

Georgia Department of Education Deconstructing the Georgia Standards of Excellence 5-Step Protocol Grade 6 Mathematics Exemplar

The purpose of the 5-step protocol is to engage collaborative planning teams or PLCs in a systematic dialogue and discussion to deepen their collective understanding of content standards. The protocol requires teachers to examine the language of a standard to determine its intent, identify implementation strategies, and establish success criteria.

The protocol addresses the following strategies of formative assessment.

Strategy 1: Provide students with a clear and understandable vision of the learning target.

Strategy 2: Identify characteristic of strong and weak work.

5-Step Protocol:

1. Determine and define vocabulary.

Identify and underline key terms within the standard and/or element(s). Define each term as it relates to the standard.

2. Study the standard and/or element(s).

Identify concepts and skills students will need to know, understand, and be able to do to reach proficiency. Generate key implementation questions related to the standard and/or element(s). Answer each question.

3. Scaffold understanding and communicate the language of the standard and/or element(s).

Paraphrase the standard and/or element(s). Create a "script" that details how teachers will describe the standard and/or element(s) to students.

4. Develop "I can" statements.

Describe the standard and/or element(s) as statements of intended learning (e.g. *I can use information from what I read to draw conclusions (make inferences), I can use mathematical vocabulary to describe how I solved a problem, etc.*).

5. Establish success criteria by identifying strong and weak work.

Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions.



5-Step Protocol adapted from:

Chappius, J. 2009. *Seven Strategies of Assessment for Learning*. Boston, MA. Pearson Education, Inc.

Georgia Department of Education
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Code:	MGSE6.EE.2a
Standard and/or Element(s):	Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as $5-y$.

1. Determine and define vocabulary. Identify and underline key terms within the standard and/or element(s). Define each term as it relates to the standard.

These definitions are for teacher reference only and are not to be memorized by the students. Students should explore these concepts using models and real-life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

- **Algebraic expression:** A mathematical phrase involving at least one variable and sometimes numbers and operation symbols.
- **Associative Property of Addition:** The sum of a set of numbers is the same no matter how the numbers are grouped.
- **Associative Property of Multiplication:** The product of a set of numbers is the same no matter how the numbers are grouped.
- **Coefficient:** A number multiplied by a variable in an algebraic expression.
- **Commutative Property of Addition:** The sum of a group of numbers is the same regardless of the order in which the numbers are arranged.
- **Commutative Property of Multiplication:** The product of a group of numbers is the same regardless of the order in which the numbers are arranged.
- **Constant:** A quantity that does not change its value.
- **Distributive Property:** The sum of two addends multiplied by a number is the sum of the product of each addend and the number.
- **Exponent:** The number of times a number or expression (called base) is used as a factor of repeated multiplication. Also called the power.
- **Like Terms:** Terms in an algebraic expression that have the same variable raised to the same power. Only the coefficients of like terms are different.
- **Order of Operations:** The rules to be followed when simplifying expressions.
- **Term:** A number, a variable, or a product of numbers and variables.
- **Variable:** A letter or symbol used to represent a number or quantities that vary

Georgia Department of Education
Deconstructing the Georgia Standards of Excellence
5-Step Protocol
Grade 6 Mathematics Exemplar

2. Study the standard and/or element(s). *Identify concepts and skills students will need to know, understand, and be able to do to reach proficiency. Generate key implementation questions related to the standard and/or element(s). Answer each question.*

Concepts <i>(Student must know and understand)</i>	Skills <i>(Students must be able to do)</i>
<ul style="list-style-type: none"> Variables can be used as unique unknown values or as quantities that vary. Algebraic expressions may be used to represent and generalize mathematical problems and real-life situations. 	<p>Students will translate between verbal and symbolic algebraic expressions and equations.</p> <ul style="list-style-type: none"> Interpreting a fraction as division Operating with whole numbers, fractions, and decimals Using parentheses, brackets, or braces in numerical expressions Writing and interpreting numerical expressions

Key Implementation Questions and Answers:

1. How do I translate between word phrases and expressions?

Students will translate between verbal and symbolic algebraic expressions and equations. Students make sense of real world situations by writing expressions to represent the situation. By using the language of real-world situations to write expressions they attend to precision. Students also model with mathematics by forming expressions from real world contexts.

