Novice Teacher Supports the Mathematics Learning of English Language Learners in Any Language

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Abstract: *A novice teacher reflects on her first class of ELLs who spoke many native languages and shares her journey to improve. Three bang-for-the-buck strategies are shared. Support for her actions is provided through connections to the literature. Readers are encouraged to bravely move forward to use trial-and-error as they attempt to implement what they are learning from the many available resources which include anchor charts, sentence frames, manipulatives, and technology.*

Keywords: *English language learners (ELLs), anchor chart, sentence frames, manipulatives, technology*

> *Many languages, many cultures, one goal—high-quality mathematics education . . . English language learners share a basic need—to engage, and be engaged, in meaningful mathematics* (Ramirez & Celedón-Pattichis, 2012, p. 237).

Introduction

This article shares early experiences of first-year teacher, Miss Smith (pseudonym), in teaching mathematics to English Language Learners (ELLs). We focus on teaching strategies she used to improve the learning of ELLs. The authoring team, with various years of experience teaching mathematics to ELLs, provided connections to the published literature and highlighted takeaways for readers.

The typical image of a classroom with ELLs probably leads a person to believe that there will be only one or two non-English languages spoken by students in a classroom. Although Spanish is often the predominant non-English language in a class, there are many other possibilities (Ruiz Soto et al., 2015). Miss Smith discovered there were more than 10 native languages in her first class of ELL students. Teachers need to be aware that a variety of non-English native languages may exist in one classroom, and more than half of a class might be English language learners who "are very diverse with unique individual characteristics and learning needs" (Dong, 2019, p. 29).

Miss Smith's Story from Uh-oh to Ah-ha: Her Account

Many first-year teachers have "uh-oh" moments in which they feel that they are in completely over their heads. For me, that moment came during my first year at an urban middle school in the Mid-Atlantic region. Before the school year began, my fellow teachers and administrators wanted to prepare me for the students I would be teaching. I had been advised that the students would be "working on their English," so I should be prepared to make some accommodations for communication. On the first day, I realized that the students spoke "little to no English at all," and there were a variety of first languages in one class! The students did not understand what I was saying in English and seemed bewildered! I thought, "How will we proceed if we can not communicate with each other?" I felt totally unprepared!

The moment I realized that most of my students in this all-male class spoke little or no English, I did not feel prepared to communicate with the boys at all. I lacked sufficient academic knowledge and experiences in teaching ELLs. My undergraduate study included several seminars to support teaching of ELLs or Culturally and Linguistically Diverse students (Lucas & Villegas, 2010). However, I realized I needed to know more to support implementation of what I had learned.

I asked myself, "What can I do? How will I make it through this very first class of the day?" I felt like running away, but of course, I would not. So, here they were, sitting in my class, trying their best to understand what I was saying. I explained in my most enthusiastic English-speaking teacher-voice that we were going to learn about ancient civilizations—about how things were a long, long time ago. I had a few props to show, but that was not going to be enough to communicate! [Talk slowly, enunciate well-in English—I thought.] I talked slowly. I used my hands to make helpful gestures. I smiled a lot, and walked around excitedly. Yet they sat, staring at me like I had five heads! I could tell that they wanted to learn and wanted to help me—if they could. In that moment I asked: What on Earth have I gotten myself into?

Finally, I stopped talking for a minute, took a deep breath, and quietly assessed the situation with, what may have appeared to be, a nervous smile on my face. I had these boys for the rest of the hour. What was I supposed to do if they had no idea of what I was saying? Thinking on my feet, and realizing that my school had a largely Hispanic population, I decided to try to teach using the little Spanish I knew rather than continuing in English. I started my lesson over again, in my terrible, choppy Spanish. The faces of a few boys lit up as they nodded their heads as if they understood. At first, I felt reassured, but then I realized that other students, who quite obviously were not Hispanic, were looking at me even more puzzled than they had before. I had tried twice to introduce my lesson, and had failed several of my students both times. I had never felt so helpless. "Tomorrow, I will do better," I thought.

