By Melissa A. Barrow

Even math requires learning academic language

While new English learners can quickly learn the language for social situations, learning English for academic purposes is a more complex challenge. Teachers can help by employing thoughtful strategies.

"Why are these kids failing math? Isn't math a universal language?" These questions are echoed by educators of English language learners (ELLs) in many school districts. It's time to dispel that myth. The fact is that math is not a universal language, and educators need to be attentive to the nuances and complexity of the English language even when teaching math.

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Consider the research, which has repeatedly demonstrated that English language learners acquire social language before academic language. Jim Cummins' (1979) research indicates that students on average require five to seven years to acquire academic language. This is because academic language is very rich with complex vocabulary and sentence structures. Research by Virginia Collier and Wayne Thomas (1989) also indicates that ELLs need significant time — seven to 10 years or more — immersed in English language instruction before acquiring academic language. The Thomas and Collier study also reveals that students who studied in their native language for two or three years before attending English-only classes took less time to acquire academic language than those who did not. This provides evidence that students who have a solid foundation of knowledge in their native language can transfer that knowledge and skills more readily to English.

Vocabulary

English language learners not only have limited vocabulary in English but also limited depth in vocabulary (August, Carlo, Dressler, & Snow, 2005). Words used outside of their core meaning can be a comprehension nightmare for second language learners. Think about the multiple ways the word bug can be used in a sentence. "There is a bug in my soup!" "Stop bugging me!" "I don't feel well. I think I caught a bug." In these examples, the word bug is used multiple ways and has completely different meanings. Consider these math vocabulary words: chord, foot, and volume. Each of these words when used in math is different from its core definition. This is why preteaching vocabulary and letting students use the words in practice is crucial to language learning.

Comprehension v. cognitive development

Students can have comprehension gaps when they're acquiring academic language. These gaps shouldn't be considered an indicator of the student's cognitive development. As an ESL/ELL instructor, I'm amazed how many ELLs are considered for special education services around 3rd and 4th grade. Referring back to Thomas and Collier's research, the time period to acquire academic language could potentially be more than five years. If the child has never received math courses in his or her native language, it could take 10 or more years. Therefore, 3rd and 4th graders are still acquiring language and need more time to develop academic language. Julie Esparza-Brown's (2012) Response to Intervention (RTI) for English learners includes the very important step of preteaching vocabulary. It also includes
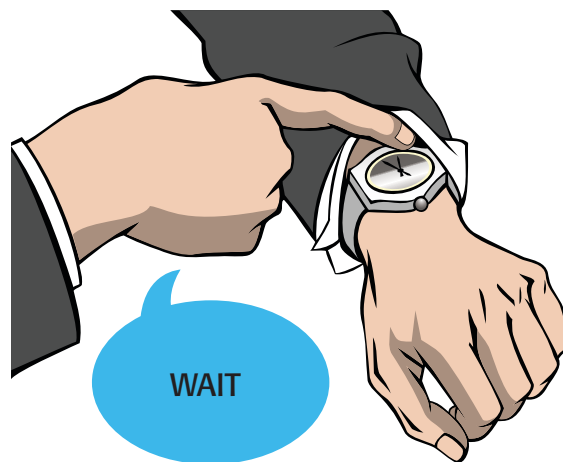
Word problems can present an enormous difficulty for ELLs.

language modeling and opportunities for students to practice language. The process also includes strategic use of the child's native language when possible. I have heard teachers say, "Well, if they need to learn English aren't I doing them a disservice by providing them with the words in Spanish?" If the goal is to increase comprehension, then the answer is no.

