The Impact of the Common Core Mathematics Standards

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Major Shifts

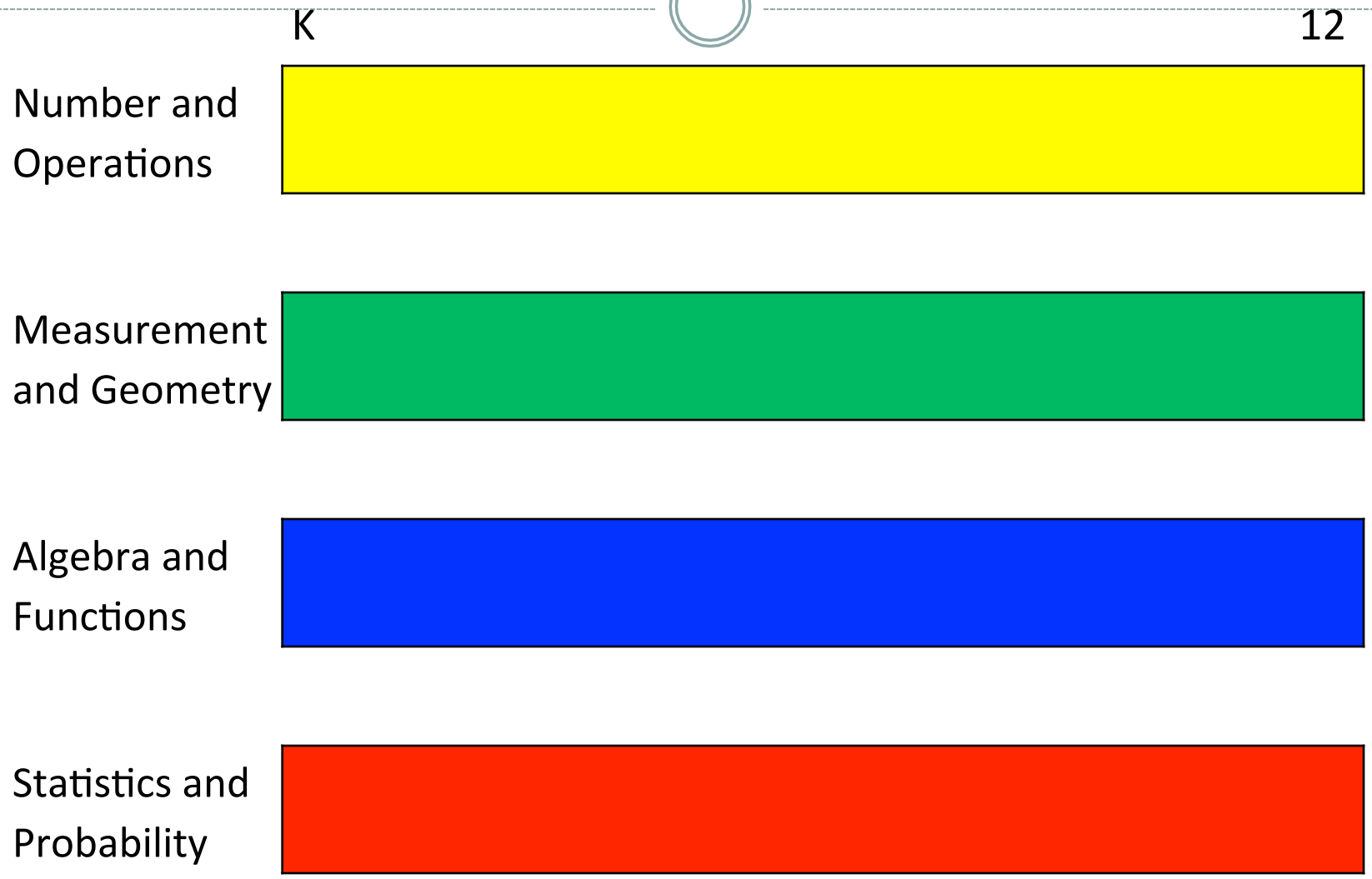
- Focus–narrower and deeper
- Coherence–across grade levels; link topics within a grade
- Rigor–balance among conceptual understanding, procedural fluency, application
- Standards for Mathematical Practice

