Common Core State Standards for Mathematics: *The Key Shifts (Focus)*

Professional Development Module

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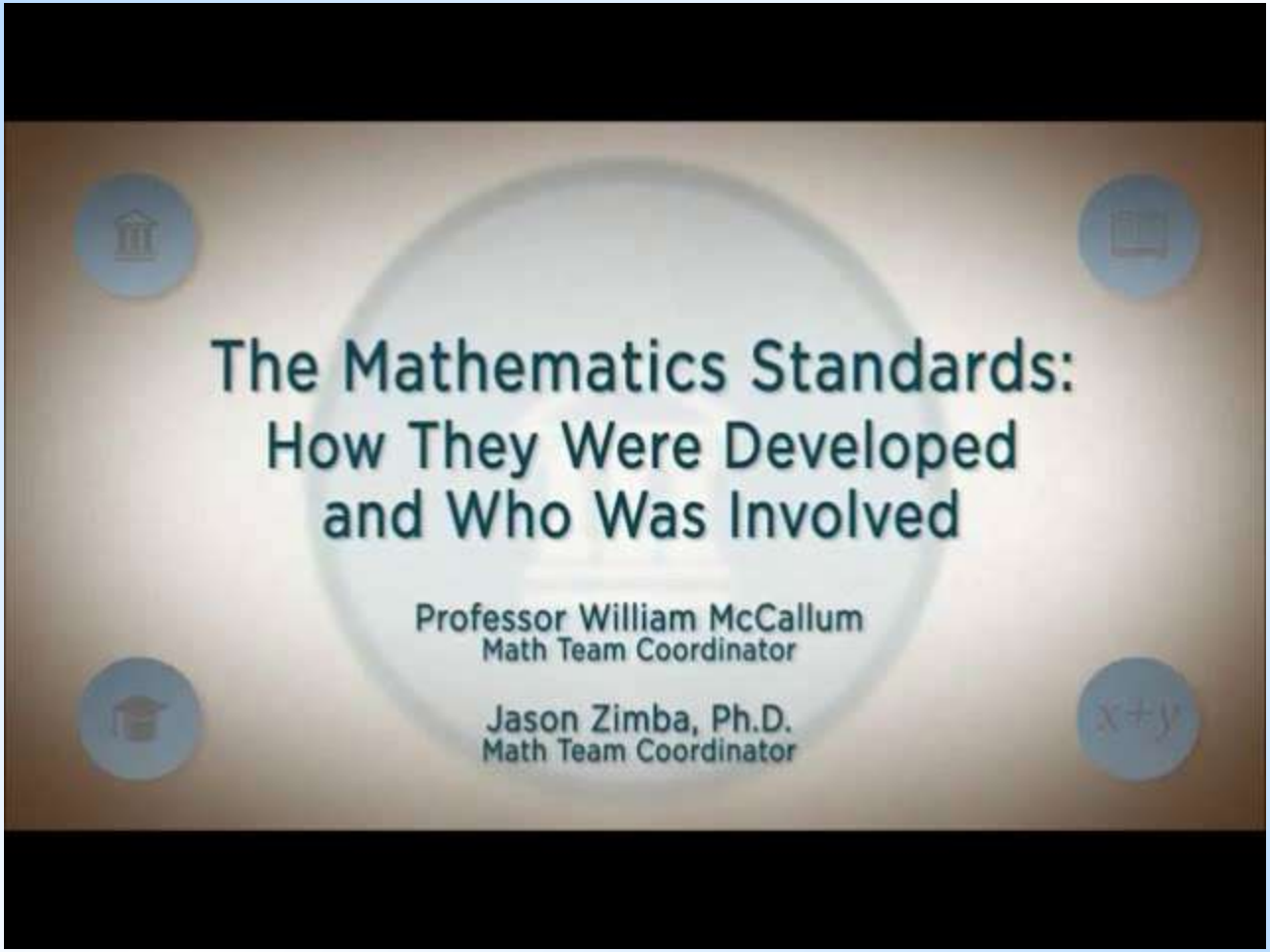

