

A Study of the Common Core State Standards

Mathematics

A Study of the Standards: Goal and Expectations

Participants will gain a common understanding of the Common Core State Standards and develop a strong working knowledge of the standards' effect on teaching and learning.

Session participants will learn . . .

- how to use a set of structured tools to promote conversations and collaboration around the Common Core State Standards.
- how to use the Common Core State Standards to guide decision making about teaching, learning, and assessment.

Group Norms

- **Understand that those who work, learn.**
- **Phrase questions for the benefit of everyone.**
- **Recognize that everyone has expertise.**
- **Challenge ideas, not people.**
- **Share talk time.**

“To begin with the end in mind means to start with a clear understanding of your destination. It means to know where you’re going so that you better understand where you are now and so that the steps you take are always in the right direction.”

Stephen R. Covey
The Seven Habits of Highly Effective People



Reflect

- Do you agree or disagree with the central idea of this quotation?
- What is the relationship between this quotation and the standards?

The Common Core State Standards do not provide . . .

- a complete scope and sequence,
- a course outline, or
- *all* the essential skills and knowledge students *could* have.

The Common Core State Standards do . . .

- outline the most important essential skills and knowledge *every* student needs to master to succeed in college and careers.

Common Core State Standards Development

- **The Common Core State Standards Initiative is a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO).**
- **The standards were developed in collaboration with teachers, school administrators, and experts to provide a clear and consistent framework to prepare our children for college and the workforce.**

Common Core State Standards Development *(continued)*

- **Aligned with college and work expectations;**
- **Include rigorous content and application of knowledge through high-order skills;**
- **Build upon strengths and lessons of current state standards;**
- **Informed by top-performing countries, so that all students are prepared to succeed in our global economy and society; and**
- **Evidence and/or research based.**

As new research is conducted and implementation of the Common Core State Standards is evaluated, the standards will be revised on a set review cycle.

Standards for Mathematical Practice: K–High School

- **Make sense of problems and persevere in solving them.**
- **Reason abstractly and quantitatively.**
- **Construct viable arguments and critique the reasoning of others.**
- **Model with mathematics.**
- **Use appropriate tools strategically.**
- **Attend to precision.**
- **Look for and make use of structure.**
- **Look for and express regularity in repeated reasoning.**

Structure

Standards for Mathematical Content (K–8)

Introduction

- **Provides important contextual information and calls out and describes critical areas of focus.**

Domain

- **Large group of related standards; connects topics and content between and among grade levels.**

Clusters/Cluster Heading

- **Smaller set of related standards within the domain; identifies the primary idea.**

Standards

- **Describe what students should know and be able to do for that cluster heading, domain, and grade level.**

Structure: K–8 Mathematics Content Standards

[] Introduction

 Domain

_____ Cluster heading

 Content standard

Mathematical Content Standards

K-8 Domains

Kindergarten–Grade 2

Counting & Cardinality (K only)
Operations & Alg. Thinking
Number & Operations in Base 10
Measurement & Data
Geometry

Grades 3–5

Operations & Alg. Thinking
Number & Operations in Base 10
Number & Operations–Fractions
Measurement & Data
Geometry

Grades 6–7

Ratios & Proportional Relationships
Number System
Expressions & Equations
Geometry
Statistics & Probability

Grade 8

Number System
Expressions & Equations
Functions
Geometry
Statistics & Probability

Structure: Mathematics Content Standards

Components

K-8	High School
	<p>Conceptual Category</p> <ul style="list-style-type: none"> Provides a coherent view of high school mathematics.
<p>Introduction</p> <ul style="list-style-type: none"> Provides important contextual information and calls out and describes critical areas of focus. 	<p>Introduction</p> <ul style="list-style-type: none"> Provides important contextual information.
<p>Domain</p> <ul style="list-style-type: none"> Large groups of related standards; connects topics and content between and among grade levels. 	<p>Domain</p> <ul style="list-style-type: none"> Large groups of related standards; connects topics and content between and among conceptual categories.
<p>Cluster/Cluster Heading</p> <ul style="list-style-type: none"> Smaller sets of related standards within the domain; identifies the primary idea. 	<p>Cluster/Cluster Heading</p> <ul style="list-style-type: none"> Smaller sets of related standards within the domain; identifies the primary idea.
<p>Standards</p> <ul style="list-style-type: none"> Describe what students should know and be able to do for that cluster heading, domain, and grade level. 	<p>Standards</p> <ul style="list-style-type: none"> Describe what students should know and be able to do for that cluster heading, domain, and conceptual category.

