The Word Problem

How To Get Our At-Promise Students Reading in Math Class

Over the years, whenever I ask teachers to identify their most challenging part of teaching math, without fail, their emphatic answer is the same: WORD PROBLEMS!

After hearing this countless times, I finally decided to create a workshop for teachers called "How to Connect Math & Literacy," which offers creative, best practices for getting students reading, writing and speaking about the math they're learning. And while all kinds of teachers have told me how helpful this workshop has been for them, I also know it's especially critical for teachers of at-promise students.

For our at-promise students, the growing need to read complex text in math class can be potentially devastating, as they often lack the academic vocabulary and reading skills required to tackle such problems.

That's why this month I offer you an overview of three of the main strategies I present for helping our students approach, decipher and reflect upon how to read in math class. These strategies can help at-promise students solve the problems that appear in textbooks, on tests, and in life.

Why And How We Must Teach Word Problems

Word problems, sometimes called "Problem Solving," traditionally were more of an afterthought in math class, where calculations reigned supreme. They were usually found toward the end of the lesson (after practicing the procedural aspects over and over), or they were the "last two" problems students needed to complete to finish their homework or test.

However, with Common Core placing a high premium on more rigorous problem solving and literacy in math, the need for students to solve word problems is beginning to take center stage in mathematics curriculum. In short, word problems are becoming more important than ever.

So, how can we help our at-promise students keep up with this trend? Here are three main strategies to start with:

1. Understand that effective reading and math problem solving require *the same skill set.*

Consider the following table:

What Effective Readers Do:	What Effective Math Students Do:
*Create mental imagery based on descriptions.	*Create mental imagery based on numbers (lengths, amounts, etc.).
*Use context clues to understand unfamiliar text.	*Use symbols/operations to guide them in how to proceed.
*Are able to maintain stamina and focus.	*Persevere to find a solution.

As the table above illustrates, effective readers and mathematical problem solvers often utilize very similar skills, just with different content. Helping teachers and students understand this is critical to their success.

To spark discussion about these skills, I'll often put this table up on a wall, with only the top line filled out, and have the teachers or students come up with the characteristics. Light bulbs go on when they see the similarities, and sighs of relief are heard when they realize they can utilize skills they already possess. Then, we move on to the important differences.

2. Explain why reading in math is *different*.

As much as it helps to understand the similar skills involved in reading and solving word problems effectively, it's equally important to understand what sets math problem solving apart from literary reading comprehension. I often talk with students and teachers about how learning to read math is like learning to read a different language, and when we approach it this way, we can be much more strategic and effective at it.

Here are some of the key differences in reading math:

- **Text Flow**: Reading in math flows differently than reading a book of only words. From the time they learn to read, students are taught to begin at the upper-left hand corner of the page, and read from left to right until they reach the lower-right hand corner. In math textbooks, this is often not the case, as students can skip around the page, looking first at the charts, or examples, which may not be near the top of the page.

- **Text Structure:** When learning to write essays, we've traditionally been taught to start with the main idea, and use the following sentences to support

it. However, in math word problems, the main idea, or what we're trying to *actually solve*, often comes at the *end* of the paragraph.

Consider the following:

> A storeowner wants to mix cashews and almonds. Cashews cost 2 dollars per pound and almonds cost 5 dollars per pound. The storeowner plans to sell 150 pounds of a mixture. How many pounds of each type of nuts should be mixed if the mixture will cost 3 dollars?

Notice that the most important sentence is at the end, prompting the student on how they will need to approach this problem.

- **Tricky Vocabulary:** The language of math has a vocabulary, which, once unlocked, can make a world of difference in comprehension and problem solving. For example, in math, we often use words that sound and are spelled the same, but have entirely different meanings (know in our language arts classes as "homonyms"). Some examples of these include:

    - Whole (all of the parts) and hole (in the ground)
    - Sum (the result of adding numbers) and some (and unspecified amount)
    - Mean (an average) and mean (not nice)
    - Negative (a number less than zero) and negative (not desirable)

    A terrific way to approach math vocabulary is to teach the students to utilize the graphic organizer method called the Frayer Model, created by Dorothy Frayer from the University of Wisconsin. Great information (and free downloads of templates) on how to teach and use the Frayer Model can be found on West Virginia's Department of Education website: http://wvde.state.wv.us/strategybank/FrayerModel.html

3. Change the way we approach word problems.

Too often, our at-promise students want to find the solution as quickly as possible, and often fail to read the problem in its entirety, or truly find a pathway to the solution. Instead of the traditional "have them read it and draw a picture" strategy, consider trying some new strategies, such as the following two:

- **Build It:** This means *literally* build it. Take a word problem, photocopy it, cut it into strips, and have the students piece it together in the order that was originally written in. Or, simply write the problem on the board with each sentence (or sentence fragment) out of order. Have the students attempt to write the problem with all of the sentences where they should be.

For example, have students put the following sentence in the correct order:

- and y represents the cost for each student ticket,
- from school concert tickets sales during two class periods.
- what is the cost for each adult ticket?
- The equations $5x + 2y = 48$ and $3x + 2y = 32$ represent the money collected
- If x represents the cost for each adult ticket

"Build It" forces the students to read *all* of the sentences, and conceptualize what the problem is asking, *before* they can possibly attempt to solve it. It can be used at any level, from first grade on up!

- **Make it Real:** Take the problem off the page and being it into *their* world. For example, instead of constantly telling the students to put their cell phones away, tell them to *take them out*, and snap a photo, or video that helps describe what the word problem is asking for.

  Is the problem asking them how many red, green and white jellybeans there are? Why not bring in a photo of jellybeans, or have the students take the photo? Remember the classic algebra problem about the farmer trying to maximize the fence area for his horse? A video of a farm, a fence, and a horse is an obvious, but often overlooked, sure-fire way to put it in context and make it real -- especially for so many of our at-promise students who have grown up in, and rarely ventured outside of, their urban upbringing.

Along this way of thinking, if you haven't seen Dan Myers' renowned TED Talk, "Math Class Needs a Makeover," view it here at:
https://www.youtube.com/watch?v=BlvKWEvKSi8

My goal with this month's column, and my workshop, is to perhaps not eliminate teachers hollering "WORD PROBLEMS!" when asked the toughest thing to teach in math, but at least to make their holler a little less emphatic. This goes especially for teachers of those at-promise students who may struggle the most with this kind of problem solving.

As we accelerate into the 21st Century, our at-promise students' ability to solve real-world, rigorous math problems that involve reading is more crucial than ever. Thus, arming ourselves with go-to strategies to help them succeed at this skill is more crucial than ever as well. When at-promise students understand the similarities and differences between solving math problems and reading, and why the two are inextricably linked in a real-world setting, they're on the path to successfully tackling all kinds of problems, in math and life.

Alex Kajitani is the *2009 California Teacher of the Year*, and a Top-4 Finalist for *National Teacher of the Year*. His workshop for teachers, "How to Connect Math and Literacy," was recently described by a 16-year veteran teacher as the "Best seminar EVER!" To bring this seminar to your school or district, contact Alex for availability.

Alex is also the author of *Owning It: Proven Strategies for Success in ALL of Your Roles as a Teacher Today*, which was named "Recommended Reading" by the U.S. Department of Education. He is **the ideal speaker for your next conference or event,** and creator of *The Rappin' Mathematician*, whose CDS are being used in classrooms and homes around the world to engage kids in math. Learn more at www.AlexKajitani.com.