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The Background of the Common Core

Initiated by the National Governors Association (NGA) and Council of Chief State School Officers (CCSSO) with the following design principles:

- Result in College and Career Readiness
- Based on solid research and practice evidence
- Fewer, higher and clearer

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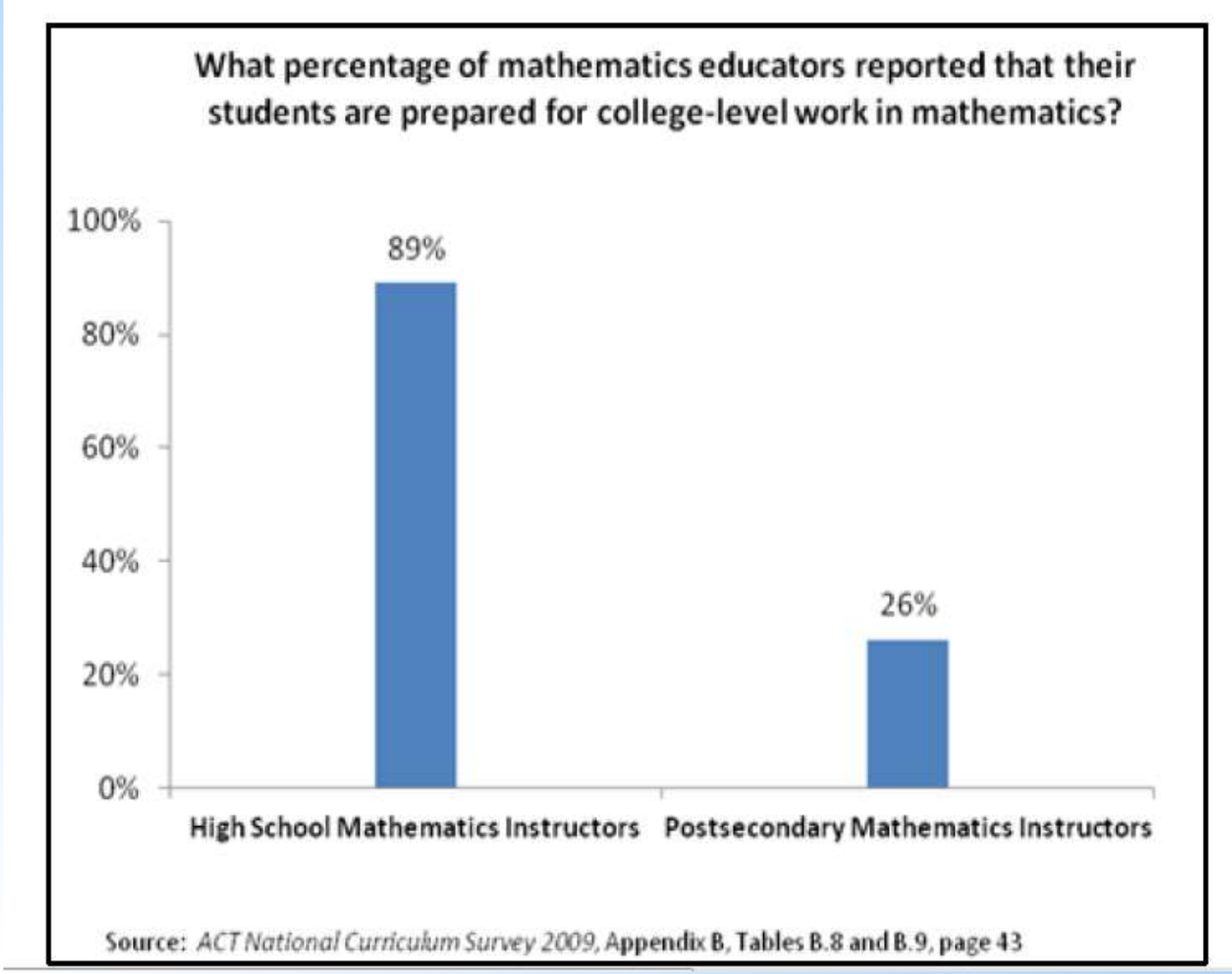
College Math Professors Feel HS students Today are Not Prepared for College Math



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

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

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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.

