K-2 Content Blueprint Series

Mathematics

Extending Assessments from Pre-K to Second Grade for All Learners

September 2025

MEASURES FOR EARLY SUCCESS

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Introduction

The Kindergarten to Second Grade (K-2) Content Blueprints are intended to help assessment developers learn about and design assessment tools that provide more accurate information about children's learning and development in early elementary school. Used in conjunction with the Pre-K Content Blueprint Series, the K-2 Content Blueprints can also support the design of assessment tools that measure children's developmental progression from pre-K through second grade, given the need for aligned data systems across pre-K and elementary school settings.

Assessment developers can use these blueprints as they embark on content research, concept definition, and product development to ensure that decision-making reflects research and best practices and incorporates users' perspectives to develop innovative assessments that address the educational needs of all early elementary school students.

A key objective of this K-2 Content Blueprint is to encourage the development of innovative assessments that support alignment across children's early learning experiences from pre-K to second grade and provide accurate insights into what all children know and can do in early elementary school.

Why should developers design assessments that are aligned from pre-K through second grade?

Having clear insight into how children learn and grow during the early years of formal schooling can help improve the quality of all children's early educational experiences by building on what children learn in pre-K and sustaining those positive benefits.[1] Aligning assessments from pre-K to second grade can create a coordinated data system that:

- enables an understanding of children's skills as they transition between grades and settings, particularly from pre-K to kindergarten;
- streamlines data collection to reduce the over-assessment of children on similar skills;
- minimizes the assessment burden on teachers so they can devote more time to instruction;
- permits communication and planning across grades to promote curricular coherence and developmentally appropriate instructional practices; and
- prevents under- and over-identification of students for special services by using common metrics over time.

How Can This Resource Be Used?

Building on the Pre-K Content Blueprints developed for the Measures for Early Success Initiative,[2] these K-2 Content Blueprints provide additional information to enable upward extension of assessment development in the following domains:

- English Language Arts[3]
- Mathematics

To support assessment developers in designing tools that create continuity in data systems during the early years of formal schooling, each K-2 Content Blueprint has four primary goals:

Describe skills in each domain and how they develop in children from kindergarten to second grade.

Provide an example of how to map learning standards in pre-K to the standards in kindergarten to second grade to understand developmental progressions in each domain.

Place assessment users' perspectives and needs at the center of the design of innovative assessments in each domain.

Provide an overview of existing assessments in each domain.

How were the K-2 Content Blueprints developed?

Each K-2 Content Blueprint was developed through a systematic review of the Common Core State Standards and select states' kindergarten through second grade learning standards, as well as theoretical and empirical literature on children's development. The K-2 Content Blueprints consider a variety of perspectives, experiences, and needs to highlight domain-specific opportunities for assessment design to ensure that all children are given a fair chance to show what they know and can do.[4]

K-2 Content Blueprints can be used in conjunction with the following resources that were developed for the Measures for Early Success Initiative:

- *Centering User Perspectives in Assessment Design* describes how assessment tools can be designed in more accurate, usable, and useful ways by integrating users' perspectives, strengths, and needs early in the assessment design process.

- The Pre-K Content Blueprint Series is a library of content blueprints outlining skills in four domains (language, literacy, mathematics, and executive function) and how these skills develop in children from ages 3 to 5. The Pre-K Content Blueprints are intended to guide the design of assessments in these domains. Assessment developers can use the Pre-K and K-2 Content Blueprints together to inform the design of assessment tools that align data across these grades.

Common Core and State Learning Standards

For the purposes of capturing children's skills and developmental progressions from kindergarten through second grade, this K-2 Content Blueprint presents definitions and summary developmental progressions that are generated from the Common Core State Standards (CCSS) and select states' learning standards.

Common Core State Standards

The CCSS were released in 2010 and provide academic benchmarks in English Language Arts and Mathematics that outline students' expected skills and knowledge at each grade level.[5] These standards were developed with input from educational stakeholders including educators, school leaders, parents, and content experts. Although the CCSS provide details about what students need to master within each grade, they do not dictate how educators should teach to accomplish this. Rather, the CCSS provide a framework for educators to use to help craft their curricula in English Language Arts and Mathematics. Assessments are used to measure student progress and inform instructional decisions to ensure that students are meeting a set of unified and consistent learning goals.

State learning standards reflected in the K-2 Content Blueprints

To create K-2 Content Blueprints that can be used alongside the Pre-K Content Blueprints, the kindergarten to second grade learning standards of a subset of states were also examined, which included Alabama,[6] California,[7] New Mexico,[8] Ohio,[9] Oregon,[10] and Tennessee.[11] These states were advisory states of the Measures for Early Success Initiative when these K-2 Content Blueprints were developed, and were selected to reflect the variation in the population and geography of the United States.

These states' standards do not represent all state standards. Currently, 41 states, the District of Columbia, four U.S. territories, and the Department of Defense Education Activity have adopted the CCSS.[12] Of the advisory states involved in the Measures for Early Success Initiative, California, New Mexico, Ohio, and Oregon currently follow the CCSS. While Alabama and Tennessee phased out formal adoption of the CCSS in 2013 and 2015, respectively, their state standards often align with the CCSS.[13]

How do skills in the domain develop from kindergarten through second grade?

This section presents definitions and developmental progressions for skills generated from the Common Core and states' K-2 learning standards in this domain.

How to use: This section can be used as an example of landscaping K-2 learning standards to inform item development for assessments that measure children's abilities in this domain. Additionally, the example of domain mapping in this section can facilitate the use of the K-2 Content Blueprints in conjunction with the Pre-K Content Blueprint Series to inform how individual skills continue to progress from pre-K through the early years of formal schooling.

Mathematics Subdomains

Using the Common Core State Standards (CCSS) in conjunction with a subset of states' specific learning standards, and advised by experts in the field, the mathematics standards were organized into the following four areas:

- **Numeric Reasoning**
  (Counting and Cardinality, Base Ten Arithmetic)
- **Operations and Algebraic Thinking**
- **Measurement and Data**
- **Geometry**

Note: A panel of experts in mathematics development reviewed the aggregated state and federal standards and provided feedback based on current research and best practices. Their additions are designated using superscript (h) on the following pages; comments from the panel do not necessarily represent the viewpoint of all experts, though there was general consensus.

