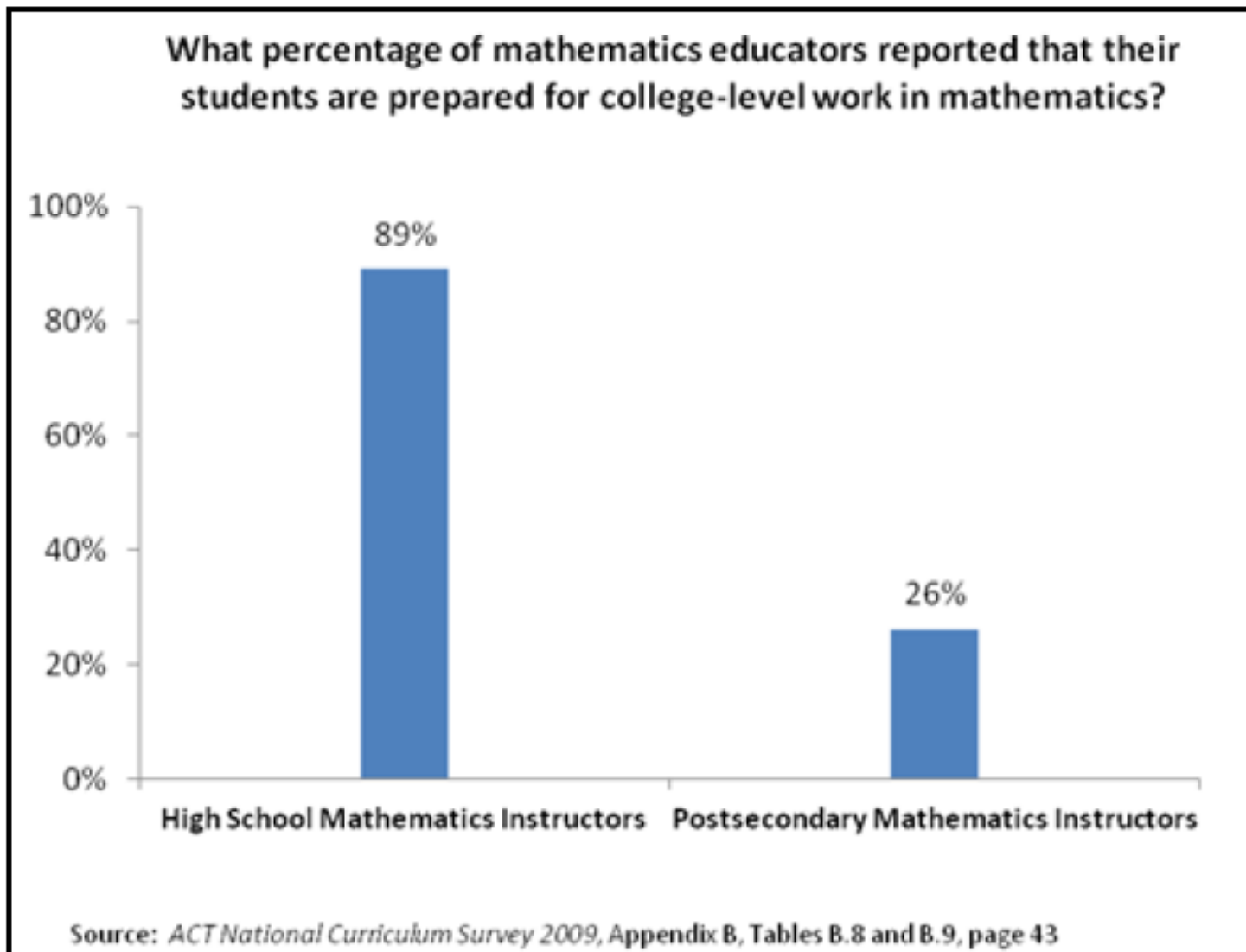# Introduction to the Math Shifts of the Common Core State Standards

College Math Professors Feel HS students Today are Not Prepared for College Math

What The Disconnect Means for Students

- Nationwide, many students in two-year and four-year colleges need remediation in math.

- Remedial classes lower the odds of finishing the degree or program.

- We need to set the agenda in high school math to prepare more students for postsecondary education and training.

The CCSS Requires Three Shifts in Mathematics

1. **Focus:** Focus strongly where the Standards focus.

2. **Coherence**: *Think* across grades and *link* to major topics within grades.

