Alignment to the New Mathematics Standards

March 7, 2013

Three Shifts in Emphasis

- Standards for Mathematical Practice
- From Breadth to Depth
- Developmental Progression

Standards for Mathematical Practice

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.

Standards for Mathematical Practice

- Eight Standards for Practice
- Describe the way in which students should engage with mathematical ideas
- Not new ideas, but Standards made more explicit than in the past

What is the meaning of “add a zero”?

- 23 x 1
- 23 x 10
- 23 x 100
- 23 x 1000
- 23 x 10,000

Thoughts from a 4th grade classroom

In learning about the multiplication of double and triple digit numbers, we began with building onto basic facts. For example, 2X3=6 so 2X30=60. Somebody said, "Yeah, you just add 0!" The room became silent. "Wait a minute. Doesn't adding 0 to 6 make 6?" What do we really mean when we say, "Just add zero"? Here students explain what is actually happening.

A Look at Student Work

Two grade 4 students explore the mathematics behind “adding a zero”

http://www.showme.com/sh/?h=P74C5NQ

http://www.showme.com/sh/?h=zIOXYfI

http://www.educreations.com/lesson/view/gfeinberg/5614829/?s=G0h2jF&ref=appemail

From Breadth to Depth

- Old Model: Teach everything every year, each time with a bit more depth.

- New Model: Don't teach everything every year. Focus on fewer concepts each year but teach them with more depth.

From Breadth to Depth: Statistics

2004 Framework

- *Grade 5* Given a set of data, find the median, mean, mode, maximum, minimum, and range, and apply to solutions of problems.
- *Grade 6* Describe and compare data sets using the concepts of median, mean, mode, maximum and minimum, and range.
- *Grade 7* Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data. *This standard is intentionally the same as standard 8.D.3.*
- *Grade 8* Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.

2011 Framework

- *Grade 6* Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
- *Grade 7* Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

From Breadth to Depth: Geometry

2004 Framework

- *Grade 4* Describe and apply techniques such as reflections (flips), rotations (turns), and translations (slides) for determining if two shapes are congruent.
- *Grade 5* Describe and perform transformations on two-dimensional shapes, e.g., translations, rotations, and reflections.
- *Grade 6* Predict, describe, and perform transformations on two-dimensional shapes, e.g., translations, rotations, and reflections.
- *Grade 7* Predict the results of translations and reflections of figures on unmarked or coordinate plans and draw the transformed figure.
- *Grade 8* Predict the results of transformations on unmarked or coordinate planes and draw the transformed figure, e.g., predict how tessellations transform under translations, reflections, and rotations

2011 Framework all *Grade 8*

- Verify experimentally the properties of rotations, reflections, and translations.
  - **a** Lines are taken to lines, and line segments to line segments of the same length.
  - **b** Angles are taken to angles of the same measure.
  - **c** Parallel lines are taken to parallel lines.
- Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates

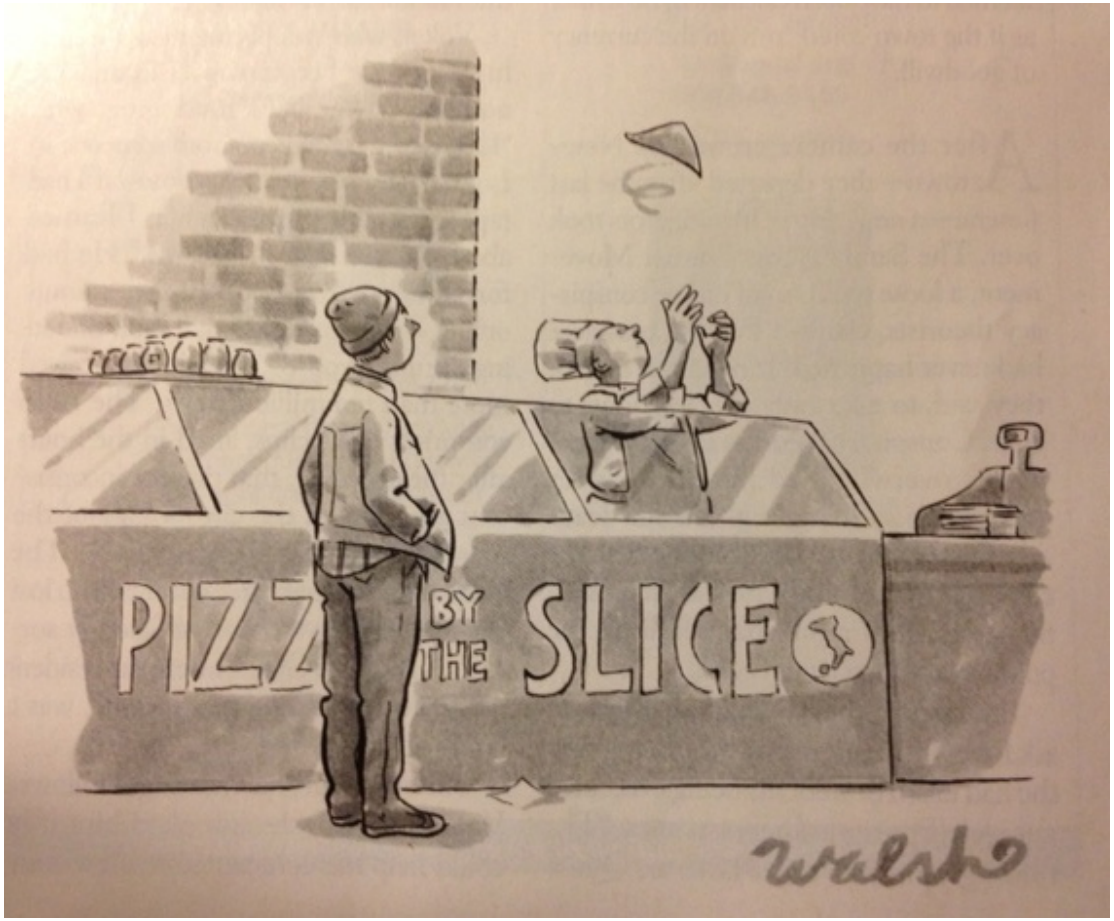
Developmental Progression

Some topics are developed in a way that is more fitting with research on learning.

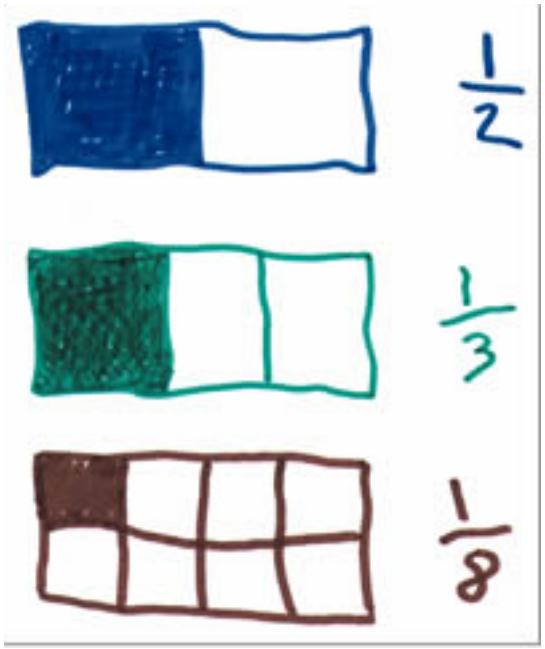
Example: Fractions

The 2011 Framework more clearly outlines a progression of concepts to build a strong understanding of fractions

Grade 2 and 3:
Emphasis on Unit Fractions



Development of Fractions



- Developing the understanding of unit fractions as parts of wholes, but also as building blocks that can be used to make other numbers.

