**KNOW THE MATHEMATICS CONTENT**

**GRADE LEVEL:**
**UNIT/TOPIC:**
**MATHEMATICS STANDARDS ADDRESSED (Common Core):**
**STANDARDS FOR MATHEMATICAL PRACTICE ADDRESSED:**
**ESSENTIAL QUESTIONS (ENDURING VALUE BEYOND SCHOOL):**
**BIG IDEAS:**
**POTENTIAL LITERACY CONNECTIONS:**

**KNOW THE LEARNER & KNOW THE LANGUAGE**

Cognitive Function:
(What is the "thinking process" involved? i.e. COUNT, EXPLAIN, CALCULATE, EVALUATE, ANALYZE, COMPARE/CONTRAST, DESCRIBE)

| **DOMAIN: listening, speaking, reading, writing** | Lang. Prof. Level 1** **Entering** | Lang. Prof. Level 2 **Emerging** | Language Proficiency Level 3 **Developing** | Language Proficiency Level 4 **Expanding** | Language Proficiency Level 5 **Bridging** | Language Proficiency Level 6 **Reaching** |
|---|---|---|---|---|---|---|
| | | | | | | |
| | Topic-Related Language:<br>(With which grade-level words and academic language expressions will all students interact?) | | | | | |

**What goes inside of these boxes will depend upon which DOMAIN you choose. These will be the indicators or Model Performance Indicators (MPI) which gives examples of the LANGUAGE with which your students may engage during your lesson and or assessment. For additional support on filling out this part of the template, see examples of mathematics lessons in the 2007 & 2012 WIDA framework

**INSTRUCTIONAL SUPPORT: Which support is necessary for students to <u>access</u> the content?**

| Sensory Supports | Graphic Supports | Interactive Supports |
|---|---|---|
| Real-life Objects<br>Manipulatives<br>Pictures & photographs<br>Illustrations, diagrams, & drawings<br>Models & figures | Charts<br>Graphic Organizers<br>Tables<br>Graphs<br>Number lines | In pairs or partners<br>In triads or small groups<br>In a whole group<br>With the Internet (websites) or software programs<br>In the native language (L1)<br>With mentors |

**STRATEGIES FOR ASSESSMENT**

How might I use varied strategies (listening, speaking, reading, writing) to have my multilingual students demonstrate their competence of the mathematics' content? What will be the different activities (formative) and projects (summative) that my students will demonstrate what they know and can do?

**POTENTIAL COMMUNITY CONNECTIONS**

How might this learning translate into something meaningful for your students outside of the school environment? How might the students take their learning and contribute to a better community?

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**Kara Mitchell Viesca**, PhD, is an Associate Professor of Teaching, Learning, and Teacher Education at the University of Nebraska Lincoln. Her research agenda centers on advancing equity in the policy and practice of educator development, particularly for teachers of multilingual students. She has been awarded $4.6 million dollars over two large federal grants to improve the preparation of educators to work with multilingual students. The current project, the International Consortium for Multilingual Excellence in Education (https://cehs.unl.edu/icmee/) is a large international, growing collaboration offering strong online professional learning opportunities for collaborative groups of teachers.

**Nicole M. Joseph**, PhD, is an Assistant Professor of Mathematics and Science Education in the department of Teaching and Learning at Vanderbilt University. She is also the founder of the Tennessee March for Black Women in STEM, an event held every fall, which seeks to bring together the Tennessee community to raise awareness of the gendered racism, Black women and girls experience in STEM. Her research explores two lines of inquiry, (a) Black women and girls, their identity development, and their experiences in mathematics (b) Whiteness, White Supremacy and how it operates and shapes underrepresentation of Black women and girls in mathematics. Dr. Joseph's work has been supported by the National Science Foundation and the National Academy of Education/Spencer. In addition to having research featured in top-tiered journals, such as the *Review of Research in Education*, the *Journal of Negro Education,* and the *Journal of Education Policy*, Dr. Joseph's scholarly contributions also includes a co-edited book, *Interrogating Whiteness and Relinquishing Power: White Faculty's Commitment to Racial Consciousness in the Classroom* (Peter Lang Publishing), a forthcoming book, *Mathematizing Feminism: Black Girls' and Women's Experiences in the P-20 Mathematics Pipeline*s (Harvard Education Press), and a new book with Information Age Publishing entitled *Understanding the Intersections of Race, Gender, and Gifted Education: An Anthology By and About Talented Black Girls and Women in STEM*.

**Nancy L. Commins**, PhD, is Clinical Professor Emeritus at the University of Colorado Denver School of Education and Human Development where she helped to lead the teacher education program representing Culturally and Linguistically Diverse Education. She has worked with students and educators from diverse linguistic and cultural backgrounds in a variety of

capacities for more than three decades. Her roles have included bilingual classroom teacher, university professor, program director, school district administrator and independent consultant assisting schools, and districts to improve instruction for bilingual learners. She is co-author of two books *Linguistic Diversity and Teaching* and *Restructuring Schools for Linguistic Diversity: Linking Decision Making to Effective Programs*. She has also been a Visiting Professor/Senior Fellow in the Faculty of Teacher Education at the University of Turku, Finland since 2012.