National Center and State Collaborative

Core Content Connectors: Symbolic Expression 1

National Center and State Collaborative

The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with significant cognitive disabilities. The project draws on a strong research base to develop an AA-AAS that is built from the ground up on powerful validity arguments linked to clear learning outcomes and defensible assessment results, to complement the work of the Race to the Top Common State Assessment Program (RTTA) consortia.

Our long-term goal is to ensure that students with significant cognitive disabilities achieve increasingly higher academic outcomes and leave high school ready for post-secondary options. A well-designed summative assessment alone is insufficient to achieve that goal. Thus, NCSC is developing a full system intended to support educators, which includes formative assessment tools and strategies, professional development on appropriate interim uses of data for progress monitoring, and management systems to ease the burdens of administration and documentation. All partners share a commitment to the research-to-practice focus of the project and the development of a comprehensive model of curriculum, instruction, assessment, and supportive professional development. These supports will improve the alignment of the entire system and strengthen the validity of inferences of the system of assessments.

IDEAs that Work
U.S. Office of Special Education Programs

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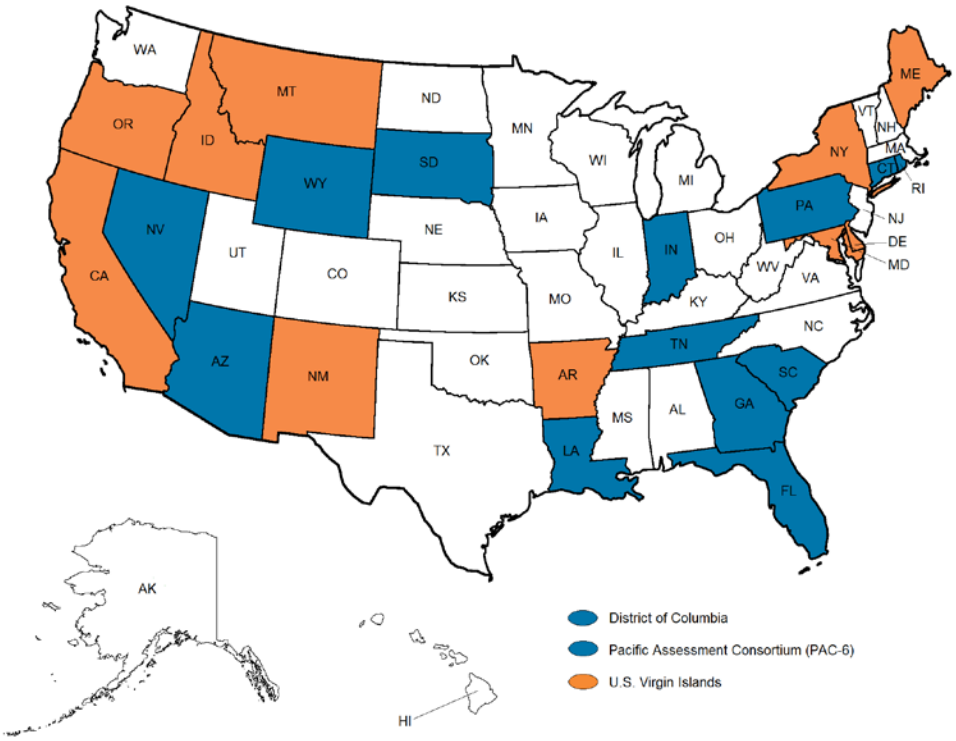
This document is available in alternative formats upon request.

National Center and State Collaborative

NCSC is a collaborative of 15 states and five organizations.

The states include (shown in blue on map): Arizona, Connecticut, District of Columbia, Florida, Georgia, Indiana, Louisiana, Nevada, Pacific Assessment Consortium (PAC-6)[1], Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Wyoming.

Tier II states are partners in curriculum, instruction, and professional development implementation but are not part of the assessment development work. They are (shown in orange on map): Arkansas, California, Delaware, Idaho, Maine, Maryland, Montana, New Mexico, New York, Oregon, and U.S. Virgin Islands.



*Core partner states are blue in color and Tier II states are orange in color.

[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).

The five partner organizations include: The National Center on Educational Outcomes (NCEO) at the University of Minnesota, The National Center for the Improvement of Educational Assessment (Center for Assessment), The University of North Carolina at Charlotte, The University of Kentucky, and edCount, LLC.

