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Algebra Balance Scales

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Name: Kevin Westrich "Algebra Balance Scales"
Grade level(s): 7^{th} & 8^{th} Grade, Algebra 1
Objectives: Students will be able to solve first degree linear equations. Students will use manipulatives to model the algebraic steps of solving an equation.

Students will use models to visualize what is actually happening when you go through the steps of solving a linear equation using algebra.

Materials: Worksheets, computer lab.

Lesson Description:

Students usually learn the steps of solving an equation either by "doing the opposite" to both sides of the equation, or more accurately (but also more abstractly) using inverses to isolate a variable. One problem is that they often learn an algorithm without a picture of what is really going on.

In the past I would try to show students an equation as a balance where both sides must weigh the same amount. I would try to set up problems with pennies and film canisters that contained pennies, but they could not see how many. If you add or subtract to one side, you must do the same to the other. Some problems with this is that you can not work with negatives at all and it is difficult to set up the problems ahead of time. The "Algebra Balance Scales" applet from the National Library of Virtual Manipulatives (http://nlvm.usu.edu/en/nav/frames_asid_324_g_4_t_2.html) shows the same thing that I struggled to show much more elegantly. Balloons represent negative values which can be cancelled out with positives.

I would first teach the steps of solving one step equations to a class. After practicing one step equations on a homework assignment, I would assess their understanding from the homework and go over some warm-up problems on one-step equations.

I would then bring students to the computer lab and have them go to the NLVM webpage (http://nlvm.usu.edu/en/nav/frames_asid_201_g_4_t_2.html). I would ask them to create an equation, starting simply at first, using only positive values such as $x + 3 = 5$. Once all students have created the same equation we would talk about how you could solve by moving three blocks from each side. Next students could work on an equation like $2x = 8$ to see that they need to divide the 8 blocks into two groups. After a few one-step examples we would create some two-step examples such as $3x + 2 = 8$. Students could see that they need to first take away two blocks from each side before dividing into groups of three. It is difficult for students to understand why it is better to add or subtract before dividing, but this model illustrates it well. After having the program creates several new equations individually students could model and solve the problems. Once students have mastered the equations with positives, they could then go to the site (http://nlvm.usu.edu/en/nav/frames_asid_324_g_4_t_2.html) and practice with negatives. It is a little more of a stretch using the balloons for negative variables or units, but it is better than anything else that I could model.

I could circulate through the computer lab and check to see how well students are understanding the concepts. It probably is impractical to have students picture a balance every time they solve an equation, but it may reinforce the algorithm if they can understand what they are actually doing with algebraic operations. Students would be given a homework assignment on two variable equations and eventually be given a quiz on solving one and two step equations.