5 Best Practices for Teaching Mathematics to English Language Learners
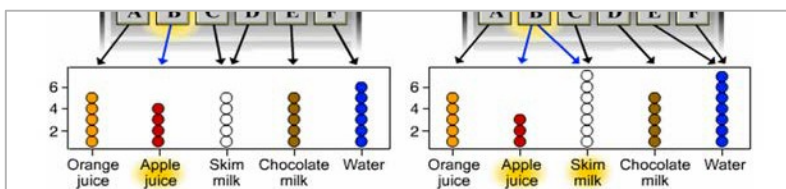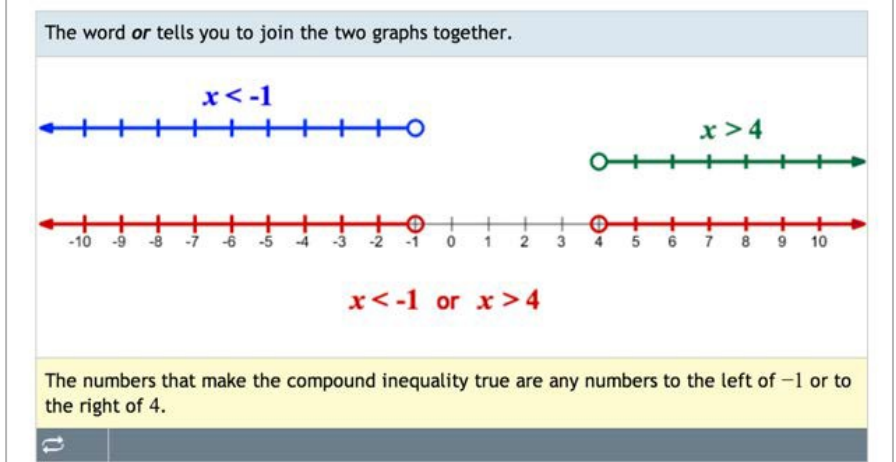
English Language Learners (ELLs) represent a significant and rapidly growing percentage of our nation's learners, and the challenge of teaching these students effectively is faced in every math classroom. The reality of this growing need, combined with the expectation of a high-quality education for all students and national accountability measures, requires rich, practical teaching strategies that support ELLs—and all students—in developing academic literacy and engaging in deeper understanding of mathematics.

1. Build academic vocabulary

Teachers can help students acquire academic vocabulary by clearly defining terms within the context of what is learned, using language connections and visual representations whenever possible to strengthen and reinforce vocabulary development.

In addition to a Glossary with visual representations of terms and definitions in both English and Spanish, Agile Mind provides definitions of key vocabulary within the context of the new learning. These definitions are often accompanied by interactive animations that highlight the concept associated with the word.

A *compound inequality* consists of two or more inequalities joined by the words **and** or **or**. When the word **or** joins two inequalities, it indicates that at least one, and maybe both, of the inequalities is true. Use the animation to learn how to represent the inequality $x < -1$ or $x > 4$ on a number line.

The word *or* tells you to join the two graphs together.

$x < -1$

$x > 4$

$x < -1$ or $x > 4$

The numbers that make the compound inequality true are any numbers to the left of -1 or to the right of 4.

The "Refreshments" vending machine is an example of a relationship that represents a function. A *function* is a relationship between two sets in which an element from one set is associated with a unique element of the other set.

Function has many meanings. Sometimes, people call a job or role that has been given to someone a function: "His *function* is to greet people who come in the door."

People also use the word "function" when they talk about some social events: "The prom is a very dressy social *function*."

Other people might use the word "function" to describe that something is working correctly: This machine *functions* normally.

In this topic, you will learn about mathematical functions: functions that describe a special kind of relationship between two sets.

Giving ELL students more ways to experience language increases their ability to create and retain meaning. Paying careful attention to word origins and multiple meanings for terms can help students develop connections between familiar, everyday language and academic vocabulary.

In Agile Mind programs, *Language notes* highlight connections between words, and *Language strategy* and *Support for ELL* notes in the *Advice for Instruction* provide additional guidance that can be used in class to help students form useful associations.

2. Bridge from vocabulary acquisition to conceptual understanding

ELL students benefit when teachers use diverse methods of communicating concepts. Using multiple representations of relationships and ideas—graphs, tables, words, images, and symbolic—helps students develop deeper understanding.

Making connections among various representations helps ELL students organize information and build a connection from the word to the concept. Embedding the mathematics in real-world scenarios can also connect ideas to students' own experiences.

Throughout the Agile Mind programs, students engage with key concepts through multiple representations. They learn to move among the various representations, forming connections and, thereby, deepening their understanding of these concepts.

The more toppings you order, the higher the price of the pizza. Each time you add another topping the price increases by $0.50.

Number of toppings	Cost in dollars
0	7.00
1	7.50
2	8.00

The price of this pizza is $8.00. Drag another topping on to the pizza to watch what happens to the table and graph when you add three toppings.

