

Common Core Standards For Mathematics

Not as Wide and Definitely Deeper

U.S Mathematics Curricula



- A Mile Wide
- An Inch Deep

Labels That Unfortunately Last



- Pookie
- Stinky
- Alley Cat
- Binky
- Scooter
- Bub
- Spanky
- Peewee
- Skillet

Before Common Core

- In the past there have been various programs, initiatives, texts etc that attempted to address the depth of mathematics taught in schools. But, isolated implementation prevented the attainment of national momentum.
- NCTM Focal Points

Common Core Mathematics Standards



- Provide a clear and consistent understanding of what students are expected to learn
- Robust and relevant to real world
- College and career readiness
- Better prepare students to compete globally
- The closest we have ever had to a nationwide initiative to address the Uncle Skillet syndrome

Copyright © 2010 Pearson Education, Inc. or its affiliate(s). All rights reserved.

Lack of Depth

- What exactly does that mean?

Common Core

- The issue of depth is NOT addressed by the number of standards nor the Rigor alone

Common Core

- Common Core addresses the issue of depth through both its structure and standards

Common Core Mathematical Standards



- The Standards are structured in such a way that they provide a more focused and coherent curricula.
- This allows teachers to spend more time on important concepts
- It also organizes the material in such a way that it supports deeper understanding by students

Copyright © 2010 Pearson Education, Inc. or its affiliate(s). All rights reserved.

Promoting the Big Ideas

- Number
- Expressions
- Equations
- Shape
- Coordinates
- Quantity
- Functions
- Modeling
- Probability
- Statistics

Common Core Mathematical Standards



- For each grade level, critical areas of study are identified.
- A thorough explanation of how the standards are used to support the critical areas of study is also provided

Critical Areas of Study

- 8th grade
 - Formulating and reasoning about expressions and equations, including modeling an association in bivariate data with linear equation, and solving equations and systems of linear equations
 - Grasping concept of a function and using functions to describe quantitative relationships
 - Analyzing 2 and 3 dimensional space and figures using distance, angle, similarity and congruence and understanding and applying the Pythagorean Theorem

Identification of Critical Areas of Study



- 6th Grade
 - Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems
 - Completing understanding of division of fractions and extending the notion of number to the system of rational numbers
 - Writing, interpreting and using expressions and equations
 - Developing understanding of statistical thinking

How Does This Help? Glad You Asked



- This use of critical areas allow teachers to better prepare their instruction and assessments by organizing around central ideas and important concepts
- Without this, there may be little change in the procedural nature of instruction

Common Core



- Students use the meaning of fractions, multiplication and division and the relationship between multiplication and division to understand and explain why procedures with fractions make sense
- Critical Area
 - Completing understanding of division of fractions and extending the notion of number to the system of rational numbers

The Standard IS

- Standard
 - Interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions
- What if I used the old stand by instructional strategy – “Ours is not to reason why. Just invert and multiply?”

Critical Areas

- What would you get if students were able to connect all of the standards to the appropriate critical areas.
- I will answer for you. Depth of Learning

Use of Conceptual Categories

- K-5
 - Operations and Algebraic Thinking
 - Numbers and Operations in Base Ten
 - Numbers and Operations- Fractions (start in 3rd)
 - Measurement and Data
 - Geometry
- The K-5 standards provide students with a solid foundation in *whole numbers, addition, subtraction, multiplication, division, fractions and decimals*

Use of Conceptual Categories

- 6-8
 - Ratios and Proportional Relationships (not in 8th)
 - The Number System
 - Expressions and Equations
 - Geometry
 - Statistics and Probability
 - Functions (start in 8th)
- The 6-8 standards describe robust learning in *geometry*, *algebra*, and *probability and statistics*
- Modeled after the focus of standards from high-performing nations, the standards for grades 7 and 8 include *significant algebra and geometry content*

Use of Conceptual Categories

- High School
 - Number and Quantity
 - Algebra
 - Functions
 - Modeling
 - Geometry
 - Statistics and Probability
- Identify the mathematics that all students should study in order to be *college and career ready*
- Call on students to practice *applying mathematical ways of thinking* to real world issues and challenges
- Require students to develop a *depth of understanding and ability to apply mathematics to novel situations*

Use of More Coherent Clusters of Standards



- 4th grade: Number and Operations – Fractions
 - Extend understanding of fraction equivalence and ordering
 - Build Fractions from unit fractions by applying and extending previous understandings of operations on whole numbers
 - Understand decimal notation for fractions and compare decimal fractions

More Coherent Use of Standards Between Grade Levels

- K- Count and understand addition as putting together
- 1st -Represent and solve addition problems:
- 2nd - Work with equal groups of objects
- 3rd – Represent and solve problems involving multiplication: Understand properties of multiplication: Multiply within 100
- 4th - Develop fluency with multiplication

Math Standards

1. Mathematical Performance
 - What students should be able to do
2. Mathematical Understanding
 - What students should understand about mathematics
3. Mathematical Practices

Mathematical Performances

- 3rd grade: Students should be able to represent and solve problems involving multiplication and division (not currently in NC 3rd grade standards)
- This standard requires that students
 - Interpret multiplication as repetitive grouping
 - Interpret division as grouping and sharing
 - Use drawings, arrays and equations with symbols

Mathematical Performances

- Common Core
 - Apply properties of operations as strategies to multiply and divide
- North Carolina
 - Use basic properties for addition, subtraction, multiplication and division

Mathematical Performances

- 8th Grade- Explain a proof of the Pythagorean Theorem and its converse
- We ask students to apply and use but do we really ask them to explain a proof?
- North Carolina Standard: Apply geometric properties and relationships, including the Pythagorean theorem to solve problems

Mathematical Performance



- Algebra
 - Use the structure of an expression to identify ways to rewrite it. (difference of squares, completing square etc)
 - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression?????

Mathematical Performance

4. Explain how the factored form of a quadratic function can be used:
 - a. To find important points on the graph of the function.
 - b. To solve a quadratic equation.

Mathematical Performance



- 1st grade
 - Understand and apply properties of operations and the relationship between addition and subtraction

Mathematical Understanding

- When comparing Common Core Standards to State standards, particularly at upper middle and high school, many of the verbs are similar.
- There is however one major difference. What does understanding mean?

"Understand"

"Understand" is used