OER In Mathematics Professional Development Project

Lesson Plan

Topic of the lesson:

Evaluating Algebraic Expressions:

Terms with Multiplication of a Coefficient and a Variable

Standard(s)/Learning Result(s):

Algebra: Symbols and Expressions

Students use symbols to represent or model quantities, patterns, and relationships and use symbolic manipulation to evaluate expressions; Students create and evaluate expressions.

Goal(s) of the Lesson:

What do you want the students to know and be able to do? What overarching questions do you want them to be able to answer?

Students should know that one way to use a variable is to represent a "container" or placeholder representing the possibility of multiple values which can be substituted for the variable. This is not the only way a variable can be used, and is different from the use of a variable as an unknown but specific value (such as when solving equations). Students should also know that the mathematical notation of a number (coefficient) immediately followed by a variable, such as 3a or 56x, means the multiplication of the number times the value of the variable, for example 3 times the value of a. Students should know this can also be represented other equivalent ways, including: 3×a (although this is discouraged when working with variables!), 3•a, 3*a, 3(a), (3)(a), etc. Students should be able to answer questions similar to (1) "If a is 4, what is the value of 3a?" (2) "How can you model the expression 3a on a number line if a = 4? How does this model change if a = 5?" and (3) "Create an accurate expression for the model shown:

- Students should be able to recognize expressions in the form Ax, where A is a given value and x is a variable, as the multiplication of A times x.
- Students should be able to accurately evaluate expressions of the form Ax.
- Students should be able to accurately create expressions of the form Ax from a model showing A jumps of x amount along a number line.

Context

What should students know to engage in the lesson?

Students should understand:

- a variable can have more than one meaning in mathematics – a variable does not always represent a specific number to be "discovered"
- the multiplication of two numbers n•m can be modeled on a number lines as n jumps of m (or m jumps of n), similar to skip counting.

Associated Student Difficulties

Describe known misconceptions (overgeneralizations, common errors, and misunderstandings) associated with the content in this lesson?

Students can have varied misconceptions around the concept of variable and algebraic notation. Some students may view an expression in the form Ax as the addition of A + (the value of x), or the concatenation of A and x (e.g. if A = 3 and x = 4, then the student may think the result is 34). Some students may see the variable as a unit of measurement, such as the variable s as seconds, and interpret 3s as "3 seconds." Similarly, some students may confuse a general use of an expression of this form with a specific related concept, such interpreting 3s as a slope of 3.

Planning for Differentiation

Describe how the lesson design incorporates a plan for differentiation.

This lesson calls for customizing instruction at the class level based on the results of a pre-assessment, and working toward at least one of the three goals outlined above.

Pre/Post Assessment

Review what you want students to know and be able to do. How will you determine what they know and don't know? How will you determine that they have met the target? (Describe the pre/post assessment)

Pre-Assessment (Probe): Administer the True Statements? assessment.

- Review results to determine specific instructional interventions.
  - Problems 3, 5, 6, and 8 are true and represent different ways to write the expression accurately (although most do not evaluate the expression completely)
  - Problem 1 is the concatenation of 5 and 4 and problem 4 is the addition of the values; students who mark these problems as true may not understand the notation means multiply the coefficient and the value of the variable
  - Problems 2 and 7 are similar in that students who mark these problems as true are not multiplying the coefficient by 4 but instead are seeing the variable *s* as a measurement (seconds) or notation for a concept (slope)

Post Lesson Assessment: Re-administer the same assessment or an equivalent version to determine any learning.

Materials & Resources

Describe any tools and resources that are needed to support the lesson.

- Student Exploration(s): ExprAlgebraicModel_Exploration-OERMath (or a revised or different exploration based on student needs)

Technology Tools / Applets

What technology tools, applets, and/or resources you will use for this lesson?

- Algebraic Expressions - Number Line Model for Multiplication applet: http://maine.edc.org/file.php/1/tools/ExprAlgebraicModel.html
- Projector
- Laptops
- Smartboard (optional)

What management strategies will you utilize during the lesson?

- Load the applet and a starting configuration on the teacher computer before having students launch the applet
- If you typically experience long loading times on your network, have students load the applet in 2-4 groups (not all at once)
- Put the link to the applet on a classroom wiki (or blog, online bookmarks, or other management site)

Teacher Notes:

Lesson Description

Preparation

What resources will you need? What type of preparation is needed before you can begin the lesson?

- Laptops
- Print Pre and Post Lesson Probes (Or make sure the probes are in an online administration site such as ThatQuiz.org)
- Print Exploration(s) planning to use
- Approximate Time: If a long block: 60 to 80 minutes; or 15-20 minutes one class (pre-assessment) and 45-60 minutes the second class

	Lesson	Questions for Learners	Notes / Reflections
Introduction	At the beginning of the lesson or the day before the main part of the lesson (so you can analyze the pre-assessment data, plan instruction, and copy appropriate explorations as needed): • Introduce the topic of evaluating algebraic expressions of the form A*x* and the pre-assessment (3-5 min.) • Students complete the pre-assessment (5-10 min). • Engage students in responding to the pre-assessment questions and results without sharing definitive "answers." Show and analyze electronic results (if using clickers, ThatQuiz, Google Forms, etc.) and/or elicit example responses and student opinions. (5 min.)	Possible questions to ask or discuss, as appropriate, before the assessment: - What is an "expression?" A "term"? - What is a mathematical "statement?" - In what ways are these concepts similar or different from each other: statement; equation; expression; term. - What does it mean for a mathematical statement to be *true*? What does it mean for a mathematical statement to be *false*?	1) Review probe prior to instruction, make observations about misconceptions and determine accurate responses 2) After the introduction, determine instructional strategy and materials to best address any misconceptions or gaps in understanding shown in the pre-assessment results. *If all students answered all questions accurately and the subsequent class discussion showed clear understanding, determine if you will probe more deeply or move to a more advanced topic or a different topic.*

Core Instruction	• Use a combination of guided instruction and student exploration throughout the lesson, pausing as appropriate to engage small groups or the entire class in discussion. • Students engage in the exploration individually or in pairs. (10-20 min.) • Pause to explore applet features and functions as appropriate to promote deeper understanding of why the applet functions a certain way. • Ask questions to address any misconceptions or gaps in understanding related to the pre-assessment, such as viewing the expression as addition or concatenation • Select students to report out about their findings using the applet by demonstrating with the projector or interactive whiteboard. (5-10 min.) • Discuss and review the meaning of expressions written in the form A*x* as multiplication of A times the value of *x*, highlight any types of mistakes/misconceptions as appropriate to the class, and review as needed the number line model representing multiplication of A*x*. (5 – 10 min.)	What do you notice about how the variable and the number line model behave in this applet as you move the sliders? What are some equivalent ways to write that expression? What do the number of jumps in the number line model have to do with the expression shown? What does the distance of each jump in the number line model have to do with the expression shown? Could you think of the number line model of this expression differently than the way it is shown? Will your method always be accurate? What are some things this expression does NOT represent?	
Closure	Students take the post-assessment (5-15 min.) Share the results with students and ask them to help interpret the results in light of both accurate responses and the pre-assessment results. (5-10 min)	What does the data from the post assessment tell us about the current understanding of our class on this topic? / What types of problems or problem numbers from the post-assessment show areas we need to work more on this topic? What areas of this topic do the pre- and post-assessment results show as areas of increased understanding?	Review data Reflect on remaining areas of difficulty Determine next instructional steps