DOINGWHATWORKS

Presentation

FULL DETAILS AND TRANSCRIPT

Helping Struggling Learners in Algebra

Castle View High School, Colorado • November 2008

Topic: National Math Panel: Major Topics of School Algebra

Practice: Multiple Paths

Highlights

- Overcoming lack of foundational skills in order to access algebra
- Learning algebra through contextual problems
- Diagnosing student misconceptions of linear equations and graphing linear equations
- Questioning and discussions to increase students' understanding of concepts
- Employing group work to focus students on learning algebra
- Developing persistence in struggling algebra students

About the Site

Castle View High School
Castle Rock, CO

Demographics
85% White
9% Hispanic
2% Black

2% Asian
1% Native American
7% Free or Reduced-Price Lunch
2% English Language Learners
9% Special Education

Castle View High School operates on a rigorous academy model designed to provide smaller learning communities within the high school. The Math, Science, and Engineering Academy offers innovative courses in science, technology, engineering, and mathematics with a supportive staff helping all students achieve their potential while acknowledging each individual's learning style. Features of mathematics instruction at Castle View are:

- Integration of mathematics content within mathematics and across other subjects;
- Implementation of technology into instruction;
- Incorporation of problem solving into each level of mathematics; and
- Accessibility of algebra to every student.

Full Transcript

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Welcome to Helping Struggling Learners in Algebra.

Slide #2

My name is Sally Collins, I'm a Math Teacher at Castle View High School, here in Castle Rock, Colorado, and we are member of the Douglas County School System.

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I believe one of the biggest hurdles that students face when they learn mathematics at any level is what they perceive as their own ability to do mathematics. But what I find most with the struggling students is I have to create a situation where they feel confident, where they feel safe, where they are willing to take risks, and that's a tough thing to do with students who have typically not been successful in mathematics.

Slide #4

The foundational skills that students lack that often make it difficult for them to learn algebra is a general

conceptual understanding of numbers and of the operations that happen on those numbers. While they may not be as efficient as some more successful students or be able to do it as quickly, they are still capable of being able to understand conceptually what's going on and actually do some fabulous mathematics.

Slide #5

Types of activities that I might use to help students learn concepts typically revolve around contextual problems. When we teach linear equations and the graphing of linear equations, we typically do a lot with presenting slope as a constant rate of change. The lesson that I did today had a lot to do with calories and the burning of calories at a constant rate, and then that was translated into linear equations. We teach inverse proportions by talking about oil spills and the depth of the oil spill versus the area of the oil spill and having a constant volume. We teach quadratic equations when we talk about launching missiles. It is impossible to teach in context without somehow crossing over into the other genres of mathematics. There are elements of geometry, there are elements of trigonometry, and there are elements of algebra inherent in every contextual problem. So, the beauty of it is it shows the students that mathematics is not a set of isolated skills that you practice and do and master. But it's actually problem solving, and the skills are what help you to become more efficient in the solving of the problem.

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In terms of linear equations and graphing linear equations, a major misconception is just the understanding of what an x-intercept is versus what a y-intercept is, and how those relate to what the equation represents. When you present a problem in context, it's almost impossible to misinterpret what the y-intercept means because it has meaning in terms of the problem. However, when I give them a problem that has no context, and so it's just a equation where I ask them to identify the slope and the y-intercept, that's when my students have the biggest problems and where they make the most mistakes and where they flip-flop the x and the y axis and start graphing off of the x-axis rather than the y-axis and put slope incorrectly as run over rise rather than rise over run. If they have context, however, it doesn't make sense to do that, so they rarely make that mistake if it's done in context.

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I also do a lot of scaffolding, particularly with my struggling students. Scaffolding to me means that I introduce a skill, introduce a concept at a very basic level, practice that until I know that they understand that and then add a twist to it. I continue to add different layers of complexity and different layers of understanding each time I do it.

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The best way, I feel, to be able identify students' misconceptions when they are learning any mathematical topic, but particularly algebra, is through the use of discussion and group work. It's easy to follow a process and be able to mimic a process, but when you have to describe what you are doing and explain what you are doing to those around you and defend what you are to those around you, that's when misconceptions become inherently apparent. In terms of what type of questions do I ask in order to determine whether students are grasping essential learnings, it's almost always an interpretation question. Tell me what that number means; tell me what that represents in this problem; explain to me why that number is negative in this case, why is the graph going down? Why is the y-intercept what it is? What does it mean in terms of the context of this problem?

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One of the ways that I work with my struggling students to make sure that they continue to stay focused on what it is that they are doing, is I want them to do a lot of work in groups. I find most students get off task when they are incapable—or they think they are incapable—of being able to solve what the problem is. I have to make sure that, when I set them up into a situation where they are doing group work, that they have the ability to be able to successful. So, there has to be enough background knowledge, there has to be enough teaching prior to that, there has to be enough practice prior to that, that when I give them a fairly rich problem they have the ability, they have the knowledge, and they have the capacity to be successful in it. Even if they are not exactly sure how to get there, they know that they can talk with their group and be successful in it. That's when they continue to be persistent and pay attention to what they are doing and don't wander.

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The way I develop persistence in my students for learning algebra is directly tied to the way that I grade. There is a big difference between being able to do the mathematics and get the grade that you want versus truly, truly understanding what it is that you are doing in the algebra. But I want the grading system to focus on their level of knowledge, not on the amount of work that they have achieved. So, my class is designed with my standards-based grading for students to have multiple opportunities to go back and rework problems and relearn concepts, and show me that they have learned it again in order for them to attain that particular standard of Meets.

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To learn more about Helping Struggling Learners in Algebra, please explore the additional resources on the Doing What Works website.