Professional Journal Article Review:

Instructional strategies and word problems of English language learners.

Lynne N. Cohen

TSL 5085 Teaching Language Minority Students, Summer 2018

University of Central Florida

In this 2012 article from the *Journal Of The International Society For Teacher Education*, Leali, Byrd, and Tungmala detail several ways in which mathematical word problems challenge English language learners, and suggest strategies to scaffold for the needs of these students. The authors begin by describing a specific problem: English language learners perform poorly on formal mathematics assessments in the United States as compared to their native English-speaking peers. It is thought that this discrepancy is not solely due to computational skills. English learners face additional cognitive load when word problems test their cognitive academic language proficiency (CALP). Word problems may also inadvertently test a student's understanding of American culture and context, leading to distorted results that are biased against English learners, particularly those who were born outside the US (Leali, Byrd, & Tungmala, 2012).

Leali et al. discuss three broad categories of challenges presented by word problems: cultural differences, vocabulary issues, and "mechanical issues", meaning challenges associated with the mechanisms of English grammar (2012). Within these categories, they drill down into specific challenges as well as strategies to address them.

Within the category of "cultural differences," Leali et al. (2012) first address the setting of a word problem. If the problem refers to cultural phenomena more common in the US than in other parts of the world, students may find themselves caught up in understanding the meaning of the scenario rather than focusing on relevant information. To address this issue, the authors suggest switching to a scenario that is more internationally recognizable, such as replacing a question involving baseball with one involving soccer (p. 100). Teachers might also base word problem scenarios off of in-class experiences or situations that have been demonstrated with physical

objects. However, teachers should avoid (if at all possible) scenarios that are offensive to certain cultures. For example, a problem involving pork or bacon may alienate Islamic students.

Teachers might also consider the units of measure used in word problems; non-US born students may be unfamiliar with the imperial units commonly used in the US, and unable to visualize or convert using these units. In this case, a teacher has the choice of changing the units used in questions, or providing specific scaffolding for the understanding of new units.

For all cultural and context concerns, the recommendation is to provide students with concrete shared experiences, plentiful visuals and manipulatives from which to build better understanding of the context of the questions. Through this process, teachers can not only mitigate the cultural gap preventing student success, but also give students an opportunity to learn about the new culture in which they are immersed (Leali et al., 2012, p. 101).

"Vocabulary Issues" is the next category addressed in the article, and includes polysemous words (words that have different meanings depending on context) and words that are commonly used in word problems but do not often appear in other contexts. A list of troublesome words is provided (p. 102), along with the specific issues associated with them. It is recommended that special attention be given to these words, that they be introduced in class slowly, and for their context-specific meaning to be demonstrated:

> Referring back to the... problematic meaning of [the word] *take* in reference to time, the teacher can write an example before giving the assignment, like 'It takes me 30 seconds to walk around the room.' The teacher can then demonstrate the action of walking around the room, while describing that it takes him/her 30 seconds to do so. (Leali et al., 2012, p. 102)

Another troublesome category of vocabulary is the variety of words that refer to mathematical operations. Leali et al. provide a sample table of the four major operations (addition, subtraction, multiplication and division) along with six words or phrases that suggest each operation (2012, p. 102). Much like the context-specific vocabulary, teachers can demonstrate use of these phrases, and even provide the table to students as a reference while working through problems. Furthermore, three specific strategies can be used to make vocabulary more accessible: simplification (where the question is restated with simpler vocabulary), expansion of ideas (where the definition is provided through further illustration of the concept), and direct definition.

"Mechanical issues" of English sentence structure is the last category of concern addressed by the article. Leali et al. discuss the confusion experienced by English learners when reading passive sentence construction, where the sentence's object is stated prior to the verb and the subject is sometimes left out completely. Complex English tenses may also confound English learners, such as "present perfect" and "past perfect" tenses, involving "have been [verb]" and "had already been [verb]" (2012, p. 103). The authors suggest starting by rewriting problems with simpler construction. However, as students move through the material, passive voice and complex tenses should be reintroduced slowly to allow students to master more complex linguistic mechanics.

Reflection & Application

This past year, I taught high school chemistry for the first time. I had never before received training for teaching English language learners. Despite that, I began the year with over a dozen EL students at various levels of English fluency and prior academic knowledge. In many ways, the experience was a crash-course in differentiation. It's difficult to tell how well I did overall in

closing the communication gap for my students, but I will say that had I read this article one year ago, I would have done a better job.

Though I teach a science course, physical science is half conceptual and half mathematical, involving plentiful word problems. This was a constant struggle for my students, and that is why I chose this article. What makes this piece stand out for me is that it describes specific concerns and solutions to address them. As I read about EL strategies on my own this past year, I've been offered abundant "best practices" in a general sense, such as to learn about my students' backgrounds. However, I often didn't know relevant and appropriate questions to ask, nor how to use the information to better serve the student body. This article provided specific ideas and non-invasive ways to derive information--such as asking students to measure length, and noting if they use inches or centimeters--along with how to adjust my teaching practices in response.

It seems to me that in pedagogical writing, the assumption is often that the readers *could* implement a strategy to obtain a certain outcome, but only need to be persuaded of the importance of implementation. On the contrary, I understand why it's important to differentiate for EL students, and I know what I should be implementing (data collection, hands-on learning, vocabulary review), but have not yet built a toolbox to implement these practices in a meaningful way. New teachers are students themselves, learning the language of pedagogy, and translating theory into daily practice is the most difficult part of teaching. The strength of articles such as this one can be demonstrated by their explanation of how to provide "expansion of ideas":

> The cutting board measures 24 inches in diameter. This cutting board is a circle. A straight line that joins the center of the board to two points on its sides is its diameter. So you can say that it is 24 inches in diameter. (Leali et al., 2012, p. 103)

Had I not read this example, but rather just read the term “expansion of ideas,” the article would have been less useful. This example demonstrated how to scaffold by considering the *subtext* of a statement: What does the word “diameter” refer to? *It refers to a circle.* How can we envision “diameter”? *If we draw a line over the circle that reaches two edges and touches the center, the length of that line is the diameter.* I could even provide strings, rulers, and circle cut-outs, and have students determine diameters for themselves. Further examples of how the article’s strategies can be applied to teaching were included in the summary itself, as it was most efficient to include them along with the description of the concern.

One aspect of teaching EL students that I still struggle with, and that the article emphasizes, is “social learning.” Leali et al. suggests that teachers “allow ELLs to work in groups with native English speakers to aid in mathematical development” (2012, p. 105). In my classroom, EL students often lacked the confidence to work with their English-speaking peers. However, advanced EL students who struggle with academic vocabulary can certainly benefit from the social strategy, and perhaps I can find ways to increase the confidence of my other EL students. I also like the idea of pairing EL students with strong computational skills with native English speakers with weak computational skills, creating a mutually beneficial relationship.

From reading this article from *Journal of the International Society for Teacher Education*, I feel more prepared to execute the SIOP model in my classroom. This article has given me more confidence in executing the components “Building Background,” “Comprehensible input,” and “Strategies.” I now have a few solid strategies to attempt when I work with my EL students next year, and I sincerely hope I can continue building my toolbox, learning about my students, and building a curriculum that is accessible to all.

References

Leali, S., Byrd, D. R., & Tungmala, M. (2012). Instructional strategies and word problems of English language learners. *Journal of the International Society for Teacher Education, 16*(2), 98-109.