Using Variables

Objective: Students will be able to read, write and evaluate expressions using variables.

Overview: In this lesson, students will be introduced to algebraic terminology, and will begin to use variables to read, write and evaluate expressions. This lesson introduces the concepts of variables through the familiar formula for finding the perimeter of a rectangle.

Key Content Standard(s):
6.EE.2

Key Practice Standard(s):
2, 4

Lesson Plan:

1. Draw a rectangle on the board, and call on students to assign values to the length and the width (e.g. length is 7, width is 4). Ask a student to calculate the perimeter of this rectangle, and ask another student to explain how they got the answer (A: add up all the sides; double the length and the width and add them together).

2. Tell students that in math, we sometimes use letters or symbols to represent numbers. For example, we can represent the length of a rectangle by the letter \( l \), and the width by the letter \( w \) (label the rectangle with \( l \) and \( w \) in the appropriate places). Tell them that you can use any letter or symbol to represent an unknown number, but we usually use ones that make sense (such as \( l \) to represent an unknown length).

3. Tell them that one advantage of using these letters, called variables, is that we can write general formulas for things like perimeter. Give students a few moments to write an expression for finding the perimeter of a rectangle. If students have difficulty, remind them that they just told you how to find the perimeter – now all they need to do is write this as an expression.

4. There are two acceptable ways of writing the expression for finding the perimeter of a rectangle. Push students to identify both:
   a. \( l + l + w + w \). This will likely be the first expression students will recognize. Have students test this with their original values (e.g. 7 and 4). Students should get the same perimeter they calculated at the beginning of the lesson (e.g. 22).
   b. \( 2l + 2w \). Students may need some guidance on this. You may need to ask students another way to find the perimeter of a rectangle (A: you double the length and double the width, and add them together). Ask students how you might write “double the length”. If they are unable to offer \( 2l \), ask students what it means to “double” something (A: multiply it by 2). Students may need to be taught the convention that a number can be written directly before a variable, and that means the two are to be multiplied. Teach them that the mathematical term for 2 in this case is a coefficient.
5. Tell students that they have now written an expression for finding the perimeter of a rectangle. Tell them that an expression is simply a set of operations that does not include an equal sign. If it did have an equal sign (for example, $7 + 7 + 4 + 4 = 22$), it is called an equation.

6. Challenge students to use their expression to calculate the perimeters of other rectangles. Write on the board ($l = 30; w = 75$) and have students evaluate for the expression $2l + 2w$. (A: 210)

7. Tell students that while you can write algebraic expressions for real-world things like perimeter and area, you can also write expressions that are purely mathematical. Write an expression on the board (e.g. $4c + 3.5 \times 3$). Ask a student to read this aloud (A: “four times c plus three and five tenths times three”). Have students evaluate for $c = 2.3$, helping them with the first step of replacing $c$ with 2.3: 

$$4(2.3) + 3.5 \times 3$$

Remind them that just like in arithmetic expressions, you follow the order of operations in algebraic expressions. Give students a moment to solve (A: 20.5).

Assessment:

1. Have students take another formula they know (e.g. perimeter/area/volume of other shapes), and write an expression using variables. Have students evaluate those expressions for some values.

2. If students have not yet mastered other formulas, give them one (e.g. Volume of a rectangular prism is $l \times w \times h$), and give them values for those (e.g. $l = 3; w = 4; h = 5$), and have them evaluate (A: 60).

3. Give a student any algebraic expression (e.g. $3b + 7$), and have them evaluate for a particular value (e.g. $b = 5$).

Differentiation:

For students needing practice with operations on fractions and/or decimals, use those values instead of integers.

Commentary:

One of the points of this lesson and standard is to have students be introduced to and use mathematical vocabulary, including variable, expression, term, and coefficient. Use these terms frequently in subsequent lessons, and insist on their correct use by students (i.e. Ask students to correctly themselves when saying things like “the number before the letter” when they mean “the coefficient before the variable.”).