Language and Math

By Donna Curry

Through the years, I've heard teachers compare math and language. Some say, "Math is just another language." Others have said, "Math is not like language at all." Whether it is another language or not, understanding and using math concepts does require an *understanding* of language. It is a LOT more than just being able to read a word problem; it is about understanding conceptually what a situation requires an individual to do with math. In order to gain understanding, it is important for teachers to focus not just on the symbolic language of math but also the actual English words that can aid or hinder comprehension. Let's look at some situations where language influences math understanding.

Those Little Words

It is not just ESOL teachers who want to tear their hair out over those little prepositions. Math teachers also need to be sensitive to the power of prepositions and other little words. Simple words like *of* and *off* can throw students.

I have a box ***of*** *12. This box is $12* ***off****.*

By and *into* used to drive me crazy as a young student. Oh, how I loved all the math pages where the decontextualized division problems were already laid out for me! Then, I didn't have to think about whether I was dividing *by* or *into*.

12 ÷ 4 was a challenge for me. Does this mean 12 divided **by** *4, or 12 divided* **into** *4?*

(Actually, when I first learned to divide, I still did not really have to think about whether this was *by* or *into* since I knew the rule: the smaller number always goes into the bigger number. Unfortunately, as I progressed through the grades, I soon discovered that that rule was a lie.)

Let's look at more examples with prepositions: *Ten divided* **by** *one-half vs. ten divided* **in** *half.*

Sometimes we talk about dividing things *up*. How does this compare to dividing *by* and dividing *into*? And, can you imagine the frustration for an English language learner who is asked to add *up* a column of numbers when she will probably do so by adding *down*?

Another example of those simple little words being a big challenge for students are the conjunctions *and* and *or*. Do we mean the intersection or union? Is it this ***and*** that, or this ***or*** that?

No wonder our students struggle with math—and not just ESOL students. It is important that we take time to help students conceptually see the difference between such statements. When they see the difference, math will begin to make more sense.

Confused Pairs

I always struggled with least common multiple (LCM) and greatest common factor (GCF). As long as I had an example right in front of me I could figure out what to do. And, I was good at finding those LCMs and GCFs. . . . not that I knew what to do with them once I found them, but I could definitely accomplish the decontextualized task. Just like LCM and GCF, many math terms, especially when taught within the same unit of instruction, can be confusing for students. Factor and multiple, part of the LCM and GCF acronyms, seem to be particularly confusing. Horizontal and vertical, rise and run, denominator and numerator, supplement and complement, combination and permutation are some other examples. I'm sure you can think of a dozen other frequently confused pairs that we often teach together.

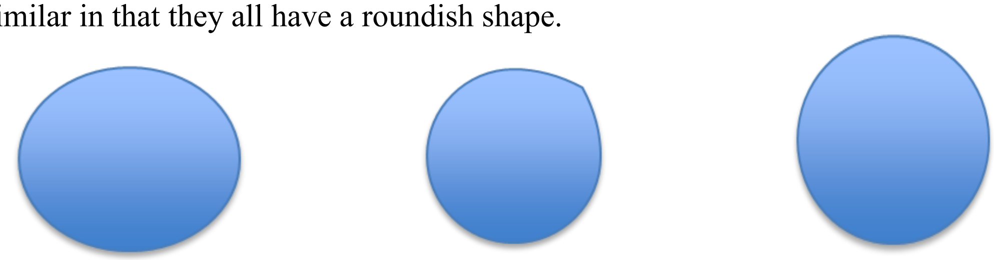
One suggested strategy is to, when possible, just teach one concept at a time, ensuring that students have the conceptual understanding behind the term before introducing the second term. This is easier to do with pairs such as factors and multiples, but more challenging with a pair such as denominator and numerator.

Another strategy is to use word origins and prefix meanings to help understand terminology. For example, the prefix *de-* often means down. You depress a clutch, you get depressed, and a denominator is the number that is down at the bottom of the fraction.