After that first day, it became my personal and professional quest to learn how to teach ELLs effectively. I spent Saturdays attending professional development seminars at a nearby university, bought numerous books about teaching ELLs, and watched online videos which demonstrated successful lessons in classrooms with high populations of struggling ELLs. When I felt that I knew enough to ask more targeted questions I consulted with my fellow teachers, administrators, and others in the school who might have suggestions. I attempted to put what I was learning into practice in my classroom. I felt that the teachers in the videos, professional development presenters, and even the support staff at my school, had not met my students or a class with so much language diversity. Could they possibly understand the challenges I faced? There were probably countless strategies to use but how was I supposed to choose the right ones? How would I know my students understood me? Couldn't someone just give me a silver bullet that would help my students understand?

As my journey to better teach ELLs continued, what it came down to was good, old-fashioned, trial-and-error. If I tried something and it didn't work, it was back to square one. One main difference after the first day however, was that I was trying things I was learning about—not things that were just coming into my head. The students seemed to appreciate the fact that I was trying so hard to help

them understand. Even though I was often unsuccessful, learning took place more often than not.

During that first semester, I came to understand much more of what it takes to teach a classroom of ELLs. The more I practiced using the strategies, the more confident I felt in my ability to teach any level of ELLs. Of course, I did not know it all after one year of teaching, but I finally knew enough to better use what I was learning. I would like to share some of these strategies in this article.

Miss Smith's Toolkit of "Bang-for-the-Buck" Strategies

For now, I have assembled a toolkit of "bang-for-the-buck" or favorite strategies (i.e., anchor charts, sentence frames, and using manipulatives) that work well for ELLs across several content areas that I taught over the last 11 years.

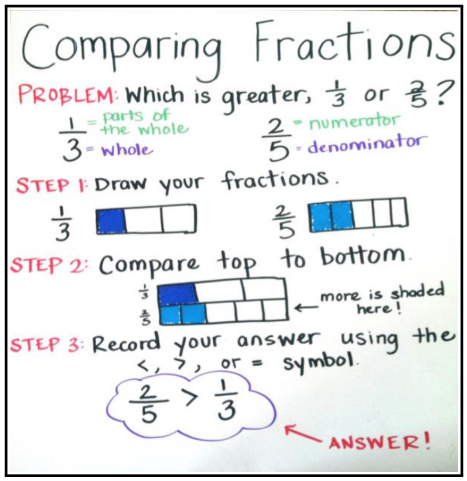
Strategy 1: Using Anchor Charts to Support Nonlinguistic Representations

The first strategy that has worked wonders for me in the math classroom is the creation and use of anchor charts as an example of "mathematical tools and modeling as resources . . . that [use] vocabulary and key visual models to enhance students' ability to engage in discourse" (Celedón-Pattichis & Ramirez, 2020, pp. 22–23, 27). Anchor charts support the development of students' learning of language (with connections to terms in their native languages when possible) while simultaneously also learning mathematics (Dong, 2019; Roberts & Truxaw, 2013; Vlach & Bursie, 2010).

I used anchor charts during mini-lessons, with students as co-creators, and later displayed the charts within the classroom as a point of reference. The anchor charts include words such as mathematics terms, procedural steps, or problem-solving steps. I used them to provide support for my ELLs to learn the associated English words. Nonlinguistic representations such as pictures, diagrams, or whatever else is appropriate in the context of a lesson further support communication, and give students something more to connect to their experiences as their English language communication improves.

The anchor charts are mostly student created, so they are much more meaningful to students than store-bought posters. For example, my class was given a fifth grade Virginia Mathematics Standard (5.2b): "students will compare and order fractions . . . in a given set, from least to greatest, and greatest to least" (Virginia Department of Education, 2016, p. 3). To address this standard, my class began by trying to compare two familiar fractions such as $\frac{1}{3}$ and $\frac{2}{5}$ (as shown in Figure 1).

Figure 1: *Anchor chart highlighting the concept of one-third and two-fifths.*



I placed each of these fractions on our anchor chart. During discussion, the students explained what $\frac{1}{3}$ meant and gave examples to support their explanations.

