

Teaching English Language Learners

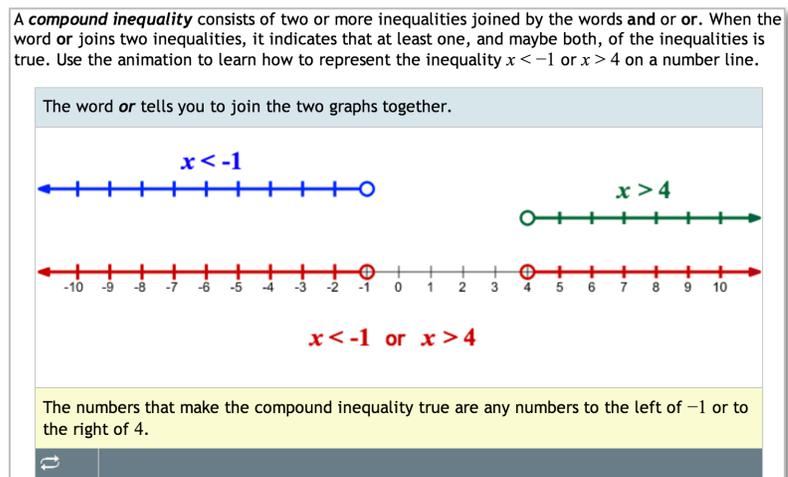
English Language Learners (ELLs) represent a significant and rapidly growing percentage of our nation’s learners. The challenge of teaching these students effectively is faced in every classroom in every subject area. The reality of this growing need, combined with national accountability measures and the expectation of a high-quality education for all students, requires rich, practical teaching strategies that support ELLs in developing academic literacy and deepening understanding of the subject matter.

To be successful, ELL students must experience the English language in many ways – through pictures, kinesthetic movements, manipulatives, listening, speaking, reading and writing (Hill and Flynn, 2006). Giving ELL students more ways to experience the language and make connections increases their ability to create and retain meaning (Sousa, 2011). This essay provides specific high-yield teaching strategies and highlights key design elements of the Agile Mind system that can be used to support rich learning by ELL students.

Building academic vocabulary

Imagine being expected to learn a foreign language only by hearing it. Would it help to see it written? Would it still be difficult to quickly develop understanding? Teachers can help ELL students acquire academic vocabulary by clearly defining terms within the context of what is learned, and by using language connections and visual representations to reinforce understanding whenever possible. In mathematics, ELL students benefit when a concept is taught before being named with the academic word. For example, students should first experience, discuss, and describe how the position of a line compares to that of the x -axis, then formally define *slope* as the word that describes the concept. (Coggins, 2014).

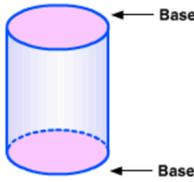
Agile Mind provides definitions of key vocabulary terms within the context of the new learning typically in the *Overview* of a topic. These definitions are often accompanied by rich visual representations and interactive animations that highlight the concept associated with the word.



Agile Mind also provides a *Glossary* of selected terms that includes definitions in both English and Spanish, as well as visual representations of key concepts.

cylinder

A cylinder is a three-dimensional geometric figure having two parallel congruent bases that are circles.

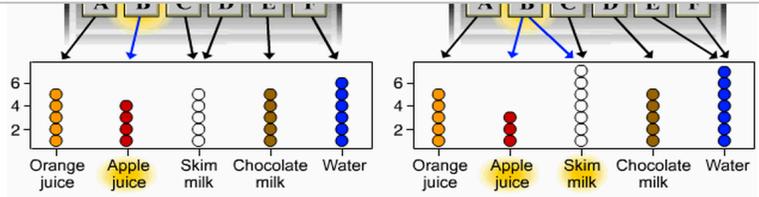


cilindro

Un cilindro es una figura geométrica tridimensional que tiene dos bases paralelas congruentes que son círculos.

It is important to be aware of academic vocabulary that may have multiple meanings within students' daily lives. Some words may sound familiar to students from use outside of the classroom, but have a specific meaning in the context of the subject area. Drawing attention to word origins and multiple meanings for terms can help students develop connections between familiar, everyday language and the unique meaning a word has in the context of the mathematics classroom. Often a primary language will have cognates— words that are similar in structure with the same meaning—with English, like angle and el ángulo in Spanish. Being familiar with these will assist students with making connections faster (Sousa, 2011).

Language notes available within Agile Mind lessons provide opportunities to point out connections between words, and *Language strategy notes* in the *Advice for Instruction* provide additional guidance that can be used in class to help students form useful associations.



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.

