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## Teaching the Common Standards in Math: Getting Rid of the GPS

By Alison Crowley

When I started teaching algebra 12 years ago, I was given a textbook, a day-by-day plan listing the sections in the textbook that I was expected to teach, and a roster of students. I attended various trainings the summer before about state assessments, technology, and special education laws—and boom! I was off and running.

One of the things that I remember most from those early years was a laminated poster I had that listed all of the state standards for algebra. I was instructed to cross them off as the year progressed so that it would be very clear to myself, my students, and any visitors exactly what was happening in my classroom.

I have to admit that as a math person, I loved my standards chart. It gave me a sense of accomplishment at the end of each lesson to cross off that related standard, confident that I was doing *exactly* what I was supposed to be doing. It gave me a sense of reassurance. If I graded a set of assessments with surprisingly low scores, I would be able to look at my chart and say to myself, "Huh, I wonder why they missed that question about exponents on the test. I mean, I can see right there on my chart that I *covered* the material. And I remember that I assigned all of the problems in the book. My students really need to spend more time on homework." Just like that, the responsibility had shifted from me to my students.

It wasn't until much later that I realized that "teaching math" and "covering textbook sections" were not synonymous.

Before I started implementing, or had even heard about, the Common Core State Standards, I had already begun shifting my instructional practices to include more hands-on activities and group work, and less book work. Project-based learning began trending in my math teacher circles, and pursuing National Board certification forced me to rethink my instructional practices. Were my students actually learning the material for mastery or were they just good at following directions and memorizing steps?

### Too Many Steps

Fast forward to the 2011-12 school year, when I heard Ann Shannon, a mathematics consultant then working with the Bill and Melinda Gates Foundation, describe what she refers to as math teachers' tendency to "GPS" students.

Think about it. If a teacher is explaining how to solve a system of equations using the substitution method, she might list on the board a set of steps for students to follow. *Step 1: Solve one of the equations for one of the variables; Step 2: Substitute the value or equation found in Step 1 into the other equation.* If you peeked inside her classroom on this particular day, you would likely see all of the students copying notes, and then probably completing a worksheet with problems similar to the example. From an observer's perspective, you might think the lesson was going very well.

But do the students really have a solid understanding of the mathematics they are using? And more importantly, do they understand why they're using it? Do they have a graphical understanding of what it means to solve a system of equations? Can they explain their methodology to another student? Can they apply it to real-world situations? Is their knowledge transferable so that they will be able to draw upon it when they are solving more difficult systems of equations in future math classes?

My guess is that the answer to most of these questions is "no." What Ann Shannon would say is that in this particular

situation, the students have been GPS-ed from problem to solution. Just like when I drive in a new city using my global positioning system, I can follow the directions and get to where I need to go. But I can't replicate the journey on my own. I don't have a real understanding of the layout of the city. If a road were blocked due to a parade, for example, I would be in trouble because I have no real understanding of the city's geography.

## Grasping the 'Why'

So, how can we keep from GPS-ing our students, so that they understand the mathematics behind a series of steps? How can teachers help them grasp the why, instead of just the how?

The good news is that the common-core standards provide an open playing field that encourages teachers to move away from the step-by-step model.

Consider the following standard for solving systems of equations:

*A.R.EI.11 Explain why the x-coordinates of the points where the graphs of the equations  $y=f(x)$  and  $y=g(x)$  intersect are the solutions of the equations  $f(x)=g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

Remember the earlier example about the teacher showing the students how to solve a system of equations using a set of steps? The first sentence of the new standard, "Explain why the x-coordinates where the graphs intersect are the solutions," really pushes the teacher to introduce and explain a new concept in a way that goes beyond one-dimensional instruction. What is an x-intercept and what does it look like on a graph? How is that related to the algebraic equation? Perhaps rather than starting a lesson with the steps for solving the equations, the teacher might first have students consider graphs of related equations, or better yet, a real-world example of a system of equations and what the values of the x-intercepts mean in that situation. This standard also challenges the teacher to present multiple types of equations from the beginning of the lesson so that the students can apply the concept of an x-intercept to many types of functions.

For many teachers, myself included, this is a fairly significant change in instructional practice. Although I have taught lessons on solving systems of equations using real-world applications and emphasizing graphical connections, I have not yet truly focused my instruction on the "why" behind the mathematics or given students opportunities to create their own understanding.

So how do math teachers make that shift away from GPS-ing students a reality? It won't be easy, and we can't do it alone. We need opportunities to collaborate, plan, and reflect with colleagues, both in our buildings and nationwide. We need quality resources and relevant, engaging professional development. We need time to learn from teachers who are already successfully implementing the common core, like Kansas educator Marsha Ratzel, who recently shared insights in her piece "[The Talking Cure: Mathematical Discourse](#)," on what happened when she gave her students time and space to have conversations about math. We need administrators and parents to support us and play an active role in helping us transform our classrooms into places where students are truly engaged in what they are learning.

In my daily classroom instruction, I am still sometimes guilty of GPS-ing students. But I am hopeful that as I learn how to fully implement the common standards, I will become less and less dependent on steps and crossing standards off a poster. After all, my students really deserve to navigate themselves.

[http://www.edweek.org/tm/articles/2013/03/13/ccio\\_crowley\\_math.html](http://www.edweek.org/tm/articles/2013/03/13/ccio_crowley_math.html)