Words with Specific Meaning in Math

Another language issue with math is that many words have one meaning in everyday conversation and a different, very specific meaning for math. For example, *mean* has several meanings: not kind, intend, etc. In math, *mean* has a specific definition: it is the value of a set of numbers that has been totaled and then divided by the number in the set. (We usually know it as 'average' although average can be used to describe median and mode as well, especially in the business world.)

When I think of the word *similar,* I think of something that is sort of like something else. In math, however, *similar* has a more specific meaning. For example, in everyday conversation, I could say that the three shapes below are similar in that they all have a roundish shape.



However, in math, *similar* shapes must have the same shape. They can't be 'round*ish*'. They all have to be round, or square, or equilateral triangles, or whatever. There is no vagueness in the term similar in math even though in English similar we often use it to suggest vague likeness.

To help students develop specific math vocabulary, encourage them to create posters showing the term in regular English usage and then the specific math usage. Students could have a lot of fun showing the different meanings of terms such as *base*, *root*, and *product*.

Another strategy is to use the Frayer Model which is a word categorization activity. Students define a math term in their own words, then give examples and non-examples. (It is sometimes easier to give non-examples to illustrate a term.) A blank model is available on page 7 for you to use with your students.

Multiple Meanings within Math

Sometimes the same word in math can have different meanings. What comes to mind when you hear the word *round*? Did you first think about estimation? Or did you envision a circular shape? Speaking of shapes, what about the term *cube* or *square*? Are you still envisioning shapes? Or are you thinking about squaring or cubing a number? If possible, help students make the link between these terms. Square and cube are things you do to a number – which creates a square or cube (three cubed can be visualized as a cube with three dimensions).

Getting students to write in journals can help them gain clarity about the language of math. Asking students to visualize concepts allows you to see whether they really understand the terminology.

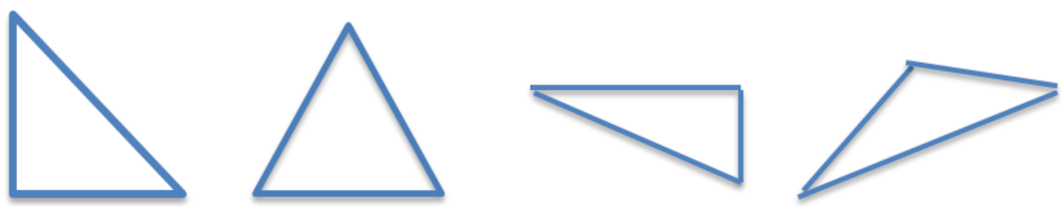
Modifying Meaning

Adjectives sometimes add little meaning to nouns. For example, a hot day vs. a sweltering day might mean a difference of a few degrees (or possibly no difference); it does not change the fact that it is still a hot day.

However, *number* can take on a completely new meaning when we add adjectives:

Whole number *Counting number* *Rational number* *Irrational number*

Suddenly, the set of *numbers* that we are talking about changes, sometimes quite dramatically.
A triangle might look like any of these shapes:



But, an equilateral triangle does not look like a scalene triangle. And, an isosceles triangle may or may not look like an equilateral triangle or a right triangle. Adjectives play a huge role in math definitions. Students may need to be taught to key in to, not just the nouns, but also the modifier as they construct meaning for math terms.

Word of Caution

Over time, mathematicians decide to change terminology. For example, it is now (supposedly) inappropriate to use the term ‘reduce’ when referring to fractions: you no longer reduce fractions, you simplify them. Teachers who immediately correct their learners who have been taught the term ‘reduce’ may frustrate students, especially when they are still struggling with the concept of reducing/simplifying. [By the way, reducing makes perfect sense to me: when you reduce 2/4 to 1/2, you are going from 2 to 1, and 4 to 2, both smaller numbers, therefore, ‘reduced’ numbers.] *Signed* numbers are no longer in vogue; it’s back to *negative* numbers. While language is important, teachers should not focus on correcting a student’s past language experiences just as he is beginning to explore a topic. It only reinforces the student’s math (and language) insecurity.