We discussed misconceptions as they arose and identified some non-examples (e.g., one piece of three pieces that are not of equivalent size). One student explained, "Pretend you have a sandwich, and you only want to eat part of it because you're not that hungry. You cut it into three equal pieces, that's the 3, and you eat one piece, that's the 1." At this point, each student drew their own representation of one-third of a rectangular sandwich on a student-sized white board. We then shared representations, and determined which examples accurately depicted $\frac{1}{3}$, which did not, and discussed reasons why. This portion of the lesson allowed me to quickly assess their learning through observation. We then followed the same steps to create graphic representations of two-fifths.

Next, students named the parts of our $\frac{2}{5}$ fraction, which they successfully told me to label, "numerator" and "denominator," based on knowledge from previous fraction lessons. I asked each of the students to draw each fraction in their math notebooks. Some drew circular representations, some drew bars, and others offered different representations. For comparison purposes, I chose to represent each fraction in bar form. As I drew each fraction bar, the students told me how much to shade. Having drawn each fraction individually, we found it difficult to say for sure which one was greater, so we drew one bar placed on top of the other, and revised our shading. This showed us that two-fifths was the greater fraction. With this new knowledge, we wrote $\frac{1}{3} < \frac{5}{2}$. After completing the mini-lesson, I hung this chart on the wall for students to use as a reference. I noticed that students used the chart less and less as they became more confident with the concept and process of comparing fractions.

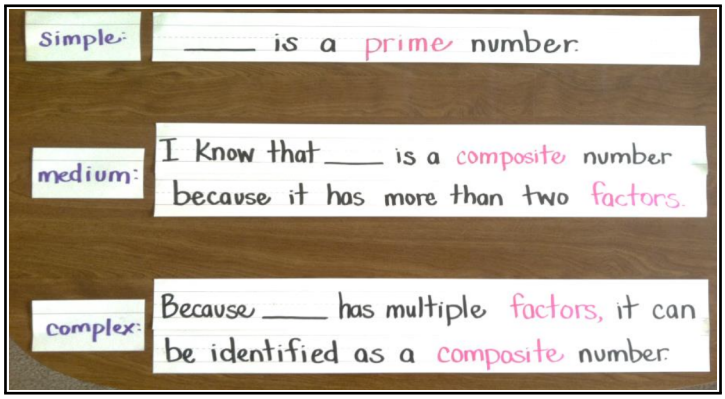
While this strategy was particularly beneficial to my ELLs, it supported differentiation for all students in my classroom. As active participants in creating the anchor chart, students immediately had an experience to visualize each time they were asked to compare fractions. The pictures provided mental images to support understanding. The anchor chart included clear, easy-to-read procedural steps and was accessible for students to refer to as much or as little as they wished.

Strategy 2: Using Sentence Frames to Model Mathematics Vocabulary

Sentence frames help teachers model and communicate the language and vocabulary that ELLs are expected to use in class by requiring "completion or fill-in-the-blank sentences with simple language structures that focus on both mathematical and linguistic development" (Celedón-Pattichis & Ramirez, 2020, pp. 23, 27). Vocabulary flash cards and word walls can be valuable learning tools. However, I felt that more development of vocabulary resulted when students were given opportunities to apply newly learned words in context (Mora-Flores, 2011). Sentence frames provide a framework for the language structures while highlighting important vocabulary words students will use as they speak about a topic (Hill & Miller, 2013). For example, for Mathematics Standard 5.3a my students had to "identify and describe the characteristics of prime and composite numbers" (Virginia Department of Education, 2016, p. 4). I created and posted sentence frames, with the targeted vocabulary highlighted in a different color (see Figure 2).

We used the frames to support discussion as we shared our findings. I had everyone start by using the simple frame. Students played a partner game related to prime and composite numbers and used these sentence frames to guide their conversations. As I walked around listening in on discussions, I suggested some students move on to more difficult frames if I felt they were ready. Once students mastered the simple and medium frames (the top two sections of Figure 2), I added a more challenging frame (bottom section of Figure 2). Many of my beginning ELLs used the simplest frames as most appropriate for the entire unit. Some of my higher-level ELLs quickly moved to the more complex frames. The majority of the students learned what "prime" and "composite" meant, felt confident using the terms in context, and remembered these terms long after the lesson was completed for the day.