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Identifying the Core Content of the Learning Progressions Framework for the Common Core State Standards for Students Who Participate in AA-AAS

Introduction

The purpose of this paper is to describe the development and prioritization of the academic content for students with significant cognitive disabilities. This prioritized academic content is referred to as Core Content Connectors (CCCs). This work is part of the NCSC GSEG and provides the foundation for the development of curriculum resources, professional development, instructional resources, and alternate assessment based on alternate achievement standards (AA-AAS). A unique feature of the development and prioritization of academic content is the use of learning progressions framework (LPF), which is built to include relationships with the Common Core State Standards (CCSSs). The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression and is a starting point for thinking about how students develop competency in an academic domain (Hess, 2010). The following sections describe the use of LPFs for identifying specific grade-level Common Core State Standards (CCSS), and the development of the CCCs for providing more specificity for teachers.

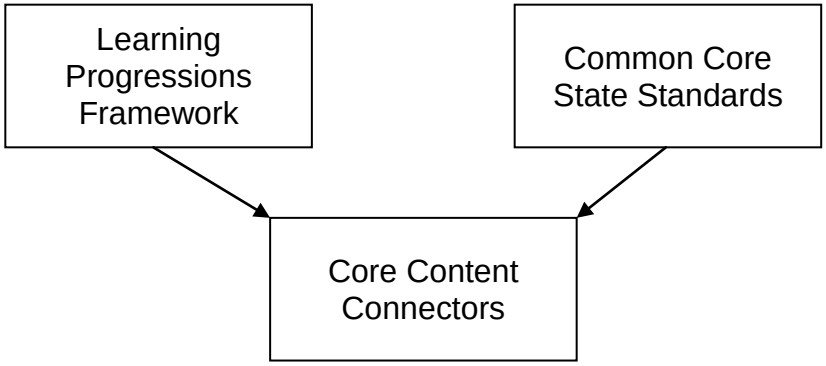
Learning Progression Framework

The National Alternate Assessment Center, under the leadership of Karin Hess, developed LPFs. Hess's (2008) definition of LPs is based on four interrelated guiding principles: (a) LPs are developed and refined using available research and evidence, (b) LPs have clear binding threads that articulate the essential core concepts and processes of a discipline sometimes referred to as the "big ideas" of the discipline, (c) LPs articulate movement towards increased understanding, and (d) LPs go hand-in-hand with well-designed and aligned assessments.

The grade span learning targets of the LPF were identified by national content experts and are a broad description of the essential content and general sequencing for student learning and skill development. The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression. The LPF is currently available at http://www.nciea.org/publications/Math_LPF_KH11.pdf

Core Content Connectors

The Core Content Connectors (CCCs) are the prioritized academic content designed to frame the instruction and assessment of students with significant cognitive disabilities. The CCCs create a connection between the Learning Progressions Framework (LPF) and Common Core State Standards (CCSS) for these students.



The purpose of the CCCs is to identify the most salient core academic content in ELA and math found in both the CCSS and the LPF Progress Indicators (LPF PIs) (i.e., observable learning along the learning continuum for each strand in the LPFs). The CCCs illustrate the necessary knowledge and skills students with significant cognitive disabilities need to reach the learning targets or critical big ideas within the Learning Progression Frameworks (LPF, Hess et al., 2010) and the Common Core State Standard. This identified core content serves as a connection or stage between the LPF (designed for typically developing students) and the CCSS (which define grade level content and achievement). The CCCs are intentionally dually aligned with both the LPFs and the CCSSs. The CCCs identify priorities for the instruction for students in this population, and the alternate assessment. CCCs are designed to contribute to a fully aligned system of content, instruction, and assessment.

Progress Indicator: M.NO.1e describing, representing, and comparing absolute value relationships		
Core Content Connectors: 6	**CCSS Domain/Cluster**	**Common Core State Standard**
6.NO.1e1 Determine the meaning of absolute value	**Expressions and Equations** 6 NS Apply and extend previous understandings of numbers to the system of rational numbers.	6.NS.7c Understand ordering and absolute value of rational numbers. a) Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of -30 dollars write |-30| = 30 to describe the size of the debt in dollars.
Progress Indicator: M.NO.1f recognizing equivalence of representations using fractions, decimals, and percents and using them solve ratio problems		
Core Content Connectors: 6	**CCSS Domain/Cluster**	**Common Core State Standard**
6.NO.1f1 Find a percent of a quantity as rate per 100	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.3c Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. c) Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
6.NO.1f2 Write or select a ratio to match a given statement and representation	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."
6.NO.1f3 Select or make a statement to interpret a given ratio	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

The CCCs preserve the sequence of learning outlined in the LPFs to the extent possible while disaggregating the progress indicators (which describe concepts and skills along the learning continuum for each grade span in the learning progression) into teachable and assessable segments of content. The connectors and corresponding curriculum resource guides were written to help promote how students can engage in the CCSS while following the learning progression.