Development of Fractions

1/3 + 1/3 = 2/3

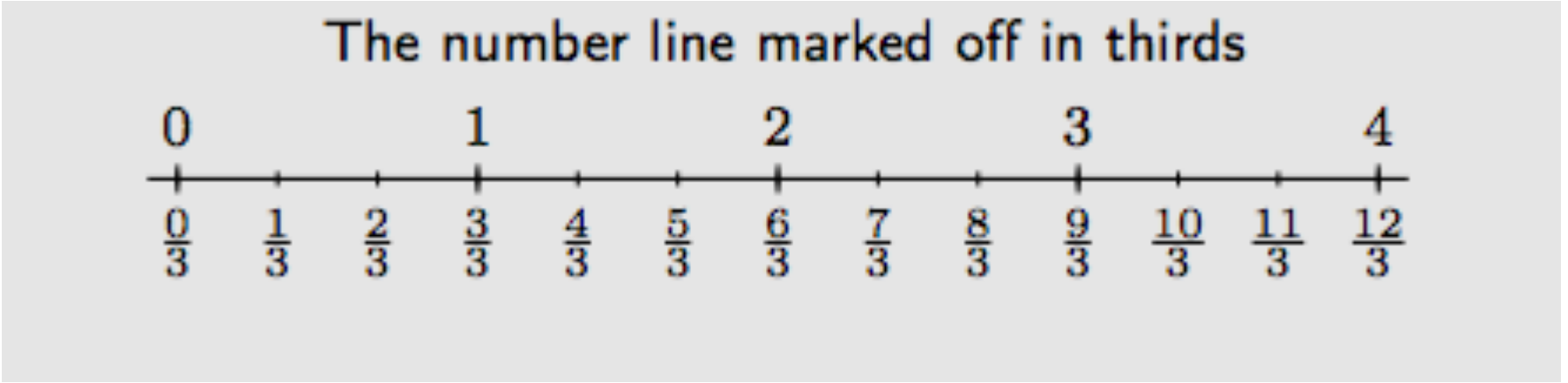
- Putting together unit fractions

1/3 + 1/3 + 1/3 + 1/3 = 4/3

- Folding in fractions greater than one

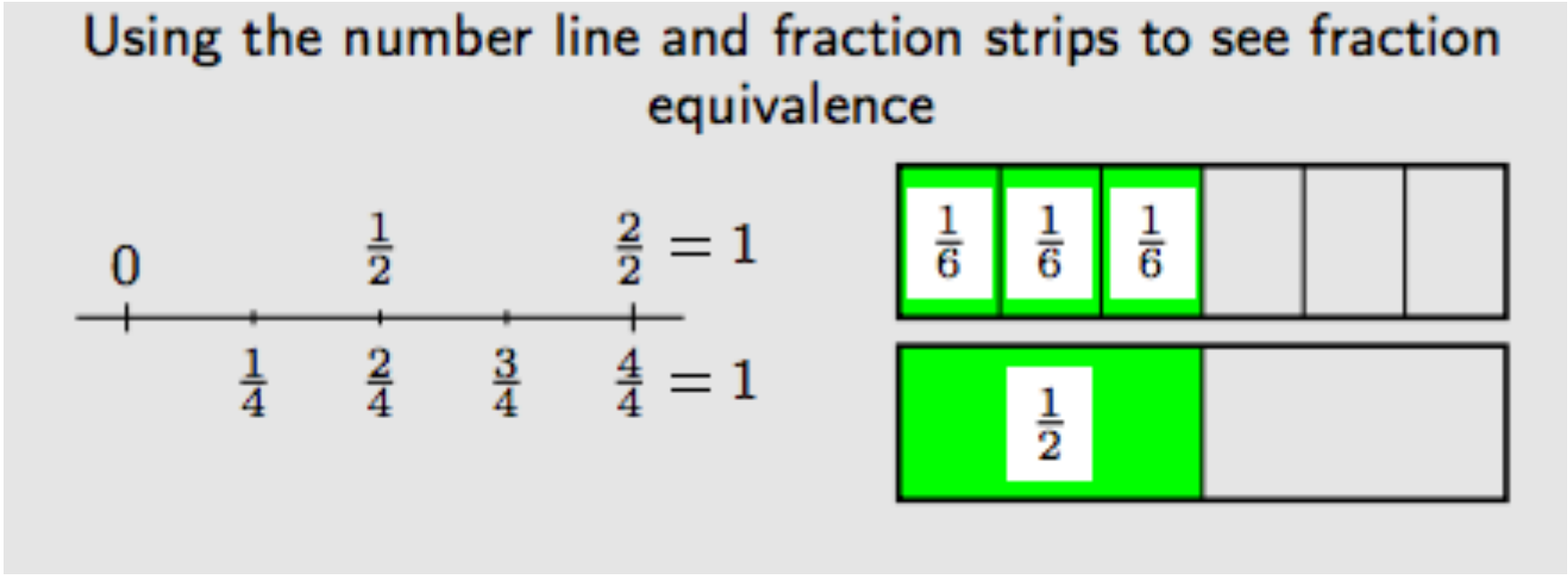
Development of Fractions

- Fractions on a number line



Development of Fractions

- Equivalent fractions on a number line and with number strips



Development of Fractions

- Grades 4 and 5: As students move on to operating with fractions, they are helped by having a strong foundation in the basic concepts.
- Grade 6: dividing by a fraction
- Grades 7 and 8: no standards on fractions, but fractions are used in the study of rates, ratio, and proportion, probability, measurement, as well as other topics.