Figure 2: *Sample sentence frames for prime and composite numbers.*



Strategy 3: Using Manipulatives to Help ELLs Make Connections

Many math teachers have manipulatives on-hand in the classroom, but seldom use them. I began as one of those teachers. I told my students that the manipulatives were available if they needed them; however few realized when manipulatives might benefit them. Manipulatives (e.g., puzzles, maps, teacher-made or purchased concrete materials, apps, websites) serve as tools to help conceptually model concepts and enhance discourse (Celedón-Pattichis & Ramirez, 2020; Hill & Miller, 2013). As the teacher, it is my job to use manipulatives during my direct instruction so my students not only see what materials are available, but also see how to use them in ways that facilitate solving problems and making connections (NCTM, 2000).

When the English as a Second Oral Language (ESOL) teacher at my school first encouraged me to use manipulatives with my math students, all I could think was "my students are fifth graders, not second graders. They should be able to access this content without using blocks!" I had two major misconceptions. First, manipulatives include far more than just blocks. Anything that students can pick up, move around, or play with is a manipulative. The second misconception I had was that manipulatives were only for primary grade students, and my students were too mathematically mature to use them. My undergraduate classes for teaching mathematics emphasized the CPA (concrete- pictorial-abstract) approach (Salingay & Tan, 2018, p. 92). I had forgotten how essential using manipulatives could be.

Once I embraced the use of manipulatives in my math class, I saw a huge improvement in the number of students who grasped the concepts I was trying to teach. For example, during our measurement unit, Mathematics Standard 5.8a required students to estimate and then measure to "solve practical problems that involve ... volume in standard units of measure (Virginia Department of Education, 2016, p. 20). To aid students in their understanding, I brought labeled containers of different measures to class: milk jugs as gallons, cartons of coffee creamer as quarts, measuring cups as pints, and small cups from our math resource room as cups. In the future, it might help make even deeper connections if I used empty containers that are more representative of items used at home. Students could even bring in containers on their own, then work as a class to identify the capacity of each one.

After making an anchor chart displaying each container and noting its measure, students worked in pairs with their own set of manipulatives. Their task was to estimate how each measure was related. For example, one problem may have been, "How many quarts of milk would it take to fill the 1 gallon milk jug?" After recording their estimates, students poured water into containers to investigate the problem (e.g., how many quarts really fit into a gallon?). This approach provided a concrete experience to refer to as they revisited the concept of capacity in future lessons. One student asked if we could keep the manipulatives available so she could practice using them to learn her units. How could I say no?

Final Aha Points for Teachers of ELLs

There are four major points that we hope you take away from this article for teachers of ELLs to use in their bang-for-the-buck toolkits. The first is that while these strategies require additional planning time, they are not difficult to execute, and the results are well worth it. You do not need to be a certified ELL teacher to use them well. Furthermore, these strategies may be used across content areas.

The second take-away is that even though this article focuses on strategies to help ELLs, these strategies are not ELL-specific. General education students and students with special needs, with varying learning styles, will embrace these approaches as well. These strategies may not work in every lesson, but the goal is to maximize learning for each student in your classroom.

The third take-away highlights that the three strategies shared here include one embedded element that has not been mentioned directly: assessment. Before, during, and after using these strategies the teacher is constantly monitoring student understanding to determine what should be used and when, along with modifications that should be applied.

The fourth take-away offers a reminder to integrate technology to support using each of these strategies more effectively. There are many computer assisted language learning (CALL) software options (e.g., Google Translate, Babbel, FluentU, Duo Lingo) available. We specifically suggest that teachers incorporate such technology to assist in communicating in the various languages available.

Finally, we would like to encourage the readers to remember the quote at the beginning of this article: Many languages, many cultures, one goal—high-quality mathematics education . . . English language learners share a basic need—to engage, and be engaged, in meaningful mathematics (Ramirez & Celedón-Pattichis, 2012, p. 237).

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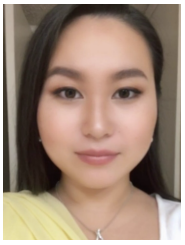

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