Explicit strategies for vocabulary acquisition

Vocabulary notebook. Even though ELL students often have access to dictionaries and translating applications, it is helpful for them to keep a notebook of new vocabulary along with visual representations (Hill and Flynn, 2006). ELL students can use the definitions and images in the Agile Mind lessons, as well as those found in the Glossary, to support the addition of key terms in their notebooks.

Think aloud. Activities such as “think alouds” support ELL students in speaking English. Teachers connect words to concepts by telling students they are going to think out loud, and then following up with a rich description of a concept or word. For example, a teacher might say, “I need to identify the slope. So I am going to think out loud: if I’m looking at the equation of the line in slope-intercept form, the slope is the number in front of the x term. I see that one side of my equation has y alone and x is on the other side, so when I see $-2x$, I know that the slope is -2 .” Use the simplest words except for particular academic vocabulary words you are working on, and always connect your description to a visual representation (Coggins, 2014).

Echo repeat and choral chant. These strategies engage students in hearing words and repeating them. Echo repeat can be used for many new words. It can be as simple as having students repeat a word you say, or having students repeat a phrase like “vertical lines have no slope -- that is, the value of the slope is undefined.” A choral chant is similar, but usually involves rhythmic chanting and often is longer than a single sentence. Teachers could use a choral chant to teach trig ratios, engaging students in clapping to add in a physical component (Coggins, 2014).

Word Walls. ELL students benefit from word walls of core vocabulary in the classroom. Teachers can add the core vocabulary words called out in the *Advice for Instruction* to a word wall. Interacting with the word walls during classroom activities reinforces students’ recall and understanding of key ideas. Specific activities teachers might use in conjunction with the word wall include:

- Missing word – After words have been on the wall for a while, remove one and see whether students can identify which word was removed.
- Guess my word – Pair students up, each with a word. Ask them to take turns acting out the word or describing the word (without using it) while their partner tries to guess it. Teachers can vary it to engage the whole class with one word by giving clues and having the class guess the word.
- Grouping words – Choose two related vocabulary words and have students guess what the words have in common.
- What do they share – Have students randomly choose two words and then find something the words have in common or a way they are related.

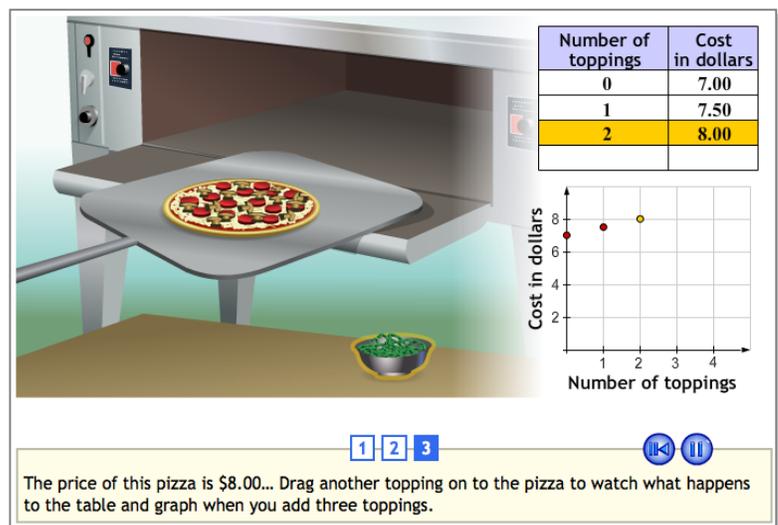
Teachers can also modify their own spoken language to support ELLs by using appropriately slower speech and reducing the use of idioms in conversation, such as “as no pain, no gain” or “practice makes perfect” (Hill and Flynn, 2006).

Bridging from vocabulary acquisition to conceptual understanding

Multiple representations

ELLs, and all students, benefit when teachers use diverse methods of communicating concepts. Learning a new language requires connections to the primary language as well as concrete connections such as visuals and real objects (Sousa, 2011). Students learning English may be troubled by differences in syntax (adjectives coming before nouns instead of after), numbers being written in reverse order, or a drastically different alphabet (Sousa, 2011). Using multiple representations of relationships—graphical, tabular, concrete, and algebraic—helps students develop deeper understanding (Hill and Flynn, 2006).

Throughout the Agile Mind programs, students engage with functional relationships through multiple representations. They learn to move among the various representations, forming connections and, thereby, deepening their understanding of these relationships. This helps ELL students organize information and build a connection from the word to the concept.



