Chris Harvey 2-NOV-2011

Modified Teacher-Observed Lesson Plan

Original Lesson

7.15 The student will
a) solve one-step inequalities in one variable; and
b) graph solutions to inequalities on the number line.

Progression

The original lesson's objective was a state standard that the students solve one-step inequalities in one variable using inverse operations. The lesson also included graphing inequalities after solving them.

The beginning of the lesson consisted of reviewing vocabulary pertaining to inequalities: "less than," "greater than," "less than or equal to," "greater than or equal to," and "not equal to." Students matched the vocabulary with the mathematical symbols, and then copied down the definitions of "inequality" and "solution to an inequality."

After matching and writing definitions, the lesson continued directly to graphing inequalities. The inequalities were all with one variable on the left, with a comparison sign, then a number on the right. Given a set of four symbols: a left arrow, right arrow, closed circle and open circle, students went up to the board and dragged these symbols onto the number line to represent the solution. The lesson did not contain directions of how to graph the solution, but there was a hint about when to use a closed circle or open circle. After students graphed mathematical statements, they graphed their English counterparts.

The above account was of the part of the lesson that I had observed, but the next day students wrote inequalities from the given graphs, and proceeded to solving inequalities and graphing those solutions. The steps for solving the inequalities included one step of either additive or multiplicative operations.

Strengths and Weaknesses

This lesson seemed to focus on the procedure of graphing a solution set of an inequality. Students understood *what to do* when graphing them, but not *why* they were doing it. The biggest confusion was when to use an open dot or a closed dot. It seems that the students had just memorized when to use them based on the symbol. I would hear, "I made an open dot because there's no line under the 'less than' sign." They had failed to understand that the shaded sections on the graph represent every possible solution to the inequality, and thus a closed dot symbolizes that the number on which it lies is part of the solution set.

Another aspect of this lesson was that it seemed disjoint from any prior knowledge the students had. It seemed like a completely new and unrelated unit. Even the very definition of *inequality*, albeit not incorrect, hid the true meaning of the term, which is a mathematical statement that compares two unequal expressions. In the presentation, there were no “not equals” inequalities, and the experience of graphing a solution was a new one for all of these students. Graphing a solution to an equation is not part of the curriculum but it very well could be, and it would be a great introduction to graphing the solution set of an inequality.

As most mathematicians will recall, we must always “flip the inequality sign” when multiplying by a negative number, but do we ever realize why we do this? The lesson does provide some reasoning for this seemingly arbitrary process. It gives examples of an inequality and what happens when one multiplies or divides by a negative number. The students will see that in order to maintain the veracity of the statement, the sign must flip, but they see this only through example and not through abstraction.

Modified Lesson

I have chosen to incorporate a new activity in the lesson that builds on prior knowledge. The activity is a word problem that students in groups of 2 or 3 can work together to solve.

After visiting my favorite museum, I decided to walk through the gift shop. Everything in the gift shop was selling at a multiple of $5. I was browsing around until I saw these awesome T-shirts that some of my friends would love. The only problem is, I didn't see any price tags on the shirts. If I only have $50 and I want to buy each of my 3 friends a shirt, what's the highest possible price of one T-shirt?

The word problem is set up as a one-step inequality, but does not require knowledge of inequalities to solve. Students could set it up as an equation and then round their final answer down to the nearest $5. I believe this activity builds on prior knowledge because these students will have already learned how to solve one-step equations. I believe this activity is a great introduction to solving one-step inequalities because it scaffolds students’ learning, moving from equations to inequalities.

The modified lesson connects to subjects that the students have done before, such as solving one-step equations in one variable, and provides a better explanation for graphing solutions to equations and inequalities.

Students with different mathematical abilities would react to this lesson differently. For example, take A.M., a student in seventh grade math. A.M. is generally unfocused or unmotivated, and needs to be reminded to pay attention frequently. He does not always know what is going on in the classroom, and follows procedure exactly how he is told. He has not shown any dislike for math, and when he understands the material he does very well, as evidenced by his homework. E.R. is in the same class as A.M., but she shows that she understands the material on a high level. She always volunteers to answer questions, is excited to learn new things, and seems to understand the underlying concepts behind what she is doing.

AM might look at the introduction activity as a very difficult task. It might take him multiple times to read the problem before deciding to attack it, for which he might need a little motivation. AM is a student who needs someone to hold his hand every step of the way, lest he get off track or start to daydream. As a teacher, I would guide AM through the necessary steps by asking him questions about what he knows and how he thinks he can approach the problem. He might or might not obtain the correct answer, but I would be happy if he were to demonstrate understanding.

ER would be excited to begin working on this problem. She is enthusiastic about math and strives to participate more in class. With her partner, she would discuss the known parameters of the problem and decide what the goal is. She She might become stuck at first, not knowing how to translate English into math. After some clarifications, she would probably see it as a division problem and obtain \$16.67. Knowing that the T-shirts had to sell for a multiple of \$5, her answer would be the greatest multiple of \$5 that is less than \$16.67, which is \$15. Without proper coverage of inequalities, I would not expect ER to set the problem up as an inequality ($3x \leq \$50$).

Justification for Modification

My goals for modifying this lesson were:

(a) I wanted to separate finding the solution sets of (a.k.a. solving) inequalities from graphing the solution sets of inequalities.

(b) I wanted students to conceptually understand graphing an inequality rather than seeing it as a set of directions or an algorithm to follow. In other words, I want to teach them that the process of graphing is shading in every possible solution to a mathematical statement, and leaving all non-solutions unshaded.

(c) I wanted to explain in a better way how the ‘less than’ or ‘greater than’ sign switches direction when multiplying the inequality by a negative number.

I believe the modifications to this lesson will make it much more effective because it emphasizes conceptual understanding rather than procedural understanding. Students who successfully follow along with this lesson will understand how to solve one-step, one-variable inequalities and graph their solution sets on a number line. Furthermore, they will understand why they are doing so. The information presented in this lesson extends from solving one-step and two-step equations with one variable and introduces graphing the solutions to said equations (a task these students have not been exposed to), thus it derives from students' prior knowledge and is not seen as a separate topic. In addition, this lesson can be extended to solving and graphing two-step inequalities with one variable, and for high school students, graphing inequalities with two variables.