

## Evaluate

The process of evaluation should occur throughout the learning experience, allowing the teacher to determine whether the learner has reached the level of understanding needed at every stage. More formal evaluation, however, can now be conducted. If at any point the teacher decides that a student has not reached the desired level, they simply go back to the appropriate stage.

## The Goal of *Making Maths Accessible*

*Making Maths Accessible* is written to provide practical classroom tips and suggestions to strengthen the quality of classroom instruction for teachers of mathematics. The tips and suggestions are based on research and in practices and strategies that address the affective, linguistic and cognitive needs of all students including English language learners.

Although this resource centres on teaching English language learners, many of the tips and suggestions benefit all students. However, it is important to remember that while the tips and strategies we explore may benefit *all* learners, they are *necessary* for the acceleration of language and content acquisition by English language learners.

We will follow five case studies of composite student profiles throughout the book with opportunities for reflection to increase personal awareness of both the teacher's role and students' needs in the mathematics classroom, tasks to provide interaction with the content of the book, and hot tips for ideas applicable to real-world classroom situations. Sample responses to the reflections and tasks are provided in appendix B (page 129).

The first four chapters of *Making Maths Accessible* lay the foundation for working with ELLs in mathematics classrooms. In chapter 1, we will focus on the challenges facing teachers in their classrooms as they strive to ensure the success of English language learners. We will introduce the students in the case studies, whose needs will be a focus in each chapter. In chapter 2, we will look at affective supports, which show how a positive classroom environment enhances learning. Chapter 3 is designed to provide teachers with practical strategies and activities for supporting ELLs' language development while still teaching mathematics content. Chapter 4 centres on providing cognitive supports by teaching mathematics conceptually for long-term retention using a variety of practices, tools and techniques.

Chapters 5 and 6 are designed to connect the fundamental supports outlined in chapters 1–4 with real-life classrooms. In chapter 5, we will use a lesson developed using the Five E (5E) instructional model, a teaching sequence that meets the needs of English language learners. To summarise the description of the model given earlier, the five phases of the sequence are:

1. **Engage**—The purpose is to pique students' interest, get them involved, and connect to their prior knowledge.

The rigorous mathematics set forth and frequently reflected in state standards demands that educators rethink their teaching of mathematics to make the content accessible to linguistically diverse students. English language learners have traditionally performed at lower levels on standardised tests than other students, even other subgroups. Low language ability makes it difficult to measure mathematics achievement since the test measures language as well as content. Additionally, variables such as socioeconomic status, parent education and family support may outweigh school influences in affecting student achievement.

According to Haynes (2003), the problem is compounded because many English language learners have gaps in their mathematics content background due to sporadic attendance or prior education under a curriculum vastly different from that in Australia. Consequently, ELLs get further and further behind their peers when they are denied the opportunity to solve meaningful mathematics and challenging problems because of language barriers.

Not only must ELLs learn the mathematics content, but they also must do so while learning vocabulary, the structure of the language and mathematics discourse. Mathematics has its own register—language specific to mathematics—in which some words, such as *table* and *face*, have a meaning that is different from the meaning of the commonly used word. Combinations of common words sometimes form mathematical terms, such as *composite number*, *place value* and *least common denominator*, in which the meaning of the combination of words is different from the sum of the separate definitions. Mathematics texts and word problems are conceptually packed, requiring vertical, horizontal and sometimes diagonal reading. The student must adjust his or her reading speed to comprehend technical language containing symbols, which often means he or she must read the text or problem multiple times (Bye, 1975). However, just because a student is not proficient in English does not mean the student cannot think. Delaying English language learners' participation in true problem solving until they have mastered the English language is not an option. Listening, reading, speaking and writing skills are the vehicles for understanding, participating in and communicating mathematical concepts and skills—and must be taught concurrently with the mathematics (Crandall, Dale, Rhodes & Spanos, 1985).

## HOT TIP!

**Understanding:** Mentally grasping an idea

**Participating:** Taking part in and sharing with others in the act of learning

**Communicating:** Engaging in discourse with other students and/or the teacher

## The Language Acquisition Process

In order to provide appropriate instruction to an English language learner that enables him or her to succeed in rigorous mathematics, it is helpful to understand the process of language acquisition.