Real-world scenarios

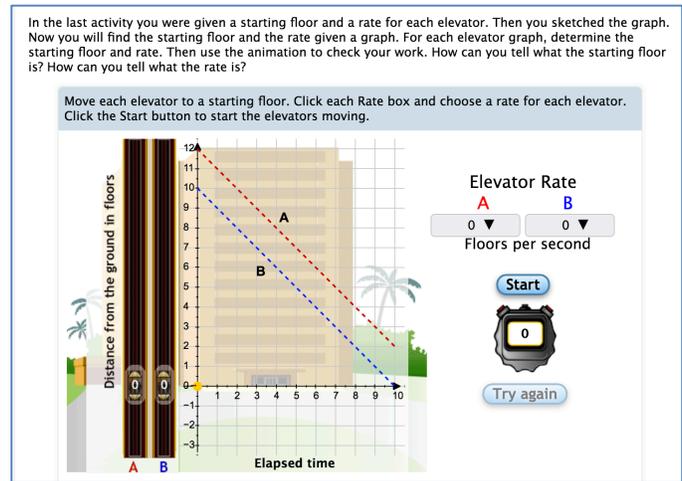
Embedding the mathematics in real-world scenarios can also connect ideas to students' own experiences, helping them better understand the meaning of the new mathematics. Whenever possible it is also helpful to bring in a real object (realia) to represent the situations and words taught (Coggins, 2014).

Sensitivity to students' backgrounds and their diversity in experiences and cultures is particularly important when working with ELL students, given the additional challenge of learning a new language. Be intentional about learning the culture of your students and recognize that they bring cultural norms different than your own that impact learning styles. Teachers can help ELL students better understand novel words and situations by exploring them in contexts that are meaningful and relevant. If a

problem scenario is unfamiliar, teachers should make connections for students to more familiar real-world experiences. Research ahead of time – and a culture of learning that welcomes and values all students – can help teachers identify what those contexts might be for a specific student or group of students. (Nuri-Robbins et al, 2012).

In Agile Mind, each topic begins with an *Overview* that introduces the mathematics of the topic with animations, simulations, and real-world scenarios. The *Overview* serves as a launch for deeper study -- students engage in scenarios designed to capture their interest and make them want to learn more about the mathematical ideas contained in the topic.

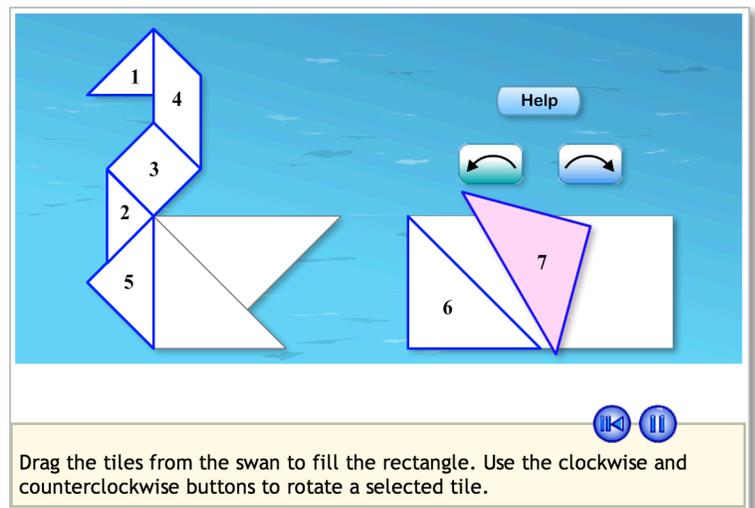
Agile Mind *Explorings* deepen student investigation with the scenarios and related mathematical concepts. Approaching ideas conceptually, in the context of the real world, engages students to build a strong foundational understanding, to retain knowledge longer, and to work toward mastery faster.



Rich visualizations and animations

By presenting key concepts with visually stimulating images, graphic organizers, and interactive animations, teachers provide students with multiple access points to engage with and learn challenging academic content (Coggins, 2014; Hill and Flynn, 2006).

Agile Mind programs include static 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.



For ELLs, the visually rich content helps them make connections between the graphical depiction of concepts and the language and academic vocabulary they are learning.

Explicit strategies for building conceptual understanding

Concept maps. ELL students benefit from graphic organizers such as Frayer Models. These models begin with the word or concept in the middle of the paper and surround it with sections for examples, non-examples, characteristics, and a definition. (Coggins, 2014; Hill and Flynn, 2006).

Manipulatives. In addition to using animations, teachers can provide manipulatives to add another layer of connections between concept and English word (Coggins, 2014; Hill and Flynn, 2006).

Total physical response. This technique gives a physical as well as visual connection. Students use movement in concert with words to describe a concept or term. These can be quick, low stress activities that provide students a chance to move. For example, acute, right and obtuse angles can be taught using arm movements to signal the angle measures (Asher, 2009).