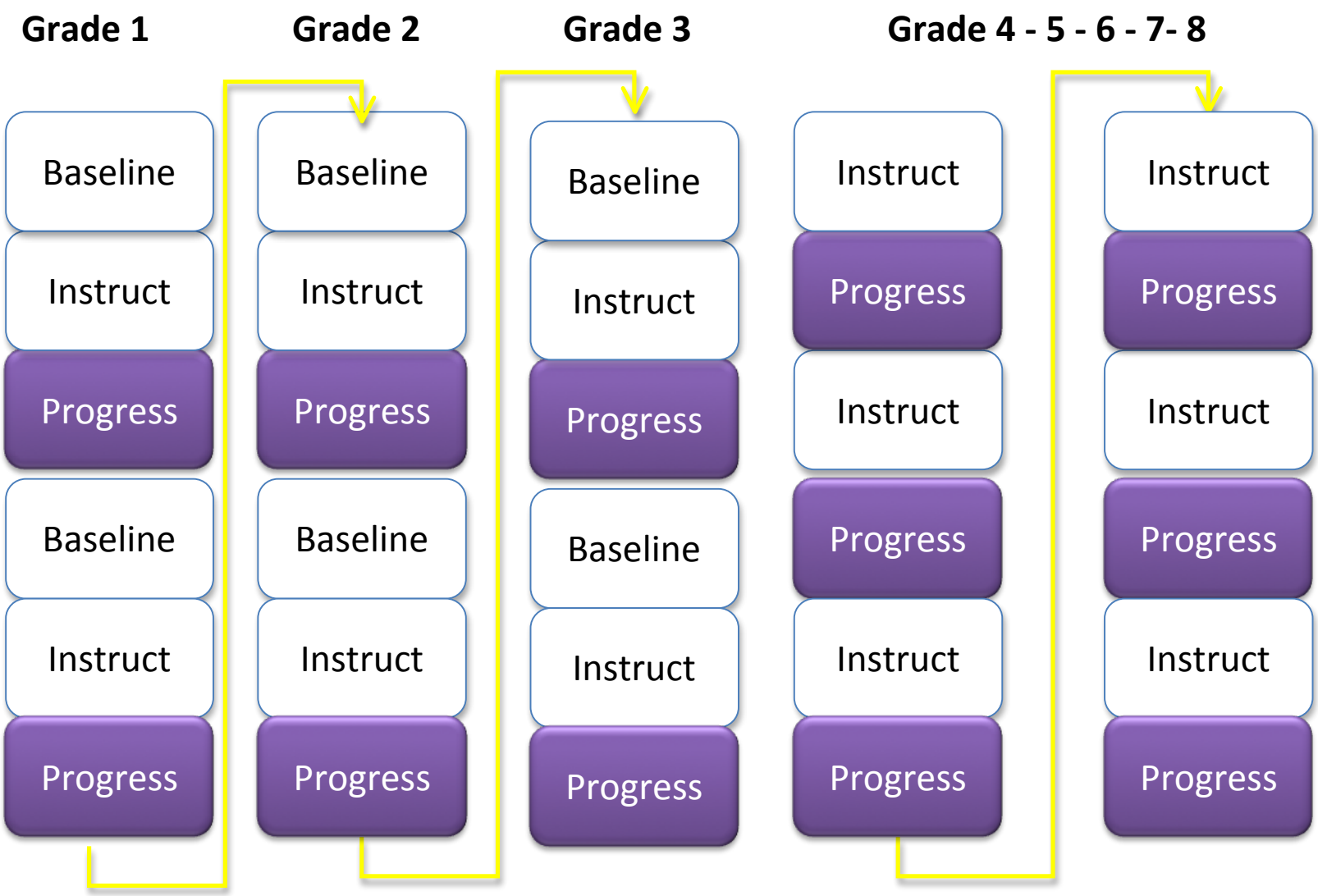
Open Response Goals

- To provide relevant and complex questions that help us to examine the development of mathematical content knowledge of students, and the processes they use for solving these problems
- To give students an opportunity to work on both problem-solving and communicating their reasoning.
- To examine the development of particular mathematical ideas in one grade level, and across several grade levels

Math Rubric for Open Response

Problem Solving				
	1	2	3	4
Interpretation Strategy Accuracy				
Communication				
Completeness Clarity				

Open Response Plan



Moving Forward…

- Finalize Common Assessment questions at each grade and make tracking system manageable for teachers
- Revise report card descriptors for mathematics, K-8
- Continue alignment by making program revisions in topics at selected grades; selecting or developing new materials
- Revise the Lincoln Learning Expectations for Mathematics
- Provide Professional Development for teachers