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Focus

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

➓ Learn from international comparisons.

➓ 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

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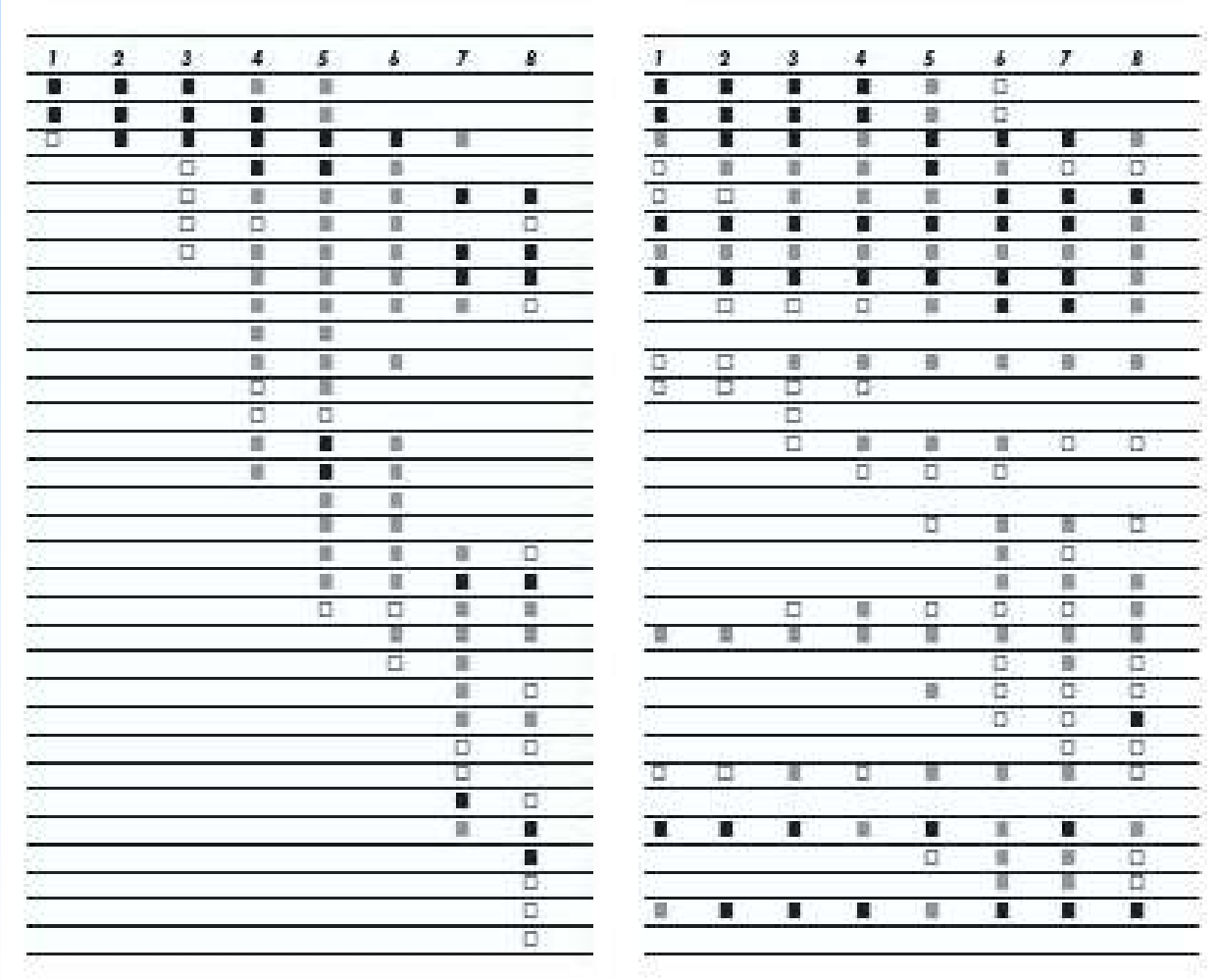
The shape of math in A+ countries