Working with expressions and equations containing variables allows students to form generalizations. Students should think of variables as quantities that vary instead of as letters that represent set values. When students work with expressions involving variables without a focus on a specific number or numbers that the variable may represent they can better recognize the patterns that occur. It is these patterns that lead to generalizations that lay the foundation for their future work in algebra.

2. What strategies can I use to help me understand and represent real situations using algebraic expressions?

Within the classroom, have the students find situations where they can role play to compare known and unknown quantities. Make sure all operations are included.

For example, Student A (Dory) and Student B (Colleen)

Dory: I have two sisters.

Colleen: I have Dory – 1 sister.

Dory: You have d – 1 sister.

You have one sister.



Richard Woods, Georgia's School Superintendent
"Educating Georgia's Future"

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3. Scaffold understanding and communicate the language of the standard and/or element(s). *Paraphrase the standard and/or element(s). Create a "script" that details how teachers will describe the standard and/or element(s) to students.*

STRATEGIES FOR TEACHING AND LEARNING

The skills of reading, writing and evaluating expressions are essential for future work with expressions and equations, and are a Critical Area of Focus. In earlier grades, students added grouping symbols () to reduce ambiguity when solving equations. Now the focus is on using () to denote terms in an expression or equation. Students should now focus on what terms are to be solved first rather than invoking the PEMDAS rule. Likewise, the division symbol ($3 \div 5$) was used and should now be replaced with a fraction bar $\left(\frac{3}{5}\right)$. Less confusion will occur as students write algebraic expressions and equations if x represents only variables and not multiplication. The use of a dot (\bullet) or parentheses between number terms is preferred.

Provide opportunities for students to write expressions for numerical and real-world situations. Write multiple statements that represent a given algebraic expression. For example, the expression $x - 10$ could be written as "ten less than a number," "a number minus ten," "the temperature fell ten degrees," "I scored ten fewer points than my brother," etc. Students should also read an algebraic expression and write a corresponding statement.

Through modeling, encourage students to use proper mathematical vocabulary when discussing terms, factors, coefficients, etc.

Because this is a foundational year for building the bridge between the concrete concepts of arithmetic and the abstract thinking of algebra, using hands-on materials (such as algebra tiles, counters, cubes, "Hands on Algebra") to help students translate between concrete numerical representations and abstract symbolic representations is critical.

4. Develop "I can" statements. *Describe the standard and/or element(s) as statements of intended learning (e.g., "I can use information from what I read to draw conclusions (make inferences)," "I can use mathematical vocabulary to describe how I solved a problem," etc.).*

I can translate real world situations and verbal expressions into algebraic expressions.

I can translate algebraic expressions into real world, verbal situations.

I can write algebraic expressions that include operations with numbers and with letters representing numbers.

Georgia Department of Education
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5. Establish success criteria by identifying strong and weak work. *Identify the characteristics of strong and weak work related to the standard and/or element(s). Identify common misconceptions.*

Strong Work	Weak Work
<p>Memorization (rapid recall of arithmetic facts or mathematical procedures) is often confused with fluency (a deep understanding of quantity and number).</p> <p>Fluent students:</p> <ul style="list-style-type: none"> • flexibly use a combination of deep understanding, number sense, and memorization. • spend their thinking and processing time unpacking problems and making meaning from them. • are able to articulate their reasoning. <p>When students work with expressions involving variables without a focus on a specific number or numbers that the variable may represent they can better recognize the patterns that occur. It is these patterns that lead to generalizations that lay the foundation for their future work in algebra.</p>	<p>Common Misconceptions:</p> <ol style="list-style-type: none"> 1. The mnemonic PEMDAS can mislead students into thinking that addition must come before subtraction and multiplication must come before division. 2. Students fail to see juxtaposition (side by side) as indicating multiplication. For example, evaluating $3x$ as 35 when $x = 5$ instead of $3 \text{ times } 5 = 15$. Also, students may rewrite $8 - 2a$ as $6a$. 3. Students also miss the understood "1" in front of a lone variable like a or x or p. For example, not realizing that $4a + a$ is $5a$. 4. Many of the misconceptions when dealing with expressions stem from the misunderstanding/reading of the expression. For example, knowing the operations that are being referenced with notation like x^3, $4x$, $3(x + 2y)$ is critical. The fact that x^3 means $(x)(x)(x)$ which is x times x times x, not $3x$ or 3 times x; $4x$ means 4 times x or $x + x + x + x$, not forty-something.