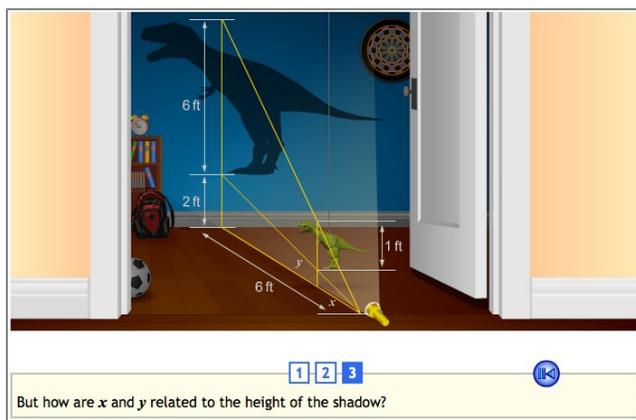
Anchor charts. These posters “anchor” a group of lessons by giving simple visuals and examples that students can turn to when they need a reminder. These remain on the wall throughout the relevant lessons and then are brought back from time to time as spiral review tools or when they support a new concept (Hill and Flynn, 2006).

Fostering 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 (Hill and Flynn, 2006). ELL students learn best when they engage in listening, speaking, reading, and writing every day in every content area (Sousa, 2011). 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.

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.

Additional questioning strategies to probe student thinking and generate classroom discussion can be found in the *Advice for Instruction*.



Explicit strategies for fostering discourse

Think-write-pair-share. Pairing ELL students with native English speakers can provide opportunities for enriching language acquisition, but it is wise for teachers to be sensitive to ELL students' comfort level, especially if a student is very new to the language and may be in a silent period. Teachers should respect that time for new learners to listen and receive language before producing it (Sousa, 2011).

Sentence frames or stems. Sentence frames or stems provide ELL students with a scaffold to the language and access to organizing their own thoughts, and are particularly useful when these students are speaking in class (Motley, 2013). It is helpful to have a set of stems that are used consistently to organize feedback and open discussions with other students (Coggins, 2014). Examples are "I wonder if _____" and "I suggest we try _____". Other suggested activities and examples of sentence stems/frames can be found in *Language strategies* in the *Advice for Instruction*.

Adapted activities. ELL students often need help making sense of problems and persevering in solving them. One strategy that can be helpful when students are just beginning to persist is to move questions to the first sentence, and to strike out unnecessary information and words (Motley, 2013).

Talk, read, talk, write. This structure begins class with a short discussion to access prior knowledge. Often the "Opening the lesson" suggestions in the *Advice for Instruction* provide a great opportunity for this. Next, students engage in a reading activity of a scenario or problem situation. Then students discuss again in groups and, finally, write about the conclusions they reached (Motley, 2013).

Kagan structures. There are many Kagan structures that are helpful in organizing discourse (Kagan, 2009). Helpful ones include:

- Quiz, quiz, trade – Students hold cards (vocabulary cards, e.g.) facing each other. They take turns quizzing each other on the card, switch cards, and move down to work with a new partner.
- Stand up, hand up, pair up – Used as a way to mix partners, students stand up and put their hands up, only putting them down when they have found a new partner.
- Rally Coach – Students take turns as problem solver and coach. One works a problem while the other coaches and encourages, then they switch roles. Depending on the language level of the ELL student, it is often helpful for that student to be "coached" first.

Leveraging formative assessment

All students need time to practice, review, and apply knowledge. Teachers must provide rich opportunities for student application and practice and for assessing understanding in real-time. Feedback is vital for ELL students, and should be focused on the knowledge and skills being assessed while reinforcing English where needed. If correction of English is needed, try to rephrase and repeat what was said using the correct form instead of correcting the student (Hill and Flynn, 2006).

Embedded formative assessments

The comprehensive resources available with each Agile Mind program include both print (Student Activity Sheets) and online opportunities for students to continuously practice and apply what they have learned, and receive real-time feedback on 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, puzzles embedded within the lesson enable students to apply new learning immediately, and enable teachers to make informal checks for understanding. Many of the puzzles in Agile Mind act as Cloze activities, helping ELL students place vocabulary words in context. Cloze activities are paragraphs where key words are removed, giving ELL students the opportunity to place words into context.

In the *Overview*, you reviewed the connections among a constant rate of change, the slope of a line, and a linear function. Before you explore these ideas further, can you solve this puzzle to check your understanding of this important vocabulary?



rate of change linear function constant slope

When talking about how quickly or slowly a linear function is changing, you are discussing the function's **A**.