Mathematics topics intended at each grade by at least two-thirds of A+ countries



Mathematics topics intended at each grade by at least two-thirds of 21 U.S. states

[1] *Schmidt, Houang, & Cogan, "A Coherent Curriculum: The Case of Mathematics." (2002).*

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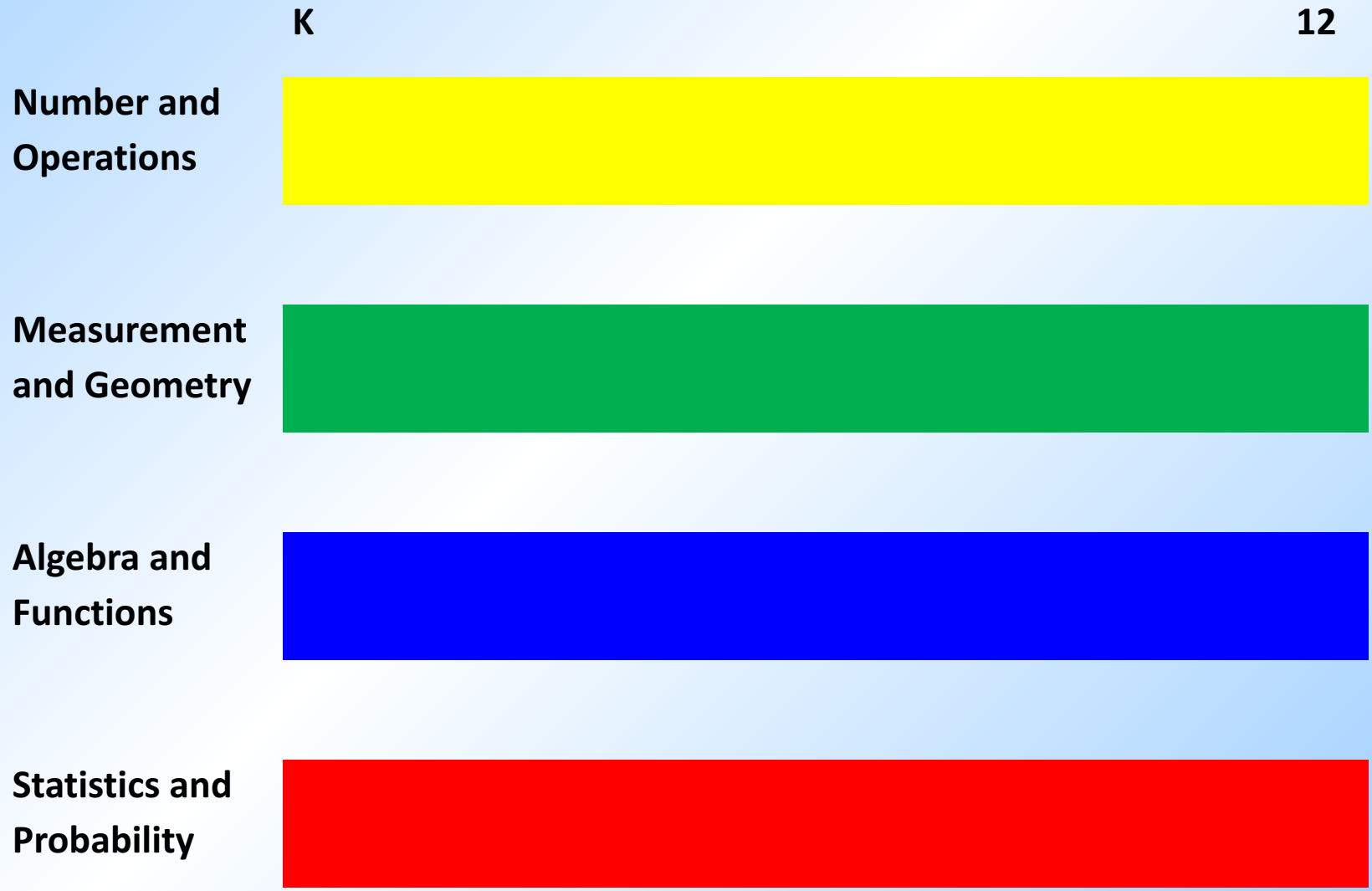
Traditional U.S. Approach