I once observed a 4th-grade Haitian student reading a book during independent reading time and having difficulty when she came to the word "waiter." She just could not move on with the rest of the book. She had chosen the book during independent reading time, which prevented the teacher from preteaching the vocabulary. The teacher came over to help her think through the word by using context cues. She said, "The setting is in a diner. Who are the people who work in a diner?" The child did not respond. The teacher realized the student didn't understand "diner" and was conflating it with "dinner." The teacher continued trying to explain diner and waiter for about 20 minutes. Finally she said the word "waiter" in French, "Un garçon. Comprend?" The child's eyes lit up. Both the teacher and the
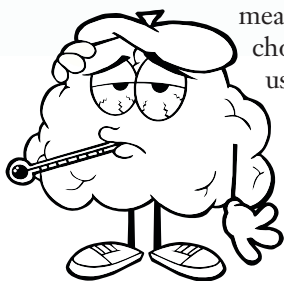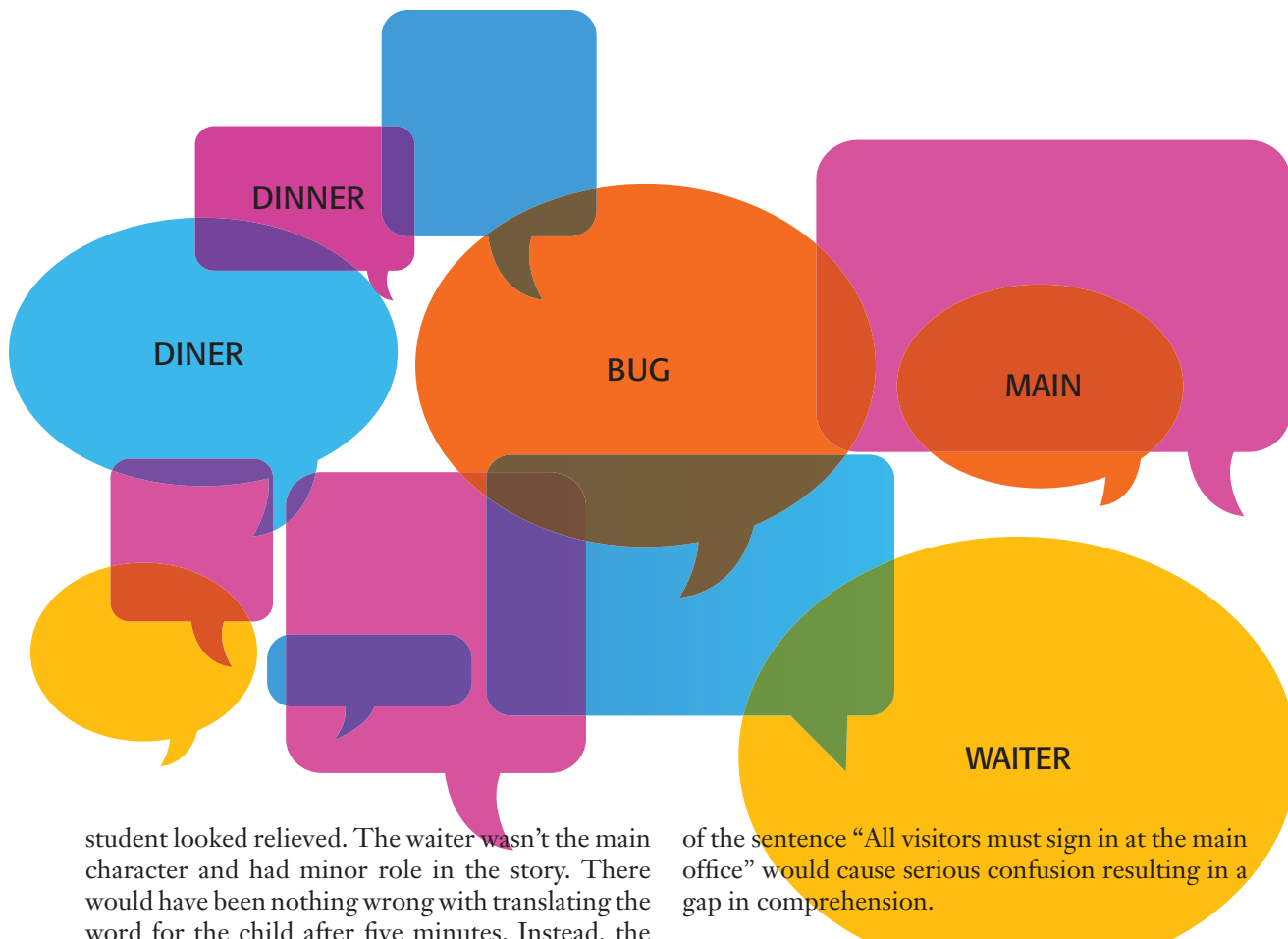
student looked relieved. The waiter wasn't the main character and had minor role in the story. There would have been nothing wrong with translating the word for the child after five minutes. Instead, the student struggled for 20 minutes with a word that wasn't very significant to the overall theme of the story because the teacher believed using the native language would be giving up and letting the child take the easy way out. In fact, it is the exact opposite. When students have the equivalent in their native language, they can use background knowledge to make connections with what they already know about the topic.