Structure

Standards for Mathematical Content (High School)

Conceptual Category

- Provides a coherent view of high school mathematics.

Introduction

- Provides important contextual information.

Domain

- Chunks a large group of related standards; connects topics and content between and among conceptual categories.

Clusters/Cluster Heading

- Smaller sets of related standards within the domain; identifies the primary idea.

Standards

- Describe what students should know and be able to do for that cluster heading, domain, and conceptual category.

Structure: High School Mathematics Content Standards



Conceptual category



Introduction



Domain



Cluster heading



Content standard

Mathematical Content Standards

High school conceptual categories and domains

Number and Quantity

The Real Number System
Quantities
The Complex Number System
Vector and Matrix Quantities

Functions

Interpreting Functions
Building Functions
Linear, Quadratic, and Exponential Models
Trigonometric Functions

Algebra

Seeing Structure in Expressions
Arithmetic with Polynomials and Rational Expressions
Creating Equations
Reasoning with Equations and Inequalities

Modeling

Mathematical Content Standards

(continued)

High school conceptual categories and domains

Geometry

Congruence
Similarity, Right Triangles, and Trigonometry
Circles
Expressing Geometric Properties with Equations
Geometric Measurement and Dimension
Modeling with Geometry

Statistics and Probability

Interpreting Categorical and Quantitative Data
Making Inferences and Justifying Conclusions
Conditional Probability and the Rules of Probability
Using Probability to Make Decisions

Structure

- What?** *What did you learn as a result of the structure activity?*
- So what?** *What is important about what you have learned?*
- Now what?** *What actions will you take as a result of your learning?*

Mathematics Appendix

appendix a:

Designing high school mathematics courses based on the common core state standards

Outlines four model course pathways

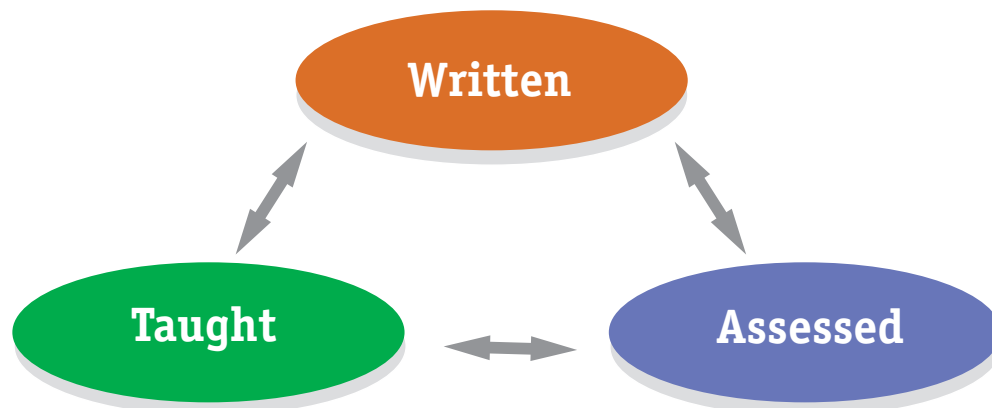
- **Traditional**
- **Integrated**
- **Compacted of Traditional**
- **Compacted of Integrated**

Alignment Is More Than . . .

- A chart
- A textbook correlation
- A scope and sequence
- A curriculum guide
- A testing plan

These things imply alignment, but they do not give us alignment.

A Basic Alignment Principle



Adapted from the work of Fenwick English

Alignment Means *Every* Educator . . .

- **Understands what is expected of students.**
- **Understands these expectations within the context of the K-12 program.**
- **Accepts responsibility for these expectations.**

Understanding Alignment

An investigation activity

- **It is not about developing content knowledge. It is about learning a process to understand alignment and its implications for teaching and learning.**
- **It is not about demonstrating our content knowledge. It is about engaging in a collaborative process and constructing meaning using that process.**
- **It is not about specific grade-level content. It is about developing a K–12 perspective on alignment.**
- **It is not about “the product”. It is about collegial conversations focused on the standards.**

Understanding Alignment

Investigating learning trajectories

Big Idea: _____

Understanding Alignment

Directions for investigating learning trajectories

As a table group . . .

1. Determine what your big idea means.
2. Read, discuss, and come to consensus on what the standards say students need to know and be able to do. Consider all parts of the standards.
3. Analyze how the demands of the standard change between grade levels. Consider changes in content and processes.
4. Document your findings.