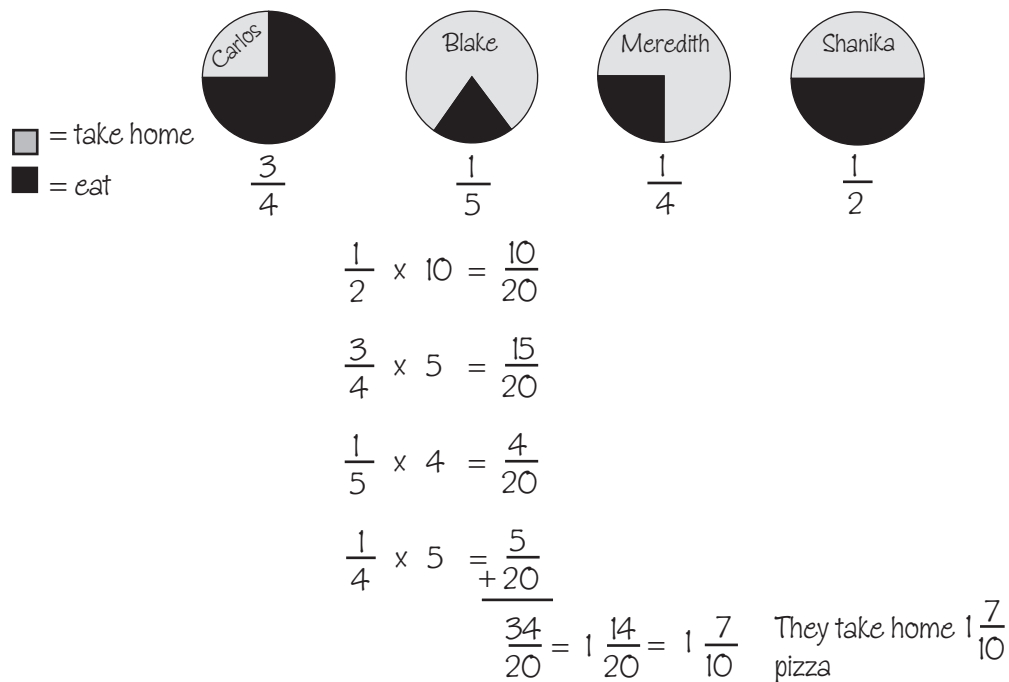
According to Cummins (1981), without ELL instructional strategies, English language learners generally take four to seven years to become academically proficient in English. They usually go through a silent period of two to five months (Krashen, 1982) and spend the first couple of years learning Basic Interpersonal Communication Skills (BICS), which involves learning essential language skills from peers and television and in other informal settings.

## Providing Affective Supports for English Language Learners

**Case Study: Hanh**

Hanh and her parents are immigrants from Vietnam. Hanh is shy and from a family that places a high value on education. She learns quickly but relies heavily on modified texts in her classes. She becomes frustrated when working out contextual mathematics problems, especially when given more than one or two problems to solve.

Carlos and his 3 friends Blake, Meredith and Shanika went out for pizza. Each person ordered a pizza. Carlos took home  $\frac{1}{4}$  of a pizza, Blake took home 0.8 of a pizza, Meredith took home 0.75 of a pizza and Shanika took home  $\frac{1}{2}$  of a pizza. How much did the friends eat?



Beginning

Early Intermediate

Intermediate

Advanced

Proficient

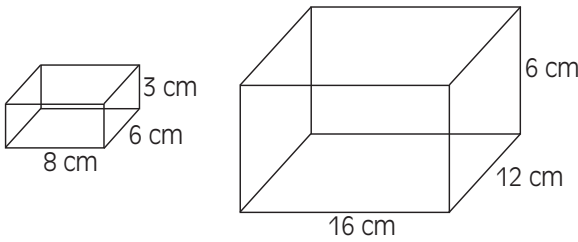
| Understanding   | Participating   | Communicating  |
|---|---|--|
| <input type="checkbox"/> Smile.<br><input type="checkbox"/> Pronounce the student's name correctly.<br><input type="checkbox"/> Be sure the student knows your name.<br><input type="checkbox"/> Establish routines so students know what to expect.<br><input type="checkbox"/> Face the class when speaking.<br><input type="checkbox"/> Speak slowly and distinctly.<br><input type="checkbox"/> Avoid slang and explain idioms.<br><input type="checkbox"/> Write legibly.<br><input type="checkbox"/> Repeat important information.<br><input type="checkbox"/> Allow students to audio record lessons.<br><input type="checkbox"/> Label objects in the classroom, such as <i>recycle bin</i> and <i>overhead projector</i> .<br><input type="checkbox"/> Create attractive, content-related display boards.<br><input type="checkbox"/> Provide plenty of wait time.<br><input type="checkbox"/> Be patient, kind, understanding and friendly.<br><input type="checkbox"/> Teach to appeal to all five senses. | <input type="checkbox"/> Smile.<br><input type="checkbox"/> Create a positive, non-threatening classroom environment.<br><input type="checkbox"/> Create a nurturing environment.<br><input type="checkbox"/> Find opportunities to bring the student's culture and language into class.<br><input type="checkbox"/> Give frequent, genuine praise.<br><input type="checkbox"/> Establish routines so students know what to expect.<br><input type="checkbox"/> Post procedures and schedules.<br><input type="checkbox"/> Use flexible grouping.<br><input type="checkbox"/> Assign bilingual students as peer partners.<br><input type="checkbox"/> Have groups present work using blank paper and textas.<br><input type="checkbox"/> Highlight contributions of mathematicians from other cultures.<br><input type="checkbox"/> Be patient, kind, understanding and friendly. | <input type="checkbox"/> Smile.<br><input type="checkbox"/> Be patient, kind, understanding and friendly.<br><input type="checkbox"/> Provide plenty of wait time.<br><input type="checkbox"/> Create word walls.<br><input type="checkbox"/> Use personal response boards.<br><input type="checkbox"/> Ask for thumbs up/thumbs down or other physical responses. |

## Providing Linguistic Supports for English Language Learners

Even though students at the intermediate level have probably acquired an active social vocabulary, they may not possess the mathematics vocabulary or understanding of the abstract structure of the language in mathematical problems such as the one in figure 3.3 to reach the solution without significant support. Students at the intermediate level still struggle with prepositions and the conditional structure of mathematics text.