3. **Rigor:** In major topics, pursue *conceptual* **understanding,** procedural skill and *fluency*, and *application.*

The Mathematics Standards and the Shifts They Require

Jason Zimba, Ph.D.
Math Team Coordinator
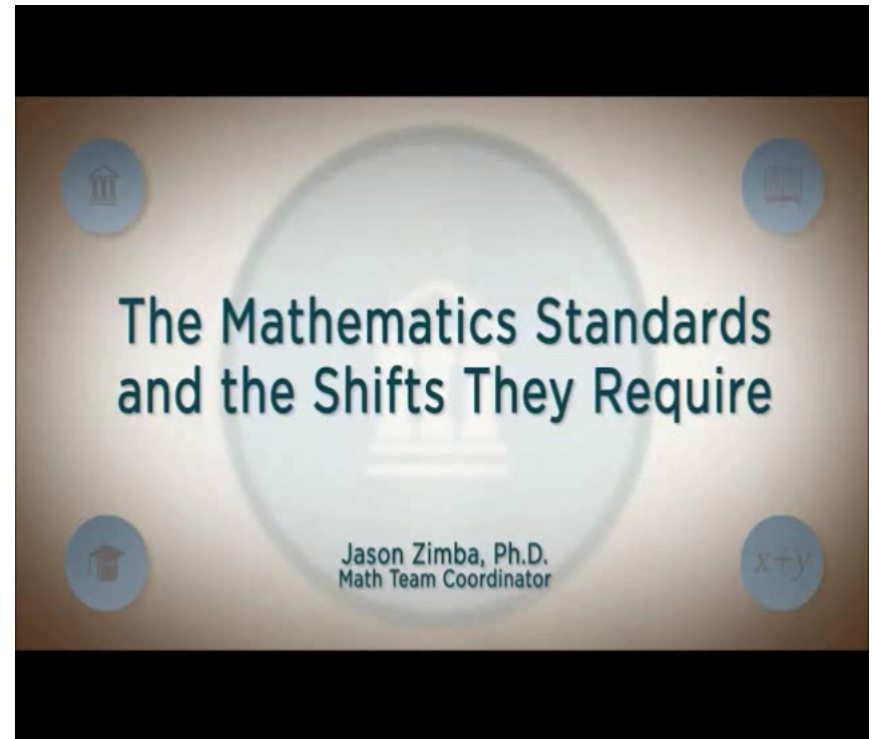
Shift #1: Focus Strongly Where the Standards Focus

- Significantly narrow the scope of content and deepen how time and energy is spent in the math classroom.

- Focus deeply on what is emphasized in the standards, so that students gain strong foundations.
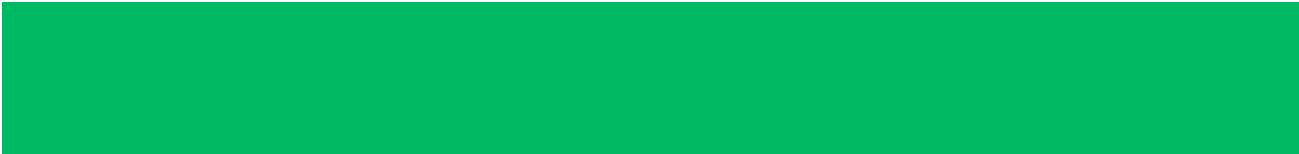
Focus

- Move away from **"mile wide, inch deep"** curricula identified in TIMSS.

- Learn from international comparisons.

- Teach less, learn more.

"Less topic coverage can be associated with higher scores on those topics covered because students have more time to master the content that is taught."