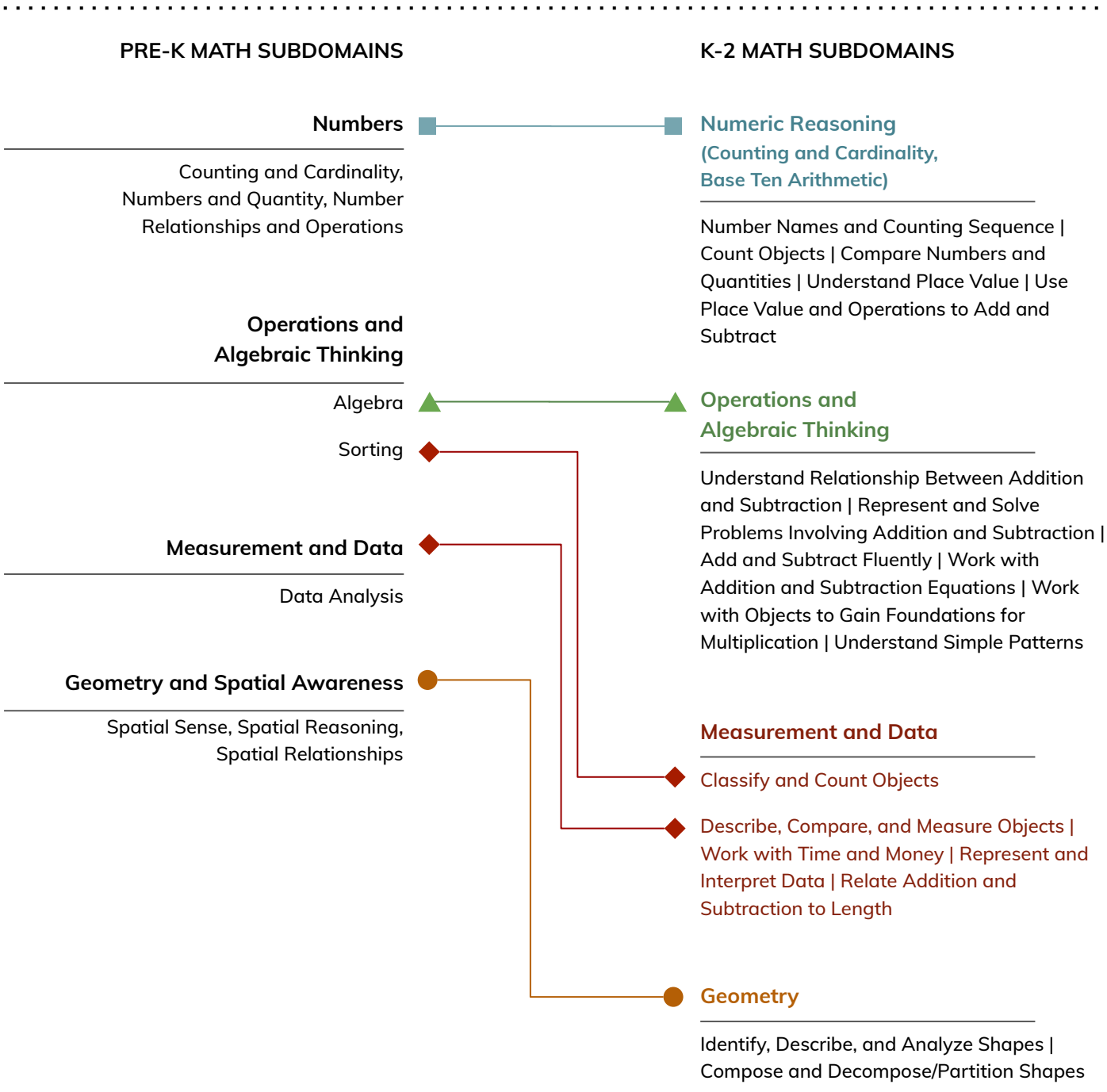
Examples of Subdomain Mapping from Pre-K to K-2

The next page provides an illustrative example of how to map the subdomains from the *Pre-K Mathematics Content Blueprint* to this *K-2 Mathematics Content Blueprint*, to understand children's developmental skill progressions in this domain. This exercise can facilitate the extension and alignment of mathematics assessment tools and item banks and support the creation of coordinated data systems across these early grades.

Subdomains: Pre-K Math to K-2 Math

K-2 Math Subdomains:

- Numeric Reasoning
- Operations and Algebraic Thinking
- Measurement and Data
- Geometry



Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic)

Know number names and counting sequence

KINDERGARTEN

- Count to 100 by ones,[a,f] fives,[g] and tens.[a,f,g] Count backward orally from 10 to 0 by ones.[b,g]
- Count forward beginning from any given number (between 0 and 99)[b] within the known sequence.[a,f,g]
- Identify number names[f] and write numbers from 0 to 20.[a,f,g]
- Represent a number of objects with a written numeral from 0 to 20 (with 0 representing a collection of no objects).[a,f,g]

FIRST GRADE

- Extend the counting sequence from 0 to 120, starting at any number less than 120.[a,f,g]
- Count to 120 by ones, twos, and fives starting at any multiple of that number. Count backward from 20.[g]
- Read and write numerals from 0 to 120.[a,f,g]
- Represent a number of objects from 0 to 120 with a written numeral.[a,f,g]

SECOND GRADE

- Count forward[a,f] and backward[e] within 1,000 by ones, tens, and hundreds;[f] skip-count by fives[a,f] starting at any multiple of five.

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic) *(cont'd)*

Count to tell the number of objects

KINDERGARTEN

- Understand the relationship between numbers and quantities; connect counting to cardinality[a,f,g] using a variety of objects including pennies.[e]
  - When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object (one-to-one correspondence).[a,g]
  - Demonstrate understanding of the cardinality principle;[h] understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.[a,g]
  - Understand that each successive number name refers to a quantity that is one larger.[a,g]
- Count to answer "how many?" questions about:
  - As many as 20 things arranged in a line, a rectangular array, or a circle.[a,f,g]
  - As many as 10 things in a scattered configuration.[a,f,g]
  - Given a number from 1 to 20, count out that many objects.[a,f,g]
  - Draw the number of objects that matches a given numeral from 0 to 20.[b]

FIRST AND SECOND GRADES

- Typically, basic cardinality and counting principles are learned by the end of kindergarten, but children will continue to apply and build on these skills.[h]
  - Children in first grade may explore more complex counting principles and count unseen objects using a number line or five frame and basic concepts of addition and subtraction.[h]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic) *(cont'd)*