Cognates: Friend or foe?

Cognates are words that are semantically and phonologically similar in two languages, (Holmes & Guerra Ramos, 1995). One example is the word "different" and its Spanish translation "diferente." They sound similar and have similar spelling. In a study of 5th-grade ELLs by Dressler (2000), the results indicated that students who used the identification of cognates as a strategy were more successful at inferring the meaning of unknown words. However, teachers must beware of false cognates. These are words that appear to be cognates yet have different meanings in their respective languages. An example of this would be the word "main." In English, it means the most important; in French, hand. Using the cognates as a strategy to determine the meaning of the sentence "All visitors must sign in at the main office" would cause serious confusion resulting in a gap in comprehension.

All students are academic English learners

With the increase of rigor due to the Common Core State Standards, every student needs to learn academic English. As teachers begin to unpack and decode the structures in math, they'll realize that it is very complex. Consider the directions on one of New York's Common Core math modules for 2nd grade: "Circle the smallest unit. Box the largest unit." The students can then choose between "four tens, two hundreds, and nine ones"(2012). Of course, the word unit would have to be pretaught in order for students to identify the correct answer. However, it may also be necessary for students to understand what "box" means in this context. As previously stated, many ELLs have limited depth of vocabulary. They may recognize "box" as a noun — a container with four sides. Although box is not a mathematical term, not knowing the word could lead the child to provide the wrong answer because she doesn't understand the directions. If this happens consistently, the child won't be successful in math and could receive interventions that don't include vocabulary or language development.

Word problems can present an enormous difficulty for ELLs. This is especially true for problems that have complex structures, such as subordinate

and independent clauses. Consider a problem on from New York's Common Core math module for Algebra I:

> At 1:00 p.m., Jacob hops in his car and drives at a constant speed of 25 mph for six minutes to the post office. After 10 minutes at the post office, he realizes he is late and drives at a constant 30 mph to the grocery store, arriving at 1:28 p.m. He then spends 20 minutes buying groceries. Draw a graph that shows the distance Jacob's car is from the house with respect to time. (2012, p.11)

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Notice that the student must read through many complex sentences filled with information before knowing the directions. Have you ever read something as an adult and said to yourself, "I know what each of these words means, but I have no idea what it means in this context?" This happens quite frequently to me when reading through education regulations and policy jargon. Teachers need to define phrases such as "hops in his car" and "with respect to time." Knowing the core meaning of the individual words in the phrase won't help students define the phrase.

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ELLs may not be the only students who would have difficulty with a math problem like the one above. Native English speakers with limited vocabulary might also have difficulty following the directions for that math problem. Many times as I present strategies to groups of teachers some are quick to point out that these vocabulary strategies are great for all students, not just ELLs. That should be all the more reason to use them on a regular basis.

Vocabulary development strategies

Talking. ELLs need to practice using the language in their speech. Teachers can ask students to restate the definition in their own words and provide opportunities for students to use academic vocabulary in discussions. Sentence structures such as these help with this:

> *Beginner:* The pattern has_____.
> *Intermediate:* The first pattern has_____, but the second pattern has. Both have____.
> *Advanced:* While the first and second pattern both have ____, both are different because ____.

Chunking. For example, instead of teaching "inch" in isolation, also teach foot, centimeter, and yard. This helps students develop their schema and mentally organize their new vocabulary.

Get moving. Gestures and movements will help students remember what words mean. They'll be able to associate the meaning of a new word to a movement or gesture.

Journaling. Have students keep definitions or nonlinguistic representations of words in a math journal. This could also include analogies such as graph is to pie chart as _____ is to _____. Allow them to complete this analogy in their native language if they choose to.

Conclusion

ELLs have limited depth of vocabulary, which causes language structures to become very complex, even in math. These gaps in vocabulary acquisition should not be mistaken for limited cognitive ability. Instead, educators should use a variety of strategies to assist ELLs in acquiring academic language. Furthermore, these strategies can be used with all students because all students are academic English language learners. **K**

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