Figure 3.4 shows what a student at the *advanced* level of language proficiency might read and comprehend.

Susan \_\_\_\_\_ a package to her cousin Robert \_\_\_\_\_ England. The \_\_\_\_\_ company sells two different-sized rectangular \_\_\_\_\_.



The cost to \_\_\_\_\_ the smaller \_\_\_\_\_ is \$2.50, and the cost to ship the larger \_\_\_\_\_ is \$20. Robert thinks that the \_\_\_\_\_ company is charging too much for the large \_\_\_\_\_ because he \_\_\_\_\_ it is only twice the size of the smaller \_\_\_\_\_. However, Susan argues that the price is correct because it is \_\_\_\_\_ on volume. Who is correct? Justify your answer.

Figure 3.4: Comprehension at advanced proficiency.

At the advanced level, students are proficient enough in both English and the language of mathematics to solve the problem with some ELL support; they may continue to have difficulty with prepositions that do not indicate position, pronouns, conditional sentences, passive voice, and words with different common and mathematical meanings (such as *table*). An example of a conditional sentence is:

- *If* Johnny has one dollar one day and doubles that amount each day thereafter, how much money *would* he have on the thirty-first day?

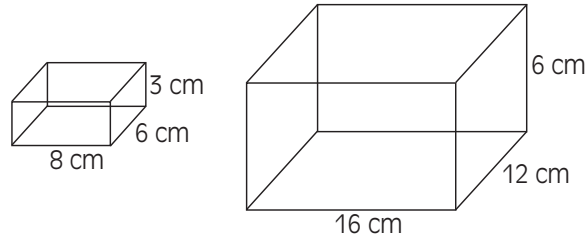
An example of active voice versus passive voice is as follows:

- Active voice—Johnny hit the ball.
- Passive voice—The ball was hit by Johnny.

Students may frequently struggle with reversals between English and number expressions: *three less than five* should be written  $5 - 3$ , but ELLs may write  $3 - 5$  instead.

We would expect students at the *proficient* level to read problems on year level with few, if any, LEP modifications. Figure 3.5 (page 36) shows the original problem. The correct answer is Susan. (The volume is 8 times greater:  $\$2.50 \times 8 = \$20$ )

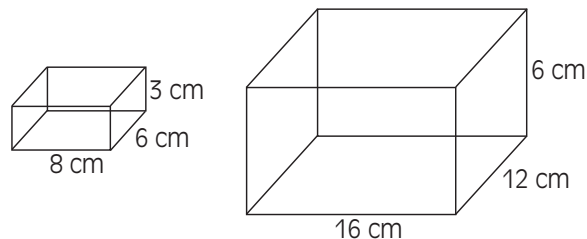
Susan \_\_\_\_\_ a \_\_\_\_\_ her cousin Robert \_\_\_\_\_ England. The \_\_\_\_\_ sells two \_\_\_\_\_-\_\_\_\_\_ rectangular \_\_\_\_\_.



The cost \_\_\_\_\_ the smaller \_\_\_\_\_ \$2.50, and the cost \_\_\_\_\_ the larger \_\_\_\_\_ \$20. Robert \_\_\_\_\_ that the \_\_\_\_\_ \_\_\_\_\_ too much \_\_\_\_\_ the large \_\_\_\_\_ because he \_\_\_\_\_ only twice the size \_\_\_\_\_ the smaller \_\_\_\_\_. \_\_\_\_\_, Susan \_\_\_\_\_ that the price \_\_\_\_\_ correct because \_\_\_\_\_ volume. Who \_\_\_\_\_ correct? \_\_\_\_\_ your answer.

Comprehension at intermediate proficiency.

Susan \_\_\_\_\_ a package to her cousin Robert \_\_\_\_\_ England. The \_\_\_\_\_ company sells two different-sized rectangular \_\_\_\_\_.



The cost to \_\_\_\_\_ the smaller \_\_\_\_\_ is \$2.50, and the cost to ship the larger \_\_\_\_\_ is \$20. Robert thinks that the \_\_\_\_\_ company is charging too much for the large \_\_\_\_\_ because he \_\_\_\_\_ it is only twice the size of the smaller \_\_\_\_\_. However, Susan argues that the price is correct because it is \_\_\_\_\_ on volume. Who is correct? Justify your answer.

Comprehension at advanced proficiency.