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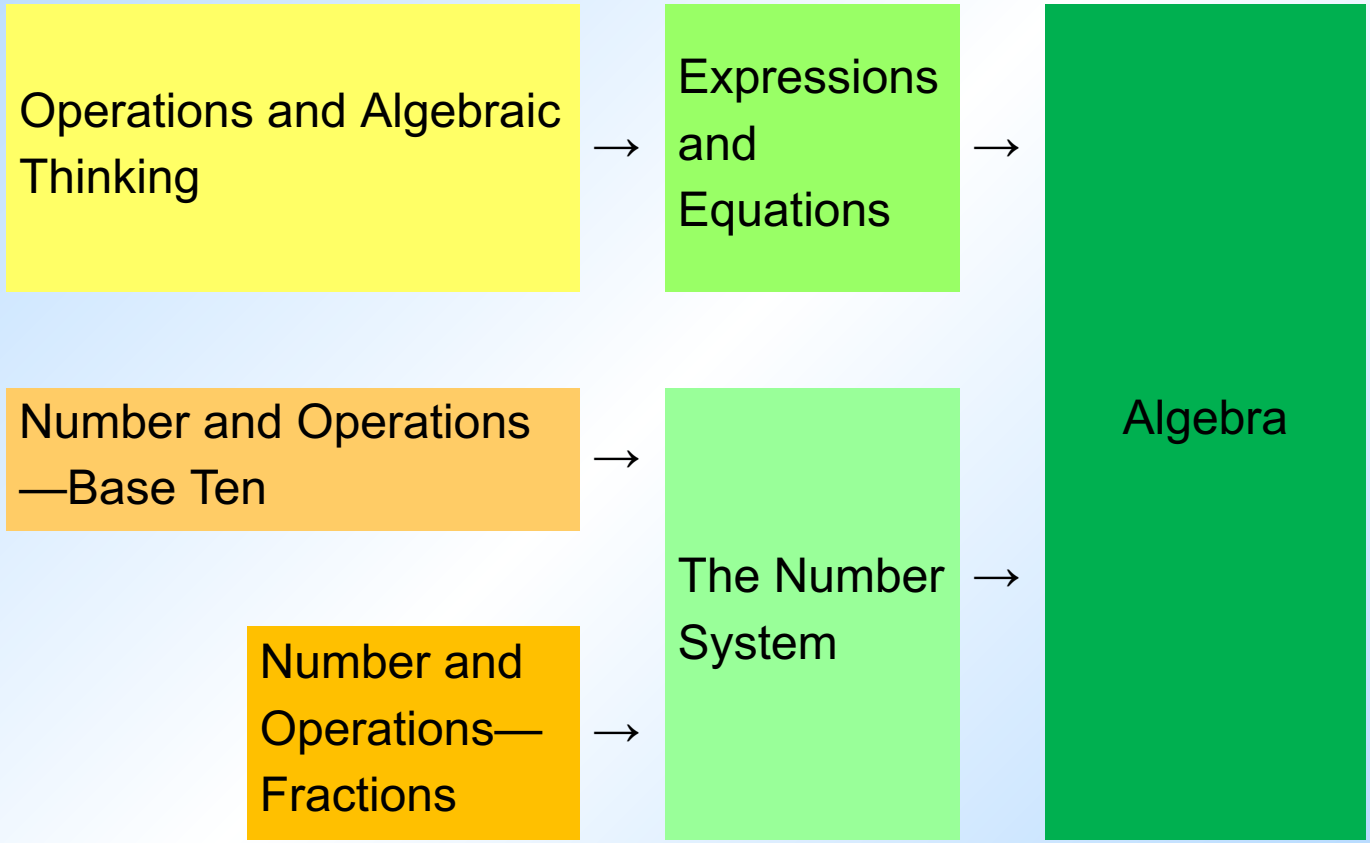
Focusing Attention Within Number and Operations