– Ginsburg et al., 2005

Traditional U.S. Approach

K   12

Number and Operations

Measurement and Geometry

Algebra and Functions

Statistics and Probability

Focusing Attention Within Number and Operations

Operations and Algebraic Thinking	→	Expressions and Equations	→	
Number and Operations—Base Ten	→			Algebra
Number and Operations—Fractions	→	The Number System	→	
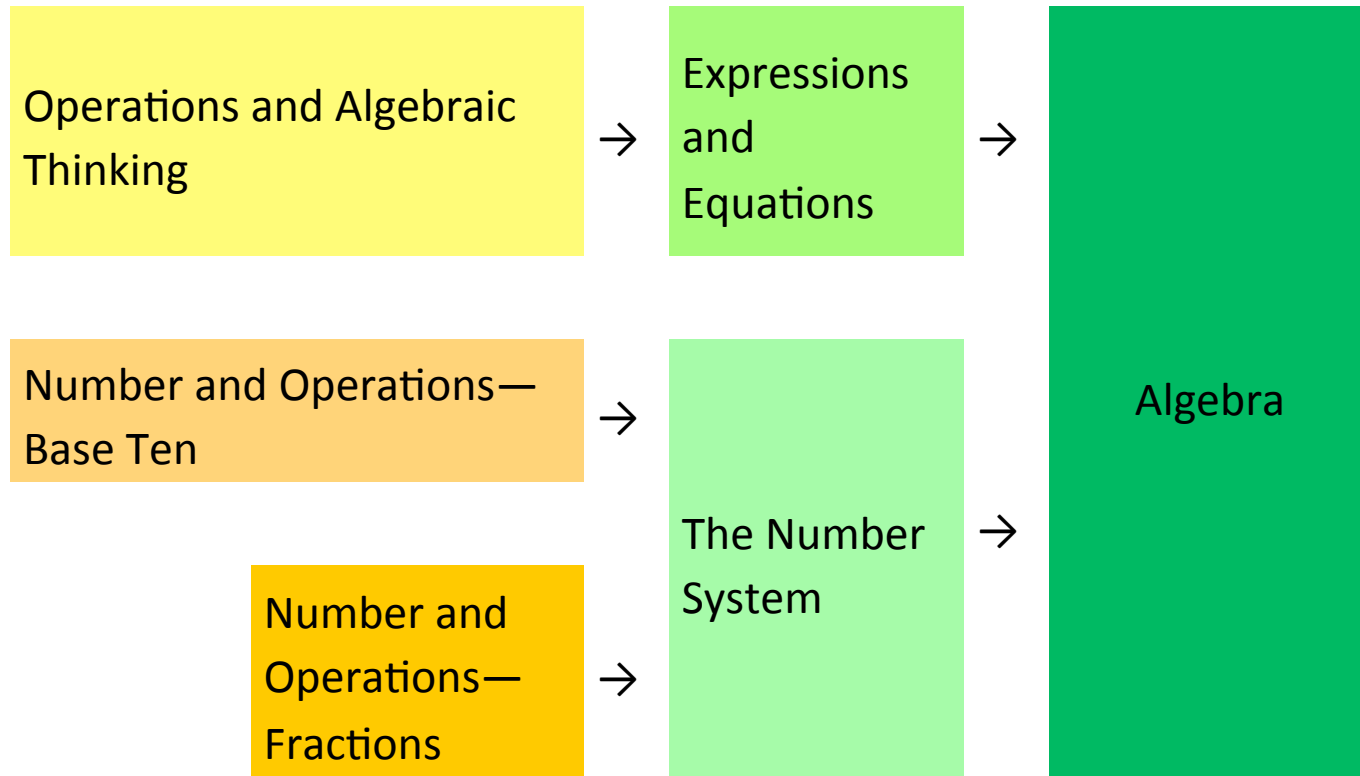
K   1   2   3   4   5   6   7   8   High School

Key Areas of Focus in Mathematics

Grade	Focus Areas in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding
K–2	Addition and subtraction - concepts, skills, and problem solving and place value
3–5	Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving
6	Ratios and proportional reasoning; early expressions and equations
7	Ratios and proportional reasoning; arithmetic of rational numbers
8	Linear algebra and linear functions

Shift #2: Coherence: Think Across Grades, and Link to Major Topics Within Grades

- Carefully connect the learning within and across grades so that students can build new understanding on foundations built in previous years.

- Begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event, but an extension of previous learning.

Coherence: *Think* Across Grades

Example: Fractions

"The **coherence** and sequential nature of mathematics dictate the foundational skills that are necessary for the learning of algebra. The most important foundational skill not presently developed appears to be proficiency with fractions (including decimals, percents, and negative fractions). **The teaching of fractions must be acknowledged as critically important and improved before an increase in student achievement in algebra can be expected**."

Final Report of the National Mathematics Advisory Panel (2008, p. 18)

Coherence: *Link* to Major Topics Within Grades

Example: Data Representation

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. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.*

Standard 3.MD.3

Shift #3: Rigor: In Major Topics, Pursue Conceptual Understanding, Procedural Skill and Fluency, and Application

- The CCSSM require a balance of:
    - Solid conceptual understanding
    - Procedural skill and fluency
    - Application of skills in problem solving situations

- Pursuit of all three requires equal intensity in time, activities, and resources.

Solid Conceptual Understanding

- Teach more than "how to get the answer" and instead support students' ability to access concepts from a number of perspectives

- Students are able to see math as more than a set of mnemonics or discrete procedures

- Conceptual understanding supports the other aspects of rigor (fluency and application)

Answer getting vs. learning mathematics

- USA:

How can I teach my kids to get the answer to this problem?

Use mathematics they already know. Easy, reliable, works with bottom half, good for classroom management.

- Japanese:

How can I use this problem to teach the mathematics of this unit?