Understanding Alignment

Investigating learning trajectories

Represent and interpret data	2D and 3D geometry	Addition and subtraction
K.MD.3	K.G.2; K.G.3	K.OA.1; K.OA.2; K.OA.5
1.MD.4	1.G.1; 1.G.2	1.OA.6; 1.NBT.4; 1.NBT.5; 1.NBT.6
2.MD.9; 2.MD.10	2.G.1	2.OA.2; 2.NBT.5; 2.NBT.6; 2.NBT.7
3.MD.3; 3.MD.4	3.G.1	3.NBT.2
4.MD.4	4.G.1	4.NBT.4; 4.NF.3c
5.MD.2	5.G.3; 5.G.4	5.NBT.7; 5.NF.1
6.SP.4	6.G.4	6.NF.3
7.SP.8b	7.G.3	7.NS.1d
8.SP.1; 8.SP.3; 8.SP.4	8.G.4	Grade 8—none
S-ID.1 through 9	G-MD.4	N-CN.2; N-VM.4a–c; N-VM.8; A-APR.1; A-APR.7

Understanding Alignment

Investigating learning trajectories

(continued)

<u>Area and perimeter</u>	<u>Place value</u>
2.G.2	K.NBT.1
3.MD.5a-b; 3.MD.6; 3.MD.7a,b,d;	1.NBT.2a; 1.NBT.2b; 1.NBT.2c; 1.NBT.3
3MD.8	2.NBT.1a; 2.NBT.1b
4.MD.3	3.NBT.1
Grade 5—none	4.NBT.2; 4.NBT.3
6.G.1	5.NBT.1; 5.NBT.4
7.G.1; 7.G.4	Grade 6—none
Grade 8—none	Grade 7—none
G-GPE.7; G-MG.2	Grade 8—none

Understanding Alignment: Reflection

1. How can the learning from this investigation affect the classroom teacher?
2. How can the learning from this investigation affect the conversations at the grade or department level?
3. How can the learning from this investigation affect the conversations at the school and district level?
4. How can the learning from this investigation guide our work toward our goals?
5. How might you use this investigation activity back on your campus and in your schools?

Three Levels of Instruction with Supporting Activities

Step 1: Provide Developmental Activities

- Emphasize problem solving.
- Use interesting problems to frame and motivate exploration.
- Use problem situations that relate to the lives of your students.
- Guide student thinking using questions.
- Do not answer your own questions. Give students time to answer.
- Use models that can be manipulated and studied.
- Emphasize concrete objects and pictures before introducing symbols.
- Work along with students, observing their progress carefully.
- Concentrate on preventing misconceptions instead of correcting them.
- Give corrective feedback as quickly as possible.
- Use observation and oral questions to evaluate, rather than just pencil and paper tasks.

Step 2: Provide Reinforcement Activities

- Create stimulating explorations that build upon previous developmental lessons where students worked together.
- Expand upon the activities that you started in the developmental lessons.

- Use materials in a variety of ways to connect concrete models, pictures, and symbolic representations.
- Emphasize problem solving.
- Organize small cooperative groups where students can share ideas and help each other.
- Let students in small groups take responsibility for making presentations, explaining processes, and creating problems.
- Let students work together but also provide opportunities to work alone.
- Prepare problem solving bulletin boards and learning centers.

Step 3: Provide Drill and Practice Activities

- Create stimulating games where students work together.
- Change the directions for worksheets to create interesting puzzles and explorations.
- Emphasize problem solving.
- Use problem situations to motivate practice.
- Give short sets of exercises and evaluate student progress.
- Do not give long and tedious assignments in which students might practice their own misconceptions.
- Never introduce drill before proper concept development and reinforcement of concepts have taken place.

Gagné, R.M. and Briggs L.J. (1997) *Principles of instructional design* (2nd edition). New York: Holt, Rinehart, and Winston.

Instructional Alignment Chart

Big Idea: _____

Standard(s) for Grade/Course:	Standard(s) for Grade/Course:	Standard(s) for Grade/Course:
<i>Changes</i>		<i>Changes</i>
<i>Levels of instruction</i>		
<i>Implications for instruction and assessment</i>		

Instructional Alignment Chart

Big Idea: _____ Represent and interpret data

<i>Standard(s) for Grade/Course: Grade 3</i>	<i>Standard(s) for Grade/Course: Grade 4</i>	<i>Standard(s) for Grade/Course: Grade 5</i>
<p>3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs.</p> <p>3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters</p>	<p>4.MD.4 Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Solve problems involving addition and subtraction of fractions by using information presented in line plots.</p>	<p>5.MD.2 Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots.</p>

<i>Changes</i>	<i>Changes</i>

<i>Levels of instruction</i>

<i>Implications for instruction and assessment</i>

Understanding and Using the Instructional Alignment Chart

The Instructional Alignment Chart provides a structure for professional collaborative conversations about the Common Core State Standards and how they inform teacher decision-making. The four steps outlined below correspond to the four sections of the Instructional Alignment Chart. This collaborative conversation—and the accompanying tool to capture important findings from the conversation—can help guide and focus teams of teachers and instructional leaders as they study the standards.