K 1 2 3 4 5 6 7 8 High School

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Engaging with the shift: What do you think belongs in the major work of each concept or grade level?

Grade	Which two of the following represent areas of major focus for the indicated grade?		
6	Understand ratio concepts and use ratio reasoning to solve problems	Identify and utilize rules of divisibility	Apply and extend previous understandings of arithmetic to algebraic expressions
7	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers	Use properties of operations to generate equivalent expressions	Generate the prime factorization of numbers to solve problems
8	Standard form of a linear equation	Define, evaluate, and compare functions	Understand and apply the Pythagorean Theorem
Alg.1	Quadratic inequalities	Linear and quadratic functions	Creating equations to model situations
Geom.	Understand the congruence in terms of rigid motions	Apply geometric concepts in modeling situations	Solve systems of equations
Alg.2	Exponential and logarithmic functions	Polar coordinates	Using functions to model situations

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High School Standards

- High School Standards Conceptual Categories
  - Number and Quantity
  - Algebra
  - Functions
  - Modeling
  - Geometry
  - Statistics and Probability
- Find the conceptual category - Algebra.
  - (*) – Notice the * by Interpret expressions that represent a quantity in terms of its context
- Find the conceptual category – Geometry
  - (+) – Notice the (+) by Derive the formula A=1/2 ab sin (C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

Mathematical Practices

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

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Appendix A

- It takes each of the Common Core Standards and shows in what year or course the standards should be taught, no matter which path your school takes.
- Traditional: Algebra, Geometry, Algebra II, Fourth Course
- Integrated: Math I-IV
- This Appendix A is very helpful in making the shift to a CCS aligned curriculum.

http://www.corestandards.org/assets/CCSSI_Mathematics_Appendix_A.pdf

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Group Discussion

Shift #1: Focus strongly where the Standards focus.

❿ *In your groups, discuss ways to respond to the following question, "Why focus? There's so much math that students could be learning, why limit them to just a few things?"*

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Fluency in High School

Fluency Recommendations

A/G Algebra I students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

A-APR.1 Fluency in adding, subtracting and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions. Manipulation can be more mindful when it is fluent.

A-SSE.1b Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring, completing the square and other mindful algebraic calculations.

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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.
- Teachers in content areas outside of math, particularly science, ensure that students are using grade-level-appropriate math to make meaning of and access science content.

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The Coming CCSS Assessments Will Focus Strongly on the Major Work of Each Grade

SMARTER
Balanced Assessment Consortium

A quality assessment should strive to reinforce focus and coherence at each grade level by testing for proficiency with central and pivotal mathematics rather than covering too many ideas superficially – a key point of the Common Core Standards.

PARCC Releases ITN To Develop Assessments

Submitted by parcc- on Fri, 2011-12-30 19:16
Major milestone met for first test administration in 2014-2015

Design for focus and coherence. Consistent with the design of the CCSSM, the previous iteration of the assessment design adopted by the Leadership Team, and the extended discussion of emphases in the standards in the *PARCC Model Content Frameworks*, the Mathematics Assessment System as a whole and in each component will focus heavily on the major content[102] of each grade.