Required Fluencies in K-6

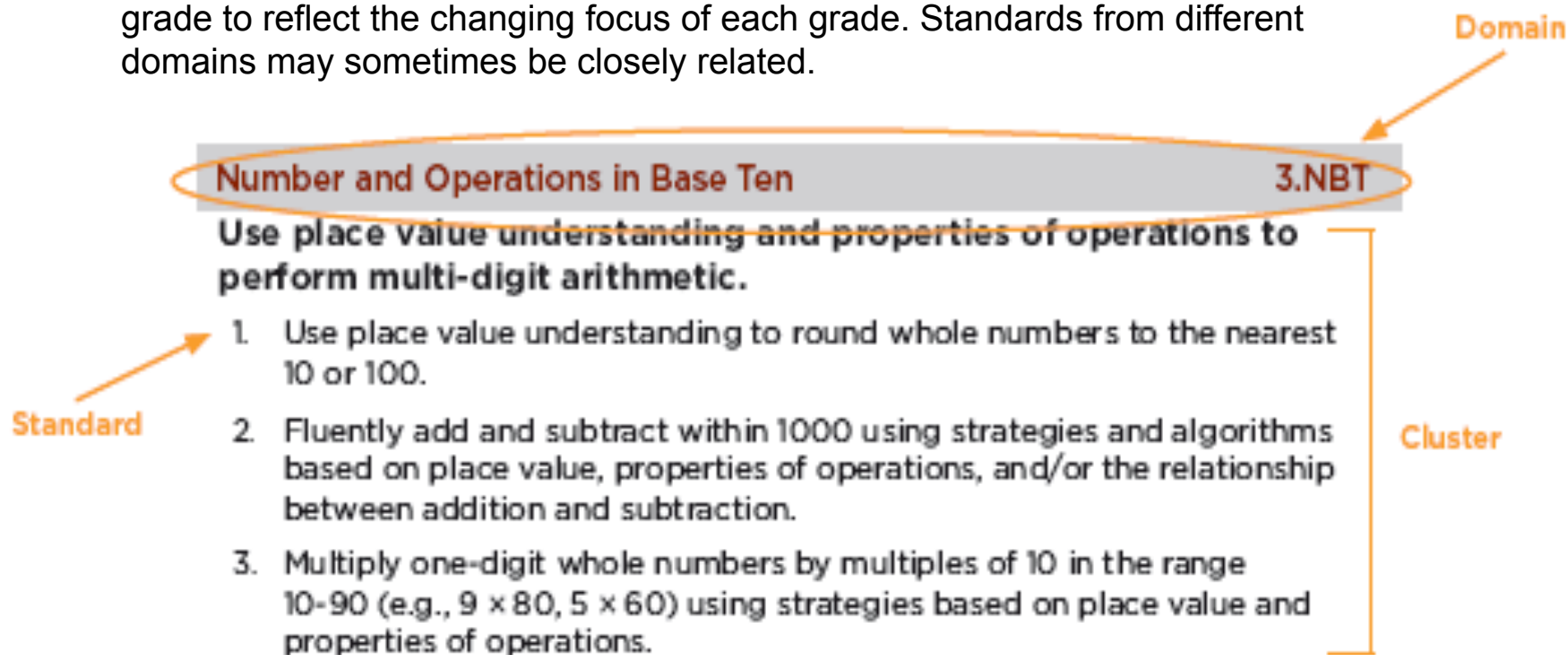| Grade	Standard	Required Fluency
K	K.OA.5	Add/subtract within 5
1	1.OA.6	Add/subtract within 10
2	2.OA.2 2.NBT.5	Add/subtract within 20 (know single-digit sums from memory) Add/subtract within 100
3	3.OA.7 3.NBT.2	Multiply/divide within 100 (know single-digit products from memory) Add/subtract within 1000
4	4.NBT.4	Add/subtract within 1,000,000
5	5.NBT.5	Multi-digit multiplication
6	6.NS.2,3	Multi-digit division Multi-digit decimal operations

Application

- Students can use appropriate concepts and procedures for application even when not prompted to do so.

- Teachers provide opportunities at all grade levels for students to apply math concepts in "real world" situations, recognizing this means different things in K-5, 6-8, and HS.

Identify the Standard

Standards define what students should understand and be able to do.

Clusters are groups of related standards. Each domain has 1 – 4 clusters. Standards from different clusters may sometimes be closely related.

Domains are large groups of related standards. Domains change from grade to grade to reflect the changing focus of each grade. Standards from different domains may sometimes be closely related.

Domain →

Number and Operations in Base Ten   **3.NBT**

Use place value understanding and properties of operations to perform multi-digit arithmetic.

Standard →

1. Use place value understanding to round whole numbers to the nearest 10 or 100.

2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

3. Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.

← Cluster

Identify the Standard

5.NBT.4

↑ Grade   ↑ Domain   ↑ Standard Number

3.OA.C

↑ Grade   ↑ Domain   ↑ Cluster

Resources

www.achievethecore.org

www.illustrativemathematics.org

http://pta.org/parents/content.cfm?ItemNumber=2583&RDtoken=51120&userID

commoncoretools.me

www.corestandards.org

http://parcconline.org/parcc-content-frameworks

http://www.smarterbalanced.org/k-12-education/common-core-state-standards-tools-resources/