Focus

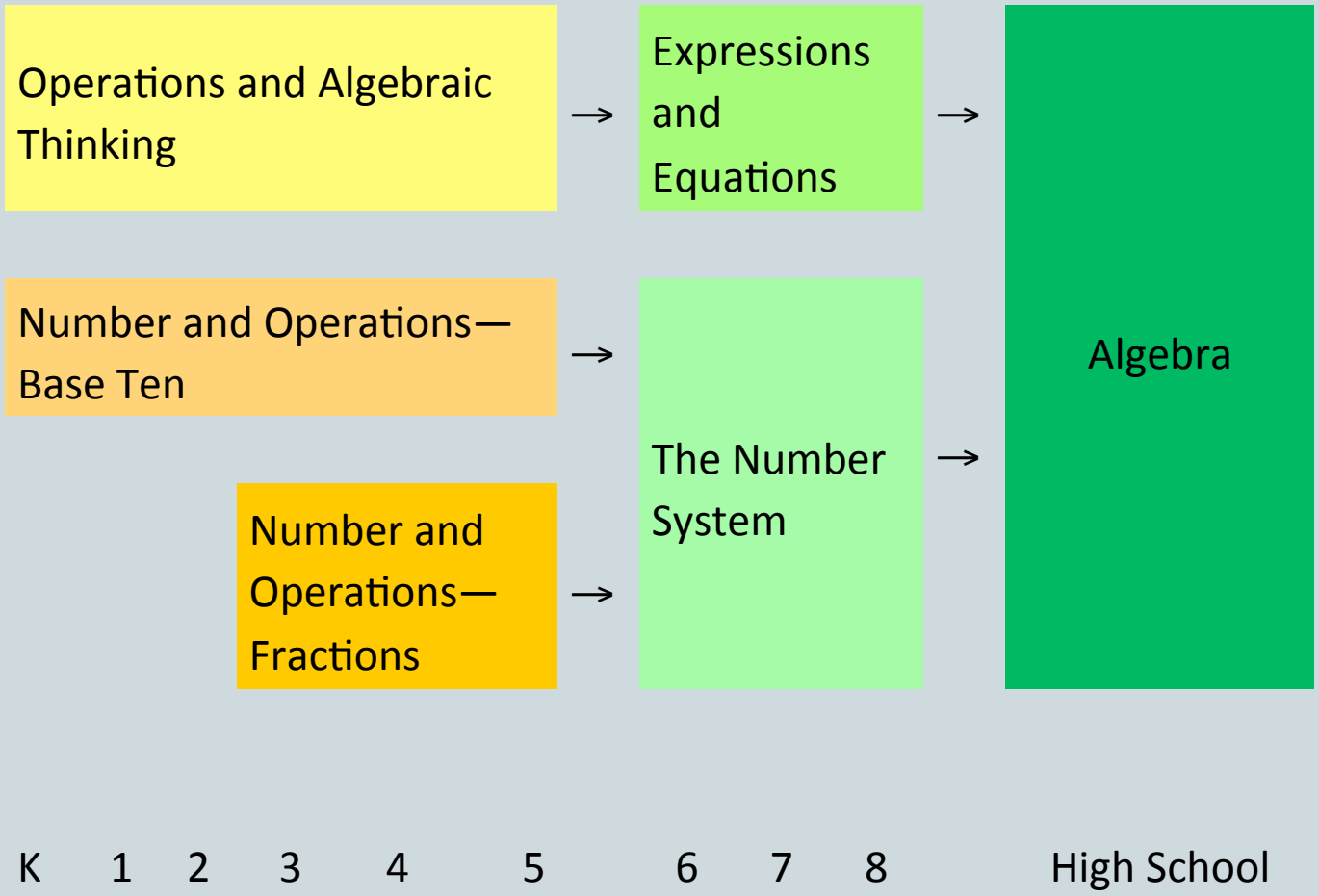
- Significantly narrow the scope of content and deepen how time and energy is spent in the math classroom