The CCCs have the following characteristics:

- Sequenced according to the LPFs to help guide meaningful instruction for students and lead to enduring skills in successive grades
- Written as outcome based, which provides a description of what students should know and do
- Written at high levels of expectations for students to eliminate potential ceiling effect for student learning
- Aligned to the grade-level CCSSs to provide access to the general curriculum
- Organized by the six major LPF strands (Symbolic Expression; Nature of Numbers & Operations; Measurement; Patterns, Relations, & Functions; Geometry; and Data Analysis, Probability, & Statistics)

In some grades, CCCs were developed that were considered important for student learning but were not aligned to the LPF. CCCs for some prerequisite skills were included in some of the grades, but these CCCs are for instructional purposes and not intended as a target for assessment. At the high school level, where only one AA-AAS will be administered to students but many CCSSs and LPFs are provided, some subsets of LPF Progress Indicators were selected for developing CCCs.

All CCCs will be provided by the curriculum and instruction work group in NCSC. While states may add additional content standards as they deem necessary that is specific to the needs, states and teachers will NOT have to develop any further CCCs. The complete set will be disseminated upon completion and validation. It is anticipated that states who have adopted the Common Core State Standards can use the CCCs as the priorities for students who take AA-AAS and will not need to create other forms of translations or create extensions of the Common Core unless they choose to do so. Teachers will be able to use these, along with the various curriculum resources, to plan instruction.

Uses of the document

There are several potential uses for this document. The first is to demonstrate how the identified core content builds critical big ideas across the grades. The format is intended to show how students can grow within the linked content across the grades and the connections between the related content to help guide sequential and meaningful instructional efforts. The second potential use is to provide clarity and specificity of the content within each grade level. In the process of identifying the CCC within each of the PI, it was evident that some considerations were necessary related to the content. First, it is necessary to disaggregate the content within some of the PI to a finer grain size. As students with significant cognitive disabilities may require instruction on single concepts, PIs that include multiple concepts may need to be separated in the unpacked content. Additionally, identifying core content requires focusing on the critical big ideas within the content and the need for considering meaningful instructional context within the instruction of students who participate in the alternate assessment. The third use for this document is to demonstrate how the CCCs have direct links to the CCSS. The CCSS that are identified as having the closest match are listed beside the corresponding CCC. As these direct links indicate, the CCC are not weakly linked or “watered down” translations, but instead pinpoint the most salient content in the standard. The potential users of this document ranges from assessment designers to teachers. While the document is not intended to be a standalone instructional resource, it is intended to support teachers in their understanding of the content.

References

Hess, K. (2010, December). *Learning progressions frameworks designed for use with the Common Core State Standards in mathematics K-12.* National Alternate Assessment Center at the University of Kentucky and the National Center for the Improvement of Educational Assessment, Dover, N.H.

Hess, K. (2008). Developing and using learning progressions as a schema for measuring progress [online]. Retrieved from http://www.nciea.org/publications/CCSSO2_KH08.pdf

(K-4) Elementary School Learning Targets		(5-8) Middle School Learning Targets		(9-12) High School Learning Targets
SE-1 *Use equations and expressions involving basic operations to represent a given context.* • *Represent numerical relationships using combinations of symbols (=, >, <) and numbers to form expressions and equations;* • *Solve for unknown in simple number binary number sentences (e.g., ____ + 4 = 7);* • *Write equations showing inverse operations and related operations (e.g., addition-multiplication).*		***SE-1*** *Represent relationships and interpret expressions and equations in terms of a given context for determining an unknown value.* • *Represent mathematical relationships symbolically and solve for any variable (for 1st degree equations and for common formula (literal equation);* • *Explain how to manipulate an algebraic expression to create equivalent expressions and provide step-by-step explanations and justifications.*		***SE-1*** *Represent relationships and interpret expressions and equations in terms of a given context (including complex and families of functions) for determining unknown values (including two or more variables).* • *Represent and interpret multi-step problems;* • *Represent complex numbers and vectors;* • *Demonstrate the relationship between systems of equations and matrix representations;* • *Represent the relationship between functions and modeling.*
Grades K-2[2]	**Grades 3-4**	**Grades 5-6**	**Grades 7-8**	**HS**
2.SE.1c1 Compare sets and use appropriate symbol to label the first as =, <, or > the second set	**3.SE.1g1 Use =, <, or > to compare 2 fractions with the same numerator or denominator**	**5.SE.1a1 Given a real world problem, write an expression using 1 set of parentheses**	**7.SE.1f1 Set up equations with 1 variable based on real world problems**	
2.SE.1c2 Label simple equations as = or the phrase not equal	**4.SE.1g2 Use =, <, or > to compare 2 fractions (fractions with a denominator of 10 or less)**	**6.SE.1b1 Evaluate whether or not both sides of an equation are equal**	**7.SE.1f2 Solve equations with 1 variable based on real world problems**	
2.SE.1d1 Represent addition of 2 sets when shown the + symbol	**4.SE.1g3 Use =, <, or > to compare 2 decimals (decimals in multiples of .10)**	**6.SE.1a2 Given a real world problem, write an equation using 1 set of parentheses**		