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Content Emphases by Cluster: Grade Four

Key: ■ Major Clusters; ▣ Supporting Clusters; ○ Additional Clusters

The Real Number System (N-RN)

- ○ Use properties of rational and irrational numbers (3)

Quantities★ (N-Q)

- ▣ Reason quantitatively and use units to solve problems (1, 2, 3)

Seeing Structure in Expressions (A-SSE)

- ■ Interpret the structure of expressions (1, 2)
- ▣ Write expressions in equivalent forms to solve problems (3)

Arithmetic with Polynomials and Rational Expressions (A-APR)

- ■ Perform arithmetic operations on polynomials (1)
- ▣ Understand the relationship between zeros and factors of polynomials (3)

Creating Equations★ (A-CED)

- ■ Create equations that describe numbers or relationships (1, 2, 3, 4)

Reasoning with Equations and Inequalities (A-REI)

- ■ Understand solving equations as a process of reasoning and explain the reasoning (1)
- ■ Solve equations and inequalities in one variable (3, 4)
- ○ Solve systems of equations (5, 6)
- ■ Represent and solve equations and inequalities graphically (10, 11, 12)

Interpreting Functions (F-IF)

- ■ Understand the concept of a function and use function notation (1, 2, 3)
- ■ Interpret functions that arise in applications in terms of the context (4, 5, 6)
- ▣ Analyze functions using different representations (7, 8, 9)

Building Functions (F-BF)

- ▣ Build a function that models a relationship between two quantities (1)
- ○ Build new functions from existing functions (3)

Linear, Quadratic, and Exponential Models★ (F-LE)

- ▣ Construct and compare linear, quadratic, and exponential models and solve problems (1, 2, 3)
- ▣ Interpret expressions for functions in terms of the situation they model (5)

Interpreting categorical and quantitative data (S-ID)

- ○ Summarize, represent, and interpret data on a single count or measurement variable (1, 2, 3, 4)
- ▣ Summarize, represent, and interpret data on two categorical and quantitative variables (5, 6)
- ■ Interpret linear models (7, 8, 9)

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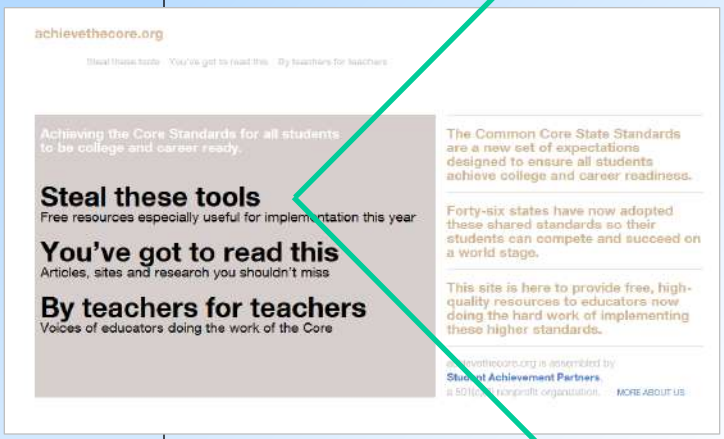