Compare numbers and quantities*

KINDERGARTEN

- Identify (without using inequality symbols)[e] whether the number of objects in one group is greater/more than, less/fewer than, or equal/the same as the number of objects in another group (up to 10 objects),[a] for example, by using matching and counting strategies.[a,f,g]
- Compare (without using inequality symbols)[e,g] two numbers between 1 and 10 presented as written numerals,[a,f,g] using the terms "greater than," "less than," or "equal to."[g]

**After kindergarten, comparing numbers and quantities is closely related to the understanding of place value (under base 10).*[h]

FIRST GRADE

- Compare two two-digit numbers (greater than 10) based on the meanings of the tens and ones digits.[a,f,g,h]
- Record the results of comparisons using the symbols >, =, and <[a,f,g] and orally with the words "is greater than," "is equal to," and "is less than."[b]

SECOND GRADE

- Compare two three-digit numbers based on the meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.[a]

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b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic) *(cont'd)*

Understand place value*

KINDERGARTEN

- Work with numbers from 11 to 19 to gain foundations for place value.[a,f,g]
- Compose and decompose numbers from 11 to 19 into groups of ten ones and some further ones.[a,f,g] By using objects or drawings, record each composition or decomposition with a drawing or equation (for example, 18 = 10 + 8).[a,g]
- Understand that these numbers are composed of a group of ten ones and one, two, three, four, five, six, seven, eight, or nine ones (for example, 11 = 10 + 1, 12 = 10 + 2, ..., 19 = 10 + 9).[a]
- Build numbers using sets of tens and *n* units (for example, using blocks, build 15 with a 10 block and 5 single units).[h]

**Understanding place value should be considered an advanced skill for kindergarten and extends into first grade. Children begin learning about place value in kindergarten but are often composing and decomposing smaller numbers.*[h]

FIRST GRADE

- Understand and explain that the two digits of a two-digit number represent amounts of tens and ones.[a,f,g]
- Understand the following as special cases:
  - 10 can be thought of as a bundle of 10 ones — called a "ten."[a,f]
  - The numbers from 11 to 19 are composed of a 10 and one, two, three, four, five, six, seven, eight, or nine ones.[a]
  - The numbers 10, 20, 30, 40, 50, 60, 70, 80, and 90 refer to one to nine tens (and 0 ones).[a]

SECOND GRADE

- Understand and explain that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.[a,f,g] Example: 706 equals 7 hundreds, 0 tens, and 6 ones.
- Understand the following as special cases:
  - 100 can be thought of as a bundle of 10 tens — called a "hundred."[a,f]
  - The numbers 100, 200, 300, 400, 500, 600, 700, 800, and 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).[a]
- Read and write numbers to 1,000 using: base 10 numerals, number names, expanded form,[a,f,g] and equivalent representations.[e]
- Compare two three-digit numbers based on the meanings of hundreds, tens, and ones.[a,f,g]
  - Use the symbols >, =, and < to record the results of comparisons,[a,f,g] and orally use the words "is greater than," "is equal to," and "is less than."[b]

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a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic) *(cont'd)*

Use place value and properties of operations to add and subtract*

**While addition and subtraction fall under the subdomain "Operations and Algebraic Thinking," the following skills are included in "Numeric Reasoning," as the highlighted math strategies are based on an understanding of place value and base 10.*[h]

KINDERGARTEN

- Decompose numbers less than or equal to 10 into pairs in more than one way, for example, by using objects or drawings, and record each decomposition by a drawing or equation (for example, 5 = 2 + 3 and 5 = 4 + 1).[a,f,g]

FIRST GRADE

- Add within 100 (including a two-digit number and a one-digit number and a two-digit number and a multiple of 10) by using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.[a,f,g]
  - Relate the strategy for adding a two-digit number and a one-digit number[b] to a written method and explain the reasoning used.[a,f]
  - Understand that when adding two-digit numbers, tens are added to tens, ones are added to ones; and sometimes it is necessary to compose a 10.[a,f]
- Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count. Explain the reasoning used.[a,f,g]
- Subtract multiples of 10 in the range of 10 to 90 from multiples of 10 in the same range (positive or 0 differences). Use concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Relate the strategy to a written method and explain the reasoning used.[a,f,g]

(continued on next page)

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic) *(cont'd)*

Use place value and properties of operations to add and subtract* *(cont'd)*

**While addition and subtraction fall under the subdomain "Operations and Algebraic Thinking," the following skills are included in "Numeric Reasoning," as the highlighted math strategies are based on an understanding of place value and base 10.*[h]

SECOND GRADE

- Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.[a,f,g]
- Add up to four two-digit numbers using strategies based on place value and properties of operations[a,f,g] and describe how two different strategies result in the same sum.[f]
- Add and subtract within 1,000 using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method.[a,f,g]
    - Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.[a,f]
- Without having to count,[f] mentally add or subtract 10 or 100 to or from a given three-digit[f] number (100 to 900,[a] 100 to 1,000[g]).
- Explain why addition and subtraction strategies work, using place value and the properties of operations.[a,f] Explanations may be supported by drawings or objects.[e]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking

Understand the relationship between addition and subtraction

KINDERGARTEN

- Understand addition as putting together and adding to and understand subtraction as taking apart and taking from.[a,f]
- For any number from one to nine, find the number that makes 10 when added to the given number, for example, by using objects or drawings, and record the answer with a drawing or equation.[a,f,g]

FIRST GRADE

- Apply properties of operations* (additive identity, commutative, and associative)[g] as strategies to add and subtract.[a,f,g] Examples:
  - If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known (Commutative Property of Addition).[a]
  - To add 2 + 6 + 4, the second two numbers can be added to make 10, so 2 + 6 + 4 = 2 + 10 = 12 (Associative Property of Addition).[a]
  - When adding 0 to a number, the result is the same number (Identity Property of Zero for Addition).[b]
- Understand subtraction as an unknown-addend problem.[a,f,g]
  - For example: subtract 10 – 8 by finding the number that makes 10 when added to 8.