1 2

By presenting key ideas with visually stimulating images, graphic organizers, and interactive animations, teachers provide students with multiple access points to engage with and learn challenging academic content.

Agile Mind programs include rich images and hundreds of animated visualizations to support dynamic lessons. The animations are designed to help teach standards-based concepts proven difficult to learn without visualization and to provide memorable mental models. They help students learn concepts more efficiently and more deeply.

How would you calculate the area of a swan–like shape?

Drag the tiles from the swan to fill the rectangle. Use the clockwise and counterclockwise buttons to rotate a selected tile.

3. Support student discourse

Active participation in classroom discussion is essential to learning for all students—and particularly for ELLs. Teachers must create and support frequent opportunities for students to speak and write about the subject matter in meaningful ways that encourage reasoning, justifying, generalizing, and deepening content knowledge. Only when students regularly use the language of mathematics and science do they become proficient with it.

Agile Mind *Explorings* offer overarching questions to drive student inquiry, help students make connections, and support development of deep understanding. Guiding questions embedded throughout the topic enable teachers to further build students' conceptual understanding as they evaluate evidence and revise their thinking.

By using probing and scaffolding questions designed to elicit thoughtful responses, teachers can promote active classroom discussion and shape students' ability to use academic language appropriately.

But how are x and y related to the height of the shadow?

1 2 3 **4**

4. Leverage formative assessment

In a study of pollution to cultivated land resulting from the use of chemicals, scientists noticed that climate seemed to have an effect on the amount of insecticide that accumulated in the air. Insecticide was applied to two different cotton fields and the accumulation of insecticide I (in $\frac{grams}{meter^3}$) was measured at periodic intervals over the next few days.

In field A, the average temperature was 30°C and the cumulative amount of insecticide was modeled by $I_A = 1.26 + 3.93 \ln x$, where x is the number of hours since the application of the insecticide. In field B, the average temperature was 21°C and the insecticide was modeled by $I_B = -8.85 + 5.95 \ln x$.

a. Graph both functions on the same set of axes. Clearly designate the equation for each curve.

b. Compare and contrast the two curves.

c. Discuss the range of this problem situation.

d. Analytically determine the solution to $I_A = I_B$ and explain what the solution represents.

All students need time to practice, review, and apply knowledge. Toward this goal, it is crucial that teachers provide rich opportunities for student application and practice and for assessing understanding in real time.

Using activities like Agile Mind's *Constructed response* assessment items enables teachers to assess students' writing about their thinking and their understanding.

Checks for understanding designed into each Agile Mind lesson equip teachers to conveniently appraise student understanding without interrupting the flow of instruction, and to adapt instruction on the fly according to their assessment of student progress.

For example, carefully designed puzzles, when embedded within the flow of instruction enable students to apply new learning immediately, and enable teachers to make informal checks for understanding. Puzzles designed as Cloze activities—paragraphs from which key words are removed—help ELL students place vocabulary words in context.

Distance from motion detector in feet

Time in seconds

Elapsed time: **10** seconds

In the *Overview*, you learned about the ideas of rate and speed. But before we begin to explore these ideas further, can you solve this puzzle to check your understanding of these important words?

| rate | distance | speed | time |

The skateboarder begins at a [A] of 7 feet from the motion detector.

How many seconds the skateboarder's ride lasts is the [B].

The skateboarder's [C] is negative.

Hint   Submit Answer

5. Use technology-enhanced practice and applications

The graph of the exponential function $y = 2^x$ is shown. Move the sliders to transform the graph and create a function with the following characteristics.

1. The function has a constant multiplier of 3.
2. The graph has a horizontal asymptote at $y = 5$.
3. The graph passes through the point (2,6).

$$y = b^{(x-h)} + k$$

$$y = 2.0^{(x-(+0.0))} + (+0.0)$$

b k

$y = 2^x$

Reset

h

Submit Answer
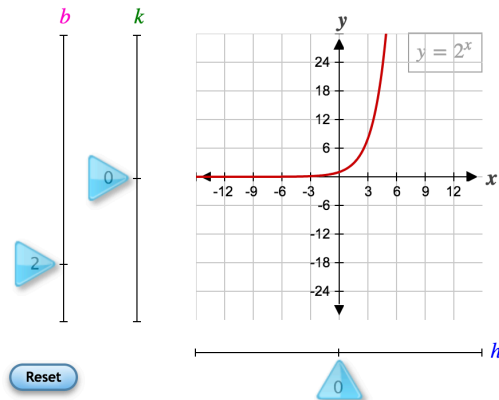
Using technology in substantive ways rather than simply for visual appeal or entertainment is crucial for all students' learning, and particularly for language learners.

Technology-enhanced tools like those in Agile Mind's instruction and assessment components can provide students with hints and feedback to support interactive learning through substantive problem solving. They also represent, in the context of learning, the high-stakes testing environments students can expect to encounter.