The graph of a **B** forms a straight line. The line is straight because the linear function has a **C** rate of change.

When you graph a linear function, **D** refers to the steepness of the line the function makes. The slope of this line is the same as the **E** of the linear function. The slope can be expressed as a decimal, fraction, or integer.

Hint Submit Answer

Student: _____ Class: _____ Date: _____

Patterns in proportional relationships
Block 2 Student Activity Sheet

- Consider a shade of green paint made by using 1 cup of blue paint for every 2 cups of yellow paint.
 - Write a rule you can use to find the number of cups of yellow paint you will need for any number of cups of blue paint. Write your rule in words.
 - The table represents the relationship between cups of blue paint and cups of yellow paint needed to make this shade of green. Complete the table. What process did you use to find the number of cups of yellow paint?

Cups of blue paint	Process	Cups of yellow paint
1		
2		
3		
4		
 - What is the **coefficient** in the algebraic rule?
 - Does this algebraic rule make sense for the scenario? Why or why not?
 - What would happen if you had 0 cups of blue paint? How many cups of yellow paint would you have?

Student Activity Sheets

Student Activity Sheets (SAS) give ELL students a way to organize their thoughts and rich text to process that connects to the lesson. They provide opportunities through writing for ELLs to further develop their understanding and practice using academic language appropriately. When students engage in offline work on their activity sheets, they are prompted to solve challenging problems, continue to practice and apply their learning, and demonstrate and justify their thinking. ELL students can pre-read the sheets, highlighting words they need to add to their notebooks and reviewing rich visuals that can be labeled with content words (Hill and Flynn, 2006).

Practice items

Dedicated practice components such as Agile Mind's *Guided practice* and *More practice* sections, provide students with opportunities to practice and apply their thinking, accompanied by hints and feedback to support interactive learning through substantive problem solving.

These areas contain interactive and technology-enhanced assessments with real-time reporting that provide rapid feedback and automatic grading, extending the teacher's presence. Students get multiple attempts at answering items correctly. Hints and feedback are available to help students organize their thinking and identify common misunderstandings.

In the diagram, \overleftrightarrow{AB} and \overleftrightarrow{CD} intersect at point E, and $m\angle AEC = 49^\circ$. Fill in the blanks with the missing angle measures for the remaining three angles.

Hint

How are the measures of vertical angles related? What is the sum of the measures of two angles that are supplementary?

Other opportunities for students to demonstrate thinking and problem-solving skills include the *Constructed response* assessment items in each program. Through the use of these rich, multi-part activities teachers can assess students' writing about their thinking and understanding.



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 $\frac{\text{grams}}{\text{meter}^3}$) 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 $I_B = -8.85 + 5.95 \ln x$.

- Graph both functions on the same set of axes. Clearly designate the equation for each curve.
- Compare and contrast the two curves.
- Discuss the range of this problem situation.
- Analytically determine the solution to $I_A = I_B$ and explain what the solution represents.

Explicit strategies for leveraging formative assessment

Learning goals. Giving explicit learning goals in student-friendly language centers the lesson and gives ELL students an idea of what to look for in the instruction/activity (Hill and Flynn, 2006).

KWL Chart. An organizer like a Know, Want to Know, and Learned Today chart provides self-assessment opportunities and gives the teacher valuable feedback that can be used in future lessons (Hill and Flynn, 2006).

Exit tickets. ELL students benefit from exit tickets that engage in self-evaluation (Hill and Flynn, 2006). For example, stems like “Today I learned...” or “One thing I am confused about is...” give opportunities for students to express their level of understanding.

Summary

Many of the supports discussed in this essay are also called out in *Agile Mind’s Advice for Instruction* for teachers to utilize within the context of specific lessons. After a few lessons teachers will begin to see other places supports can be employed. The goal of all ELL supports is to immerse students in the English language, utilizing as many different senses and methods possible. When spoken and written language is supported with explicit strategies, visualizations, and interactions, ELL students will acquire and be successful with English and mathematics together.

Supporting other special populations of students

A number of principles that have emerged from Universal Design for Learning (UDL)—a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn—are beneficial when used both for English language acquisition by ELLs and for knowledge acquisition by learners with special needs, including those who qualify for special education. Per these frameworks a curriculum should stimulate interest and motivation in students; present information in different ways and through a variety of representations; and provide students with various methods for demonstrating what they know. Many of the key design elements of the Agile Mind programs highlighted in this essay support implementing UDL practices in the classroom. These design elements, as well as many of the explicit strategies called out in this essay to support vocabulary acquisition and conceptual development, will also support students with specific learning differences.

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