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

Traditional U.S. Approach



CCSSM approach–Number &Operations



Content Foci by Grade

Grade	Priorities for Fluency and Conceptual Understanding
K–2	Addition and subtraction, measurement using whole number quantities
3–5	Multiplication and division of whole numbers and fractions
6	Ratios and proportional reasoning; early expressions and equations
7	Ratios and proportional reasoning; arithmetic of rational numbers
8	Algebra–linear equations

High School

- Number & quantity
  - Real number system
  - Complex number system
  - Vector & matrix quantities
- Algebra
  - Seeing structure in expressions
  - Arithmetic with polynomials and rational expressions
  - Reasoning with equations and inequalities

High School, cont'd.

- Functions
  - Interpreting function
  - Building functions
  - Linear, quadratic, trigonometic, and exponential
- Geometry
  - Congruence
  - Similarity, right triangles, trigonometry
  - Expressing geometric properties with equations
  - Geometric measurement and dimension
  - Geometric modeling

High school, cont'd.

- Statistics and probability
  - Interpreting categorical & quantitative data
  - Making inferences & justifying conclusions
  - Conditional probability & the rules of probability
  - Using probability to make decisions
- Modeling

Coherence

- Carefully connect the learning within and across grades so that students can build new understanding onto foundations built in previous years.
- Teachers can begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event for students but an extension of previous learning.

Rigor

- The CCSSM require a balance of:
  - Solid conceptual understanding
  - Procedural skill and fluency
  - Application of skills in problem solving situations
- This requires equal intensity in time, activities, and resources in pursuit of all three

Standards for Mathematical Practice

- 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.

Implications for college content courses

- CCSSM requires that students complete precalculus in high school.
- Need articulation between HS and college
- What is the future of developmental mathematics, college algebra, mathematical modeling, the mathematics of decision-making, and precalculus?
- Will we need more remedial classes or fewer?
- How/when will we know?
- What do our placement tests tell us? How confident are we in them? How do they align with CCSSM?

Alternatives

- What mathematics does a non-STEM major need in college if s/he has completed a rigorous precalculus course in high school?
  - Quantitative literacy
  - Integrated STEM course based on engineering tasks
  - Other options that do not lead to calculus?
- This may not seem like "our" problem, but
  - We have insights to offer.
  - Some teacher education students take these classes, too.
  - High school teachers don't expect their students to have to repeat their courses in college.

Pedagogical implications

- Students should come to us
  - Having engaged regularly in the mathematical practices
  - Used to working in groups
  - Used to explaining their thinking, verbally and in words
  - Proficient in using technology to explore mathematical ideas
- How does our pedagogy build on this?
  - Need/opportunity for professional development for higher ed faculty

Up the ante

- Our preservice teachers should be prepared for rigorous courses in college
- How does this affect courses for teachers?

Implications for Teacher Education

- Content courses for teachers
  - Need to ensure teachers are proficient with content of CCSSM…probably 2-3 grades beyond what they will teach
  - Teachers need to see the mathematical horizon of topics
  - Quantitative literacy/statistics, especially in middle school
  - Content courses for secondary teachers; middle grades content for secondary teachers
  - Teachers need to engage in the mathematical practices

Implications for Teacher Education

- Pedagogy
  - Representations
  - Methods
  - Student learning progressions
  - Curriculum progressions
  - Standards for mathematical practice

Inservice Teacher Education

- There is and will continue to be a tremendous need for inservice teacher education/professional development
- Does not have to be graduate programs
- Collaboration among Arts & Sciences and Education with school partners is crucial.

Bottom Line

- Those of us in higher ed cannot continue to use the same tasks and activities we have always used.
- We need to dig into the Common Core and align our work with it.

Challenges

- Curriculum materials are lagging implementation
- Assessment is lagging implementation
- Assessment is a scary unknown