**A child's ability to name the properties of operations is less important than the child's ability to demonstrate and apply an understanding of the properties.*[h]

SECOND GRADE

- Understand the property of equivalence—two expressions or quantities have the same numeric value.[h]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking *(cont'd)*

Represent and solve problems involving addition and subtraction

KINDERGARTEN

- Represent addition and subtraction (up to 10)[b] with objects, fingers, mental images, drawings, sounds (for example, claps), acting out situations, verbal explanations, expressions, or equations.[a,f,g] Drawings need not show details, but should show the mathematics in the problem (applies to all drawings in the math domain).[a]
- Solve addition and subtraction word problems (written or oral),[e] and add and subtract within 10, by using objects or drawings to represent the problem.[a,f,g] Solve contextual problems with unknown results or totals involving situations of add to, take from, put together, or take apart.[g]

FIRST GRADE

- Use addition and subtraction up to 20 to solve word problems (in authentic contexts)[f] by using concrete objects, drawings, equations, and/or number lines* with a symbol for the unknown number to represent the problem.[a,g,h]
  - Add when the change is unknown to solve word problems up to 20. For example, 2 + ? = 5.[a,f,g]
  - Subtract when the change is unknown to solve word problems up to 20. For example, 5 - ? = 3.[a,f,g]
  - Put together/take apart with an unknown addend to solve word problems up to 20. For example, 3 + ? = 5 or 5 - 3 = ?[a,f,g]
  - Compare quantities, when the difference is unknown (for example, Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie?), the unknown is bigger (for example, Lucy has three fewer apples that Julie. Lucy has two applies. How many applies does Julie have?), and the unknown is smaller (for example, Lucy has three fewer apples than Julie. Julie has five apples. How many apples does Lucy have?) while solving word problems up to 20.[a,f,g]
- Solve word problems that call for the addition of three whole numbers whose sum is less than or equal to 20, for example, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.[a,f,g]

**Number lines are a powerful central conceptual structure in helping children organize their mathematical thinking; understanding number lines provides a strong foundation for later work with fractions and magnitudes.*[h]

SECOND GRADE

- Use addition and subtraction up to 100 to solve one- and two-step word problems by using drawings and equations with a symbol for the unknown number to represent the problem.[a,f,g] Problem types include adding to, taking from, putting together, taking apart, and comparing with unknowns in all positions.[a,g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking (cont'd)

Add and subtract with increasing fluency*

**Fluency involves a mixture of "just knowing" answers, knowing answers from patterns, and knowing answers from the use of strategies. The word fluently is used in the standards to mean accurately, efficiently, and flexibly. Automaticity of facts becomes evident when a student no longer uses a pattern or mental algorithm to determine the answer.*[b]

KINDERGARTEN

- Fluently add and subtract up to five[a,f] with accurate, efficient, and flexible strategies.[f]
- Use mental strategies flexibly to develop fluency in addition and subtraction up to 10.[g]

FIRST GRADE

- Add and subtract within 20, demonstrating fluency for addition and subtraction up to 10.[a,f,g] Use strategies such as:
  - Counting on[a,g]
  - Making 10 (for example, 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14)[a,g]
  - Decomposing a number leading to 10 (for example, 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9)[a,g]
  - Using the relationship between addition and subtraction (for example, knowing that 8 + 4 = 12, one knows 12 – 8 = 4)[a,g]
  - Creating equivalent but easier or known sums (for example, adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13)[a,g]
- Relate counting to addition and subtraction (for example, by counting on 2 to add 2).[a,f]
- By the end of Grade 1, know all sums and differences up to 10.[g]

SECOND GRADE

- Fluently add and subtract up to 20[a,f] (30[g]) using accurate, efficient, and flexible[f] mental strategies,[a] such as counting on, making 10, decomposing a number leading to 10, using the relationship between addition and subtraction, and creating equivalent but easier or known sums.[b]
- By the end of Grade 2, know from memory all sums of two one-digit numbers[a] and related subtraction facts.[g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking *(cont'd)*

Work with addition and subtraction equations

KINDERGARTEN

Not found in the Common Core and advisory states' standards.

FIRST GRADE

- Understand the meaning of the equal sign (means "the same as")[b] and determine if equations involving addition and subtraction are true or false.[a,f,g]
  - 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
- Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.[a,f,g]
  - For example: Determine the unknown number that makes the equation true in each of the equations: 8 + ? = 11, 5 = ? – 3, 6 + 6 = ?

SECOND GRADE

- Identify arithmetic patterns in an addition or hundreds chart and explain them using properties of operations. For example, analyze patterns in the addition chart and observe an alternating pattern of even and odd numbers (because each time we move to the right one box or down one box, we are adding one more to our sum: (2 + 3) + 1 = 2 + (3 + 1) = 2 + 4, which uses the associative property of addition).[g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking *(cont'd)*

Work with groups of objects to gain foundations for multiplication*

**Subitizing is not included in K-2 learning standards but is strongly related to multiplication. Through subitizing, children begin to visualize groups and see multiplication as the repeated addition of groups.*[14]

KINDERGARTEN

- Perceptually subitize: recognize a quantity, or set of four or fewer objects or dots, without counting.[h]
- Conceptually subitize: recognize a quantity, or set of five or more objects or dots, without counting.[h]

FIRST GRADE

- Conceptually subitize with fives and tens.[h]

SECOND GRADE

- Determine whether a group of objects (up to 20) has an odd or even number of members, for example, by pairing objects or counting them by two.[a,f,g]
  - Write an equation to express an even number as a sum of two equal addends.[a,f,g]
- With the assistance of concrete and pictorial representations,[b] use repeated addition to find the total number of objects arranged in rectangular arrays with up to five rows and up to five columns.[a,f,g]
  - Write an equation to express the total number of objects as a sum of equal addends.[a,f,g]
  - Conceptually subitize with place value.[h]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Operations and Algebraic Thinking (cont'd)

Understand simple patterns*

*For a greater level of detail around the developmental trajectory of patterning (sequence of recognizing, fixing, duplicating, extending, and identifying the core unit), see the Building Blocks Developmental Levels for Patterning and Early Algebra.[15]

KINDERGARTEN	• Duplicate and extend simple patterns using concrete objects.[b] • Recognize, describe, extend, and create patterns and explain a simple rule for a pattern using concrete materials.[g] Analyze the structure of the repeating pattern by identifying the unit (core) of the pattern.[g]
FIRST GRADE	• Reproduce, extend, create, and describe patterns and sequences using a variety of materials.[b] • Recognize, describe, extend, and create patterns when counting by ones, twos, fives, and tens and use those patterns to predict the next number in the counting sequence up to 120 through counting or building with concrete materials.[g]
SECOND GRADE	• Reproduce, extend, create, and describe patterns and sequences using a variety of materials.[b] • Recognize, describe, extend, and create patterns when counting by ones, twos, fives, tens, and hundreds and use those patterns to predict the next number in the counting sequence up to 1,000.[g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Measurement and Data

Classify and count objects

KINDERGARTEN	• Classify objects into given categories (of 10 or fewer);[g] count the number of objects in each category and sort the categories by group size.[a,f]
FIRST GRADE	Not found in the Common Core and advisory states' standards.
SECOND GRADE	• Sort objects according to multiple attributes, naming and relating the attributes; understand that some objects can belong to more than one group.[16]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Measurement and Data *(cont'd)*