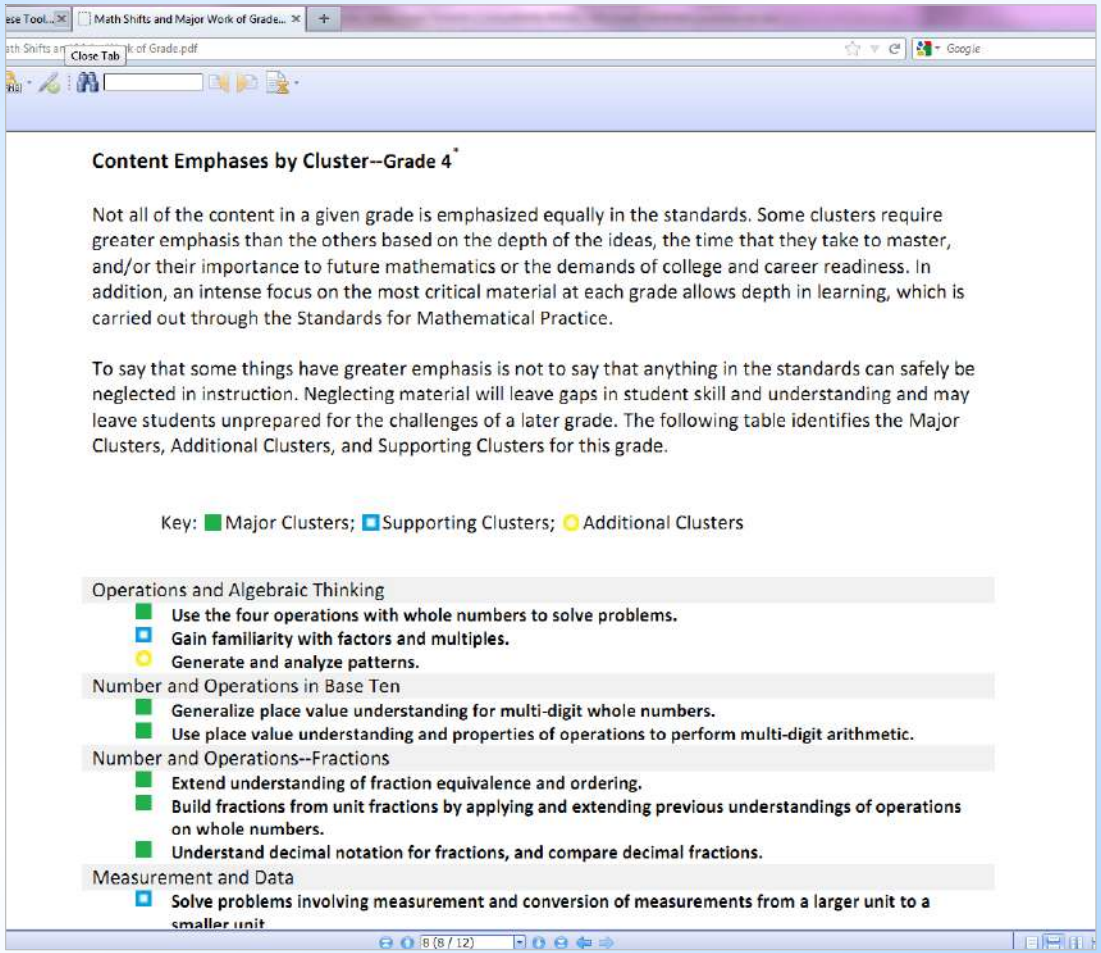

www.achievethecore.org

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Cautions: Implementing the CCSS is...

- Not about “gap analysis”
- Not about buying a text series
- Not a march through the standards
- Not about breaking apart each standard

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Resources

- www.achievethecore.org
- www.illustrativemathematics.org
- www.pta.org/4446.htm
- commoncoretools.me
- www.corestandards.org
- http://parcconline.org/parcc-content-frameworks
- http://www.smarterbalanced.org/k-12-education/common-core-state-standards-tools-resources/

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Teacher Resources

- http://www.doe.k12.de.us/commoncore/
- http://educationnorthwest.org/common-core
- http://www.ccsso.org/Resources.html
- www.corestandards.org
- http://www.centeroninstruction.org/
- www.learningpt.org/greatlakeseast/
- http://www.youtube.com/playlist?list=PLD7F4C7DE7CB3D2E6

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- http://www.illustrativemathematics.org/
- http://math.arizona.edu/~ime/progressions/
- http://www.education.ohio.gov/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1907&ContentID=120301&Content=120301
- http://www.parcconline.org/parcc-content-frameworks
- http://www.p21.org/tools-and-resources/publications/p21-common-core-toolkit

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- https://www.teachingchannel.org/
- http://www.achievethecore.org/
- http://www.pta.org/4446.htm
- http://dww.ed.gov/
- http://balancedassessment.concord.org
- http://www.insidemathematics.org
- http://map.mathshell.org/materials/tasks.php
- http://illuminations.nctm.org
- www.OhioRC.org

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