The language of math can be frustrating. As teachers, we need to take every opportunity to include vocabulary lessons along with teaching math computation and conceptual understanding. If not, our students may come to continue to believe that all of math is irrational, not just some numbers.

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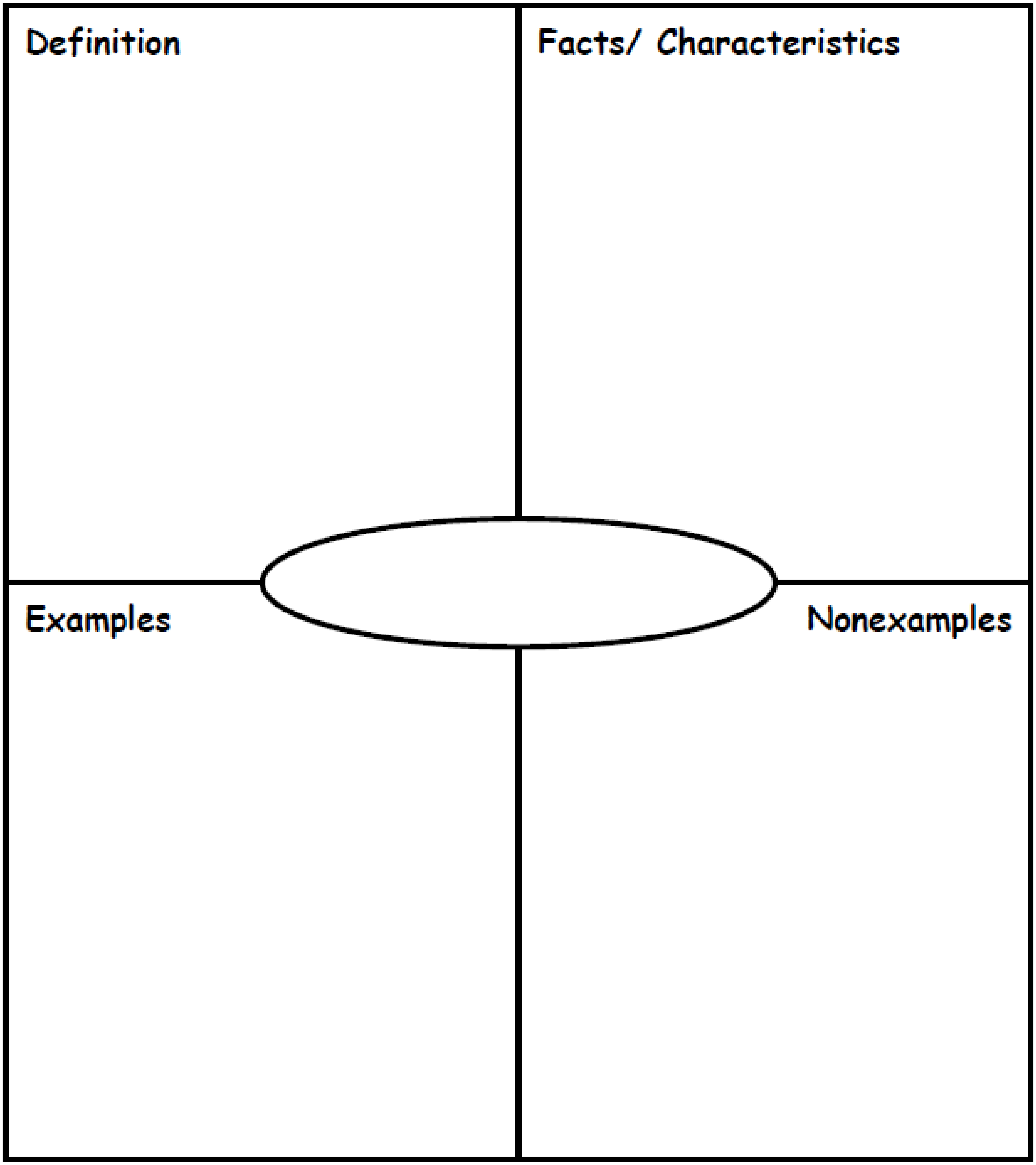

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