Step 1: Standards for grade / course

Purpose

- To develop a common understanding of what the written grade level/course standard(s) require students to know and be able to do.

Process

- Individually, read and analyze the grade/course level standard to determine what is required of students in terms of content and processes.
- As a group, discuss and come to consensus on what the grade/course level standard(s) require student to know and be able to do.

Step 2: Changes

Purpose

- To develop a common understanding of how the standards from adjacent grades influence our understanding of the content and processes of the grade/course level standards.

Process

- Individually, analyze the standards for the adjacent grade levels to determine the similarities and differences. Describe and document the changes between the target grade level and the grade before; the target grade level and the grade after in terms of content and processes.
- As a group, discuss and come to consensus on what the grade/course level standard(s) require students to know and be able to do.

Step 3: Levels of Instruction

Purpose

- To identify the intended level of instruction.

Process

- Individually, analyze the changes documented above to determine the appropriate level(s) of instruction (developmental, reinforcement, and/or drill and practice).
- As a group, discuss and come to consensus about the appropriate levels of instruction. Document your findings.

Step 4: Implications for instruction and assessment

Purpose

- Generate instructional and assessment approaches that are aligned to the content and processes called for in the standards. In ELA, consider all 4 strands. In mathematics, consider both the Standards for Mathematical Practice and Standards for Mathematical Content.

Process

- As a group discuss what was learned about the standards through the analysis above. Collaboratively generate instructional and assessment approaches that will ensure that students acquire the learning as called for in the standards.

Instructional Alignment Chart

Big Idea: _____

Standard(s) for Grade/Course:	Standard(s) for Grade/Course:	Standard(s) for Grade/Course:
<i>Changes</i>		<i>Changes</i>
<i>Levels of instruction</i>		
<i>Implications for instruction and assessment</i>		

Reflection

1. **What is the purpose of the Instructional Alignment Chart?**
2. **Why spend time with your colleagues using the Instructional Alignment Chart?**
3. **What's the difference between the "building the learning trajectories" and the Instructional Alignment Chart? When would you use each?**

A Study of the Standards: Goal and Expectations

Participants will gain a common understanding of the Common Core State Standards and develop a strong working knowledge of the standards' effects on teaching and learning.

Session participants will learn . . .

- **how to use a set of structured tools to promote conversations and collaboration around the Common Core State Standards.**
- **how to use the Common Core State Standards to guide decision making about teaching, learning, and assessment.**

Instructional Alignment Chart

Big Idea: _____ Represent and interpret data

<i>Standard(s) for Grade/Course: Grade 3</i>	<i>Standard(s) for Grade/Course: Grade 4</i>	<i>Standard(s) for Grade/Course: Grade 5</i>
<p>3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs.</p> <p>3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters</p>	<p>4.MD.4 Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Solve problems involving addition and subtraction of fractions by using information presented in line plots.</p>	<p>5.MD.2 Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots.</p>
Changes		
<ul style="list-style-type: none"> • Added eighths when making, gathering, and displaying line plot data • Scaled picture and bar graphs disappear • Moved from generating measurement data to solving problems using information from the line plot. • Added solving problems using line plots involving adding and subtracting fractions 	<ul style="list-style-type: none"> • Added multiplication and division of fractions when solving problems using line plots 	
Levels of instruction		
<ul style="list-style-type: none"> • Concept of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ should be taught at the reinforcement level since it first appeared in grade 3 • Line plots should be instructed at the drill/practice level • Solving of problems involving adding/subtracting fractions should begin at developmental and moves to reinforcement 		
Implications for instruction and assessment		
<ul style="list-style-type: none"> • Use what students know about number lines when creating the line plot for the measurement data • Use number lines to help students subdivide for halves and fourths to get to eighths. • Consider the learnings students are engaged in the Domain of Number and Operations—Fractions when planning. • Identify the Standards for Mathematical Practice that will be used to approach the content. 		