[2] NOTE: The focus of Symbolic Expression is for the student to identify and apply symbols like numbers, operations, and formulas. These skills are always combined with the related skills from the other mathematics standards. For example, the student identifies that + means to perform addition and then uses the addition task analysis from Numbers and Operations.

(K-4) Elementary School Learning Targets		(5-8) Middle School Learning Targets		(9-12) High School Learning Targets
SE-1 *Use equations and expressions involving basic operations to represent a given context.* • *Represent numerical relationships using combinations of symbols (=, >, <) and numbers to form expressions and equations;* • *Solve for unknown in simple number binary number sentences (e.g., ____ + 4 = 7);* • *Write equations showing inverse operations and related operations (e.g., addition-multiplication).*		***SE-1*** *Represent relationships and interpret expressions and equations in terms of a given context for determining an unknown value.* • *Represent mathematical relationships symbolically and solve for any variable (for 1st degree equations and for common formula (literal equation);* • *Explain how to manipulate an algebraic expression to create equivalent expressions and provide step-by-step explanations and justifications.*		***SE-1*** *Represent relationships and interpret expressions and equations in terms of a given context (including complex and families of functions) for determining unknown values (including two or more variables).* • *Represent and interpret multi-step problems;* • *Represent complex numbers and vectors;* • *Demonstrate the relationship between systems of equations and matrix representations;* • *Represent the relationship between functions and modeling.*
Grades K-2[2]	**Grades 3-4**	**Grades 5-6**	**Grades 7-8**	**HS**
2.SE.1d2 Represent a "taking away" situation with the – symbol		**6.SE.1a3 Write expressions for real-world problems involving one unknown number**		
	4.SE.1h1 Express whole numbers as fractions			
	4.SE.1h2 Identify the equivalent decimal for a fraction			

Progress Indicator: E.SE.1c using symbols (=, >, <) to compare whole number quantities, write equations, and determine if equations are true		
Core Content Connectors: 2	**CCSS Domain/Cluster**	**Common Core State Standard**
2.SE.1c1 Compare sets and use appropriate symbol to label the first as =, <, or > the second set	**Counting and Cardinality** K CC Compare numbers.	K.CC.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
2.SE.1c2 Label simple equations as = or with the phrase not equal	**Operations and Algebraic Thinking** 1 OA Work with addition and subtraction equations.	1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 =6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*
Progress Indicator: E.SE.1d representing addition and subtraction in multiple formats, including expressions		
Core Content Connectors: 2	**CCSS Domain/Cluster**	**Common Core State Standard**
2.SE.1d1 Represent addition of 2 sets when shown the + symbol	**Operations and Algebraic Thinking** 2 OA Represent and solve problems involving addition and subtraction.	2.OA.1 Use addition and subtraction within 100 to solve one-and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
2.SE.1d2 Represent a "taking away" situation with the – symbol	**Operations and Algebraic Thinking** 1 OA Work with addition and subtraction equations.	1.OA.8 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = _ – 3, 6 + 6 = _.*
Explanations and clarifications:		

Progress Indicator: E.SE.1g using symbols (=, >, <) to compare whole numbers, fractions, or decimals; write equations; and express inverse or related operations		
Core Content Connectors: 3	**CCSS Domain/Cluster**	**Common Core State Standard**
3.SE.1g1 Use =, <, or > to compare 2 fractions with the same numerator or denominator	**Number and Operations – Fractions** 3 NF Develop understanding of fractions as numbers.	3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size d) Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Explanations and clarifications:

Progress Indicator: E.SE.1g using symbols (=, >, <) to compare whole numbers, fractions, or decimals; write equations; and express inverse or related operations		
Core Content Connectors: 4	**CCSS Domain/Cluster**	**Common Core State Standard**
4.SE.1g2 Use =, <, or > to compare 2 fractions (fractions with a denominator of 10 or less)	**Number and Operations – Fractions** 4 NF Extend understanding of fraction equivalence and ordering.	4.NF.2 Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
4.SE.1g3 Use =, <, or > to compare 2 decimals (decimals in multiples of .10)	**Number and Operations – Fractions** 4 NF Understanding decimal notation for fractions, and compare decimal fractions.	4.NF.7 Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.
Progress Indicator: E.SE.1h expressing whole numbers as fractions, and fractions as equivalent decimals; recognizing that a fraction is one number, not two		
Core Content Connectors: 4	**CCSS Domain/Cluster**	**Common Core State Standard**
4.SE.1h1 Express whole numbers as fractions	**Number and Operations – Fractions** 3 NF Develop understanding of fractions as numbers.	3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size c) Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.*
4.SE.1h2 Identify the equivalent decimal for a fraction	**Number and Operations – Fractions** 4 NF Develop understanding of fractions as numbers.	4.NF.6 Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*
Explanations and clarifications:		

Progress Indicator: M.SE.1a using symbols (=, >, <) to compare whole numbers, fractions, or decimals; write equations; and express inverse or related operations		
Core Content Connectors: 5	**CCSS Domain/Cluster**	**Common Core State Standard**
5.SE.1a1 Given a real world problem, write an expression using 1 set of parentheses	**Operations and Algebraic Thinking** 5 OA Write and interpret numerical expressions.	5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
Explanations and clarifications:		

Progress Indicator: M.SE.1a using symbols (=, >, <) to compare whole numbers, fractions, or decimals; write equations; and express inverse or related operations		
Core Content Connectors: 6	**CCSS Domain/Cluster**	**Common Core State Standard**
6.SE.1a2 Given a real world problem, write an equation using 1 set of parentheses	**Expressions and Equations** 6 EE Apply and extend previous understandings of arithmetic to algebraic expressions.	6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers. c) Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.*
6.SE.1a3 Write expressions for real-world problems involving one unknown number		No CCSS linked
6.SE.1a4 Given a real world problem, write an inequality.	**Expressions and Equations** 6 EE Apply and extend previous understandings of arithmetic to algebraic expressions.	6.EE.8 Write an inequality of the form x>c or x<c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x>c or x<c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
Explanations and clarifications:		
Progress Indicator: M.SE.1b writing, interpreting, and using expressions, equations, and inequalities (including using brackets, parentheses, or braces)		

Core Content Connectors: 6	CCSS Domain/Cluster	Common Core State Standard
6.SE.1b1 Evaluate whether or not both sides of an equation are equal	**Expressions and Equations** 6 EE Apply and extend previous understandings of arithmetic to algebraic expressions.	6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*
6.SE.1b2 Use properties to produce equivalent expressions	**Expressions and Equations** 6 EE Apply and extend previous understandings of arithmetic to algebraic expressions.	6.EE.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2+x) to produce the equivalent expression 6 + 3x: apply the distributive property to the expression 24x +18y to produce the equivalent expression 6(4x + 3y): apply properties of operations to y+y+y to produce the equivalent expression 3y.

Progress Indicator: M.SE.1f writing and interpreting mathematical expressions, equations, and inequalities that correspond to given situations		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
7.SE.1f1 Set up equations with 1 variable based on real world problems	**Expressions and Equations** 7 EE Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
7.SE.1f2 Solve equations with 1 variable based on real world problems	**Expressions and Equations** 7 EE Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
7.SE.1f3 Add and subtract linear expressions.	**Expressions and Equations** 7 EE Use properties of operations to generate equivalent expressions	7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
7.SE.1f4 Factor and expand linear expressions.	**Expressions and Equations** 7 EE Use properties of operations to generate equivalent expressions	7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
Explanations and clarifications:		

Progress Indicator: M.SE.1f writing and interpreting mathematical expressions, equations, and inequalities that correspond to

given situations		
Core Content Connectors: 8	**CCSS Domain/Cluster**	**Common Core State Standard**
8.SE.1f5 Use properties of integer exponents to produce equivalent expressions	**Expressions and Equations** 8 EE Work with radicals and integer exponents	8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.
Explanations and clarifications:		