Describe, compare, and measure objects*

**Measurement is an important concept for learning fractions, as children learn to measure the number of equal parts of a whole. Early fraction understanding receives more emphasis in first and second grade but begins in kindergarten.*[h]

KINDERGARTEN

- Describe and compare measurable attributes.[a,g]
- Describe measurable attributes of object(s), such as length or weight[a,f,g] using vocabulary such as long or short, heavy or light, or tall or short.[b,e,g]
- Directly compare two objects with a measurable attribute in common, to see which object has "more of" or "less of" the attribute and describe the difference. For example, directly compare the heights of two children and describe one child as taller or shorter.[a,f,g]

FIRST GRADE

- Measure lengths indirectly and by iterating length units.[a,g]
- Order three objects by length; compare the lengths of two objects indirectly by using a third object.[a,f,g]
- Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end;[a,f] understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.[a]
- Measure the length of an object using nonstandard units (paper clips, cubes) and express this length as a whole number of units.[g]

SECOND GRADE

- Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.[a,f,g]
- Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the chosen unit.[a,f,g]
- Estimate lengths using units of inches, feet, centimeters, and meters.[a,f,g]
- Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.[a,f,g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Measurement and Data *(cont'd)*

Work with time and money

KINDERGARTEN

- Identify the penny, nickel, dime, and quarter based on their attributes (size and color) and recognize the value of each.[g]
- Counting and sorting coins should be limited to pennies.[e]

FIRST GRADE

- Recognize a clock as a measurement tool.[g] Tell and write time in hours and half-hours using analog and digital clocks.[a,f,g]
  - There is growing literature on the importance of vocabulary for math. If a child does not know the word "half," this influences their ability to comprehend math questions.[h]
- Identify pennies and dimes by name and value.[b,e]
- Count the value of a set of like coins less than one dollar using the ¢ symbol only.[g]

SECOND GRADE

- Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.[a,f,g]
  - Express and understand common terms such as, but not limited to, quarter past, half past, and quarter to.[b]
- Solve contextual word problems involving dollar bills, quarters, dimes, nickels, and pennies.[a,f,g]
  - Identify nickels and quarters by name and value.[b,e]
  - Find the value of a collection of quarters, dimes, nickels, and pennies.[b,e]
    - Example: If you have two dimes and three pennies, how many cents do you have?[a]
  - Solve word problems by adding and subtracting within one dollar,[b] using $ and ¢ symbols appropriately[a,f] (not including decimal notation).[b,e]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Measurement and Data *(cont'd)*

Represent and interpret data

KINDERGARTEN

- Categorize data on Venn diagrams, pictographs, and "yes-no" charts using real objects, symbolic representations, or pictorial representations.[b]
- Generate questions to investigate situations within the classroom. Collect or consider data that can naturally answer questions by sorting and counting.[f]

FIRST GRADE

- Collect,[b,f] analyze,[b,f] and organize,[a,g] data sets with up to three categories by representing data visually, such as with graphs and charts,[f] and interpret[a,f,g] information presented to answer investigative questions.[f]
  - Ask and answer questions about the total number of data points in organized data.[a,g]
  - Summarize data on Venn diagrams, pictographs, and "yes-no" charts using real objects, symbolic representations, or pictorial representations.[b]
  - Determine how many in each category.[a,g]
  - Determine how many more or less are in one category than in another[a,g] using data organized into two or three categories.[b]
- Generate questions to investigate situations within the classroom.[f]

SECOND GRADE

- Collect and analyze data and interpret results.[b]
- Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.[a,g]
- Organize, represent, and interpret data with up to four categories.[e] Draw a picture graph and a bar graph (with single-unit scale) to represent a data set[f] with up to four categories.[a,g]
  - Using information presented in a bar graph, solve simple "put-together," "take-apart," and "compare" problems.[a,g]
  - Using Venn diagrams, pictographs, and "yes-no" charts, analyze data to predict an outcome.[b]
- Generate questions to investigate situations within the classroom. Collect or consider data that can naturally answer questions by using measurements with whole-number units.[f]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Measurement and Data *(cont'd)*

Relate addition and subtraction to length

KINDERGARTEN	Not found in the Common Core and advisory states' standards.
FIRST GRADE	Not found in the Common Core and advisory states' standards.
SECOND GRADE	• Use addition and subtraction within 100 to solve word problems involving the same unit of lengths, representing the problem with drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.[a,f,g] • Create a number line diagram (with equally spaced points corresponding to the numbers, 0, 1, 2, ...) using whole numbers and use it to represent whole-number sums and differences within 100.[a,f,g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Geometry

Identify, describe, and analyze shapes

KINDERGARTEN

- Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).[a,g]
- Describe objects in the environment using the names of shapes and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.[a,g]
- Correctly name shapes and solids[g] regardless of their orientations or overall size.[a,g]
- Identify shapes as two-dimensional (lying in a plane or "flat") or three-dimensional ("solid").[a,g]
- Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (for example, number of sides and vertices or "corners") and other attributes (for example, having sides of equal length).[a,g]

FIRST GRADE

- Distinguish between defining attributes (for example, triangles are closed and three-sided) versus nondefining attributes (for example, color, orientation, and overall size); build and draw shapes to possess defining attributes.[a,f,g]

SECOND GRADE

- Recognize and identify triangles, quadrilaterals, pentagons, and hexagons[a,g] based on the number of sides and vertices.[e] Recognize and identify cubes,[a] prisms, cones, and cylinders.[e]
- Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.[a,f,g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

Geometry *(cont'd)*

Compose and decompose/partition shapes*

**The composition and decomposition of shapes is an important foundation for learning fractions, as children learn to divide shapes into equal parts; second graders may begin to use simple notation such as ½ and ¼.*[h]

KINDERGARTEN

- Model shapes in the world by building shapes from components (for example, sticks and clay balls) and drawing shapes.[a,g]
- Compose simple shapes to form larger shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"[a,g]

FIRST GRADE

- Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.[a,f,g] Students do not need to learn formal names such as "right rectangular prism."[a]
- Partition circles and rectangles into two and four equal shares,[a,f,g] describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of.[a,g]
  - Describe the whole as two of, or four of the shares of circles and rectangles partitioned into two or four equal shares.[a,f,g]
  - Understand for these examples that decomposing into more equal shares creates smaller shares of circles and rectangles.[a,f,g]

SECOND GRADE

- Partition a rectangle into rows and columns of same-size squares and count to find the total number of squares.[a,f,g]
- Partition circles and rectangles into two, three, or four equal shares,[a,f,g] describe the shares using the words *halves, thirds, half of, a third of*, etc., and describe the whole as two *halves, three thirds, four fourths.*[a,g] Recognize that equal shares of identical wholes need not have the same shape.[a,f,g]

a: Common Core State Standards, Alabama, California, New Mexico, and Ohio (states that primarily follow CCSS)
b: Alabama c: California d: New Mexico e: Ohio f: Oregon g: Tennessee h: additions by a panel of math experts

What are domain-specific opportunities for innovation?

This section provides examples that are specific to the development of assessment tools in this domain.

How to use: This section should be used in conjunction with the opportunities listed in the *Pre-K Mathematics Content Blueprint* to identify new opportunities for innovation in kindergarten to second grade mathematics assessments. However, these considerations are not exhaustive.

Centering User Perspectives in Assessment Design

Because public schools serve a broad range of families and children, assessment developers are encouraged to review the *Centering User Perspectives in Assessment Design* resource. This resource was created to ensure that the decision-making used to develop and design learning assessments focuses on the perspectives, challenges, and context of those who will ultimately use the tools. While originally developed for use when designing assessments for pre-K programs and systems, the principles and prompts outlined within this resource are applicable to assessment development for a range of grade levels.

Using that resource, along with this K-2 Content Blueprint, assessment developers are encouraged to:

Expand the types of skills that are measured to capture the strengths and capabilities of all students.

Explore how students might demonstrate these skills in different ways.

Innovate approaches to address key user considerations in new assessments in this domain.

Consider ways to align assessments across grades by factoring in the perspectives of users in different educational systems and contexts.

Examples of Opportunities

The examples on this page should be used in conjunction with the opportunities listed in the *Pre-K Mathematics Content Blueprint* to identify new opportunities for innovation in kindergarten to second grade assessments. The opportunities for innovation in pre-K assessments are still relevant for assessment developers to consider as they extend their tools for use in early elementary school. This K-2 Content Blueprint includes new considerations as children start learning more complex content and have more experience in formal education settings.

Young students come to elementary school with different backgrounds, experiences, and educational histories. When math problems are set within familiar situations, students are better able to use the context to develop strategies to find the answers to the problems.[17] As math assessments become more complex and connected to real-world problems in early elementary school, they may be less relevant or interpreted differently by students who have not had those experiences.[18] Assessments that provide young students with familiar situations or experiences are more likely to allow them to express their math knowledge, particularly for students who are emergent bilingual learners.[19]

How can math assessments build on students' knowledge and experiences in their homes and communities to offer students better opportunities to display their mathematical thinking and abilities?

Many elementary math assessments measure whether students provide the correct answer to a problem. However, students engage in mathematical thinking and reasoning in different ways, and they may display their understanding of math concepts in varied ways.[20]

How can math assessments be designed to allow students to describe their approach to problem solving and reasoning when solving math problems?

Examples of Opportunities *(cont'd)*

The examples on this page should be used in conjunction with the opportunities listed in the *Pre-K Mathematics Content Blueprint* to identify new opportunities for innovation in kindergarten to second grade assessments. The opportunities for innovation in pre-K assessments are still relevant for assessment developers to consider as they extend their tools for use in early elementary school. This K-2 Content Blueprint includes new considerations as children start learning more complex content and have more experience in formal education settings.

Though math is traditionally considered to be a "universal language" using numbers and having minimal language demands, students often draw on their language and literacy skills to complete math assessments (for example, reading and understanding prompts).[21] Math assessments start introducing simple word problems to students with increasing complexity from kindergarten to second grade, placing demands on young students' reading abilities.[22] Moreover, math assessments may test students' understanding and use of math vocabulary—words that can take on a different meaning than everyday vocabulary (for example, *equal* or *table*)—as well as their ability to provide both written and verbal explanations for how they are solving problems.[21] For emergent bilingual students who are still learning English and students struggling with reading, math assessments that rely heavily on language and reading may not accurately capture their math knowledge and problem solving skills.[23]

How can math assessments provide language- or literacy-focused support so that students are better able to demonstrate their math knowledge in multiple ways?

Students are more likely to experience math anxiety—an acutely negative emotional response triggered by situations involving math—when they feel the pressure of timed tests or think the test is too difficult for their capabilities.[24] Math anxiety starts to emerge as early as age 6,[25] and may hinder students' performance in math.[26] Over time, students who do not experience success in math can develop negative attitudes toward math and their own abilities in math.[27]

How can math assessments be designed to reduce test-taking anxiety, reduce time stressors, or give students a sense of confidence to provide all students with opportunities to demonstrate their true math knowledge?

Examples of Opportunities *(cont'd)*

The examples on this page should be used in conjunction with the opportunities listed in the *Pre-K Mathematics Content Blueprint* to identify new opportunities for innovation in kindergarten to second grade assessments. The opportunities for innovation in pre-K assessments are still relevant for assessment developers to consider as they extend their tools for use in early elementary school. This K-2 Content Blueprint includes new considerations as children start learning more complex content and have more experience in formal education settings.

What additional opportunities for innovation do you see in the assessment of mathematics?

Math assessments that use computer-based adaptive testing (CAT) are typically shorter yet use scoring methods that are as precise as traditional fixed-item tests by only asking questions that match a student's ability (students with higher abilities receive more difficult items whereas students with lower abilities receive less difficult items).[28] While math CAT assessments can reduce testing fatigue and motivate middle school students by presenting items that are appropriately challenging,[29] some younger students' math scores may depend on their familiarity with technology or they may experience testing anxiety or disengagement because of the difficulty of the items presented to them based on their responses or their inability to review earlier responses.[30]

How can CAT math assessments in early elementary grades be designed specifically for young children, to ensure that students are familiar with digital platforms, tests with adaptive logic do not skip foundational early skills, and students receive explicit developmentally appropriate instruction about how CAT assessments function?

How are skills in the domain currently measured?

This section presents a sample of direct assessments that measure skills in this domain and are commonly used by the state partners of the Measures for Early Success Initiative. A detailed overview of each assessment is provided.

How to use: This section can be used to understand the current state of assessments in this domain and to identify potential opportunities for innovation and improvements. These tools are presented as examples—not exemplars—of direct assessments of children's skills in kindergarten to second grade in this domain.

Assessment developers should not try to replicate these tools or copy example prompts or items. Assessment developers should consider the needs of students, educators, families, and other assessment users when designing these tools.

Star Math[31]

Subdomains Measured

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic); Operations and Algebraic Thinking; Measurement and Data; Geometry

Grade Range

K to 12

Language Versions

English, Spanish

Administration

- Star Math is a computer-based assessment and uses adaptive branching to change the difficulty level of items based on whether the student answers a question correctly (leading to a more difficult question) or incorrectly (leading to an easier question). This computer-adaptive structure allows for more efficient assessments, as students do not see all test items; rather, students see items that closely match their ability level. The first item students see is typically one or two levels below their current grade level to avoid frustration.[32]
- There are two versions of Star Math available: a comprehensive version and a brief version. The comprehensive version has 34 multiple-choice items and takes less than 25 minutes to complete. The shorter version has 24 items and takes about 15 minutes to complete.[32]
- Star Math aims to: (1) provide educators with a quick snapshot of students' math understanding, (2) compare students' knowledge with national norms, and (3) track students' growth over time.[32]

Sample Items[33]

- Numbers and Operations (Kindergarten item)
  - *(Student is shown a picture of a basket with four oranges outside of the basket.) There are 8 oranges. Some are in the basket. How many oranges are in the basket?*
    - a) 6 oranges
    - b) 5 oranges
    - **c) 4 oranges**
    - d) 3 oranges
- Algebra (Grade 1 item)
  - *What number goes in the box?*
    - ____ + 8 = 15
    - **a) 7**
    - b) 23
    - c) 8
    - d) 24
- Geometry and Measurement: (Grade 2 item)
  - *Count the money. How much is shown? (1 quarter, 2 dimes, 2 nickels)*
    - a) 22 cents
    - b) 37 cents
    - c) 47 cents
    - **d) 55 cents**

Scoring

- Star Math provides three types of scores: scaled scores, norm-referenced scores, and criterion-referenced scores.
  - The scaled score is a consistent measure of performance for all students across all domains. This allows for comparison among students, over time, and across grades. The Unified Scaled Score ranges from 600 to 1,400. The scaled score is used to generate all norm-referenced scores.[32]
  - The Grade Equivalent score is an example of a norm-referenced score; this score shows how students' performance compares with their peers nationally and indicates whether students are above, at, or below average for their grade.[32]
  - Domain specific scores are one type of criterion-referenced score provided by Star Math and represent the percentage of questions a student is expected to answer correctly in each domain. For example, a first-grader who earns a domain score of 50 would be expected to correctly answer about half of all first grade items in that domain.[34] Scores range from 0 to 100. Domains include:
    - Numbers and Operations
    - Algebra
    - Geometry and Measurement
    - Data Analysis, Statistics, and Probability

Acadience Math[35]

Subdomains Measured

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic); Operations and Algebraic Thinking; Measurement and Data; Geometry

Grade Range

K to 6

Language Versions

English

Administration

- Acadience Math is a universal screener and progress monitoring assessment that measures the development of math skills. Specifically, the assessment focuses on early numeracy, computation, and problem solving, as these skills are essential for later proficiency in mathematics.[36]
- Students provide a response to verbal prompts from the teacher or assessor. Most of the subtests are administered one-on-one, but the Computation and Concepts/Applications subtests can be administered in a group setting.[37] Subtests take between 1 and 2 minutes to administer.[38]
- Subtests vary by grade.[38]
  - Early Numeracy
    - Beginning Quantity Discrimination: Kindergarten
    - Number Identification Fluency: Kindergarten – Grade 1
    - Next Number Fluency: Kindergarten – Grade 1
    - Advanced Quantity Discrimination: Grade 1
    - Missing Number Fluency: Grade 1
  - Computation: Grades 1 and 2
  - Concepts and Application: Grade 2

Sample Items[38]

- Beginning Quantity Discrimination
  - *(Students are shown two images with each displaying a different number of dots.) Students are asked to say the number that represents the larger set of dots from the two images.*
- Number Identification Fluency
  - *(Students are shown numbers and are asked to identify which number the assessor points to.) Example: Identify the numbers:* 5 3 2
- Advanced Quantity Discrimination
  - *(Students are shown two numbers and are asked to identify which is larger.) Example: Which number is more? 12 or 48*
- Missing Number Fluency
  - *(Students are shown a series of numbers with a missing box.) The assessor asks the students to fill in the blank for the missing number. Example: Which number is missing? 20 30 __ 50*

Scoring

- Assessors manually score the Acadience Math assessment as they administer the test. Digital administration and scoring are also available; assessors can directly administer and score the assessment on a tablet or enter scores manually after administering the assessment on paper.[39]
- Acadience Math provides two types of scores following each administration: a raw score for each subtest and a composite score. The raw scores for each subtest represent the number of correct answers. The Math Composite Score (MCS) provides the most comprehensive estimate of students' math skills, and when compared with benchmarks, it can be used to identify children who may need more support. The MCS is not comparable across or within grades and should not be used to track student growth.[40]

i-Ready: Diagnostic Math[41]

Subdomains Measured

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic); Operations and Algebraic Thinking; Measurement and Data; Geometry

Grade Range

K to 8

Language Versions

English, Spanish

Administration

- The i-Ready Diagnostic test is administered digitally with students responding to a series of multiple-choice questions. If students have previously taken an i-Ready Diagnostic test, they will begin at the proficiency level shown in the previous test. If students have not already taken i-Ready, they will start with items that are approximately one grade below their current grade.[42]
- i-Ready is a computer-adaptive assessment. Each student sees a different assessment, as the items that are presented reflect a student's performance on previous questions. After a series of correct answers, a student will see slightly harder questions; after a series of incorrect answers, a student will see slightly easier questions. This allows for more precise insight into a student's knowledge.[42]
- The test is untimed and can be done in several sittings. For students in kindergarten and first grade, the assessment takes between 40 and 60 minutes (often completed in two sittings). For students in second through eighth grade, the assessment takes between 80 and 100 minutes (often completed in two sittings).[43] i-Ready is typically administered three times throughout the school year.[44]

Administration *(cont.)*

- The i-Ready Math Diagnostic assesses items in four domains:[45]
  - Numbers and Operations
  - Algebra and Algebraic Thinking
  - Measurement and Data
  - Geometry

Sample Items[46]

- Number Line Item
  - *(Students are shown a number line from 0 to 3 with markings on whole and half numbers.) Click on the number line to show 1/2.*
- Multiple-Choice Item
  - *(Students are shown a picture with eight balloons.) Matt has 8 balloons. He gives 4 to a friend. Which number sentence shows how many balloons Matt has left?*

    a) 4-4=0

    b) 8-0=8

    c) 8-4=4
- Short-Answer Item
  - *(Students are shown a picture of a ribbon placed above a ruler marked in feet.) Elena has 2 ½ feet of ribbon. She needs a total of 3 feet of ribbon for a project. How many more inches of ribbon does she need? Type the answer in the box.*

Scoring

- The i-Ready Diagnostic produces both criterion- and norm-referenced scores. Criterion-referenced scores compare a student's performance with a set of standards, separate from how others perform on the test; this scaled score ranges from 100 to 800 and allows educators to compare both across and within grades.[47] Norm-referenced scores compare a student's performance with the performance of the normative group (which is a nationally representative sample of other students); these scores are reported as percentile ranks.[47]
- Scale Score Placement Tables are also provided, which aim to provide instructional recommendations and support placement decisions. When a student completes the diagnostic, both an overall score and a domain-level score are provided, and these scores are responsive to the difficulty of the items a student answered.[48] Scores are compared to diagnostic placement levels, which provide an indication of the student's performance based on scaled score ranges for the student's grade. Placement levels include:[48]
  - Mid, Late Above Grade Level
  - Early on Grade Level
  - One Grade Level Below
  - Two Grade Levels Below
  - Three or More Grade Levels Below

Istation Math[49]

Subdomains Measured

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic); Operations and Algebraic Thinking; Measurement and Data; Geometry

Grade Range

Pre-K to 8

Language Versions

English

Administration

- The Istation Indicators of Progress, Early Math (ISIP Early Math) assessment is a computer-based test of children's mathematical knowledge designed to function as a universal screener and progress monitor. The assessment uses a game-like format; for example, children complete activities in a grocery store called Mario's Market.[50] The assessment is designed to be administered regularly over time to gather more accurate insights into a student's knowledge.[50]
- The assessment takes about 30 minutes or less with the questions read aloud to the student by the narrator via an audio recording.[51]
- The first item to be administered is based on the student's grade level, after which adaptive testing is used to tailor the assessment to each student. If the student answers a question correctly, it leads to a more difficult question. If the student answers a question incorrectly, it leads to an easier question.[50]
- ISIP Math covers six primary math subdomains: number sense, operations, algebra, geometry, measurement, and data analysis.[50] In pre-K through Grade 5, children see items in four primary math domains:[52]
  - Number Sense (NS)
  - Computations & Algebraic Thinking (CA)
  - Measurement & Data Analysis (MDA)
  - Geometry (G)

Sample Items[52]

- *Anna has 4 bananas. She puts 2 apples in her shopping cart. How many pieces of fruit does Anna have now?*

  a) 6

  b) 2
- *(Students are shown a picture of a cucumber and a loaf of bread.) Which statement describes these objects?*
  - The cucumber is longer than the French bread.
  - **The cucumber is shorter than the French bread.**
- *(Students are shown a picture of a cookie and a yield sign.) Which object is round?*
  - **Cookie**
  - Yield sign

Scoring

- The measurement scale used by the ISIP assessment is called an ability index. All items are placed on the ability index scale and assigned a numeric value based on their difficulty level. The assessment ends, and an overall mathematical ability index score is generated, when ISIP determines the difficulty level at which a student is able to perform.[53]
- Students are given an overall mathematical ability index score and individual indices for each domain based on the difficulty of items they complete on the test through the adaptive testing method. The Ability Index Scores are aligned with three normative groupings for each grade level:[53]
  - Tier 1 (above the 40th percentile): Students are performing at grade level
  - Tier 2 (between the 21st and 40th percentile): Students are performing below grade level and need additional support
  - Tier 3 (20th percentile and below): Students are performing severely below grade level and need significant support

Measures of Academic Progress (MAP): MAP Growth[54]

Subdomains Measured

Numeric Reasoning (Counting and Cardinality, Base Ten Arithmetic); Operations and Algebraic Thinking; Measurement and Data; Geometry

Grade Range

K to 12

Language Versions

English, Spanish (K-12 math, K-8 reading)

Administration

- There are three assessments included under MAP Growth K-2:[55]
  - Screening: available for early literacy and mathematics, this assessment aims to establish a baseline understanding of student knowledge for the youngest learners (for example, children starting kindergarten).
  - Skills Checklist: gathers information about specific skills within a domain (for example, phonological awareness); it can be administered multiple times at the discretion of educators.
  - Growth: this digital assessment of student achievement uses computer-adaptive testing to assess reading, math, language usage, and science. The following assessment information describes the Growth assessment.[56]
- MAP can be administered remotely or in person. The assessment is untimed, but most students finish a test in 45 to 55 minutes.[56] For students in K-2, it is recommended that students take a break during the middle of the assessment. Students typically complete the assessment three times each school year.[56]

Administration *(cont.)*

- Test items include multiple-choice, fill-in-the-blank, and drag-and-drop questions. MAP Growth is designed to be child-friendly; audio assistance is provided to help children who are learning how to read, and illustrations are used throughout.[57]
- Instructional areas represented in the Growth assessment align with the Common Core State Standards and include:[55]
  - Number and Operations
  - Operations and Algebraic Thinking
  - Measurement and Data
  - Geometry

Sample Items[58]

- *(Students are shown pictures of a cube, a cylinder, a sphere, and a cone.) Choose the cube.*
- *(Students are shown a picture of short and long pencils.) Move the short pencils to the short pencils' box. Move the long pencils to the long pencils' box.*
- *(Students are shown a picture of five cookies). Putting an 'X' on a cookie means it is taken away. Move an 'X' to the cookies to show five take away two.*

Scoring

- MAP Growth uses Rasch Unit (RIT) scales which rely on each individual item's difficulty level to measure a student's performance across grades. MAP Growth results, representing a student's ability, are reported as RIT scores, ranging from 100 to 350.[59] RIT scores are continuous across grades, meaning a student's growth can be directly measured from year to year; a child may have a score in the 170s in third grade and progress to the 220s in high school.[60]
- The RIT scores can be translated into:[60]
  - Achievement percentiles that compare a student's performance with similar students in the norming sample.
  - Growth percentiles, which reflect a student's growth compared with the growth of similar students within the norm group. Two or more MAP Growth tests must be completed to generate this score.

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differences. In the Mathematics domain, Alabama, California, New Mexico, and Ohio are primarily aligned with the CCSS, whereas Oregon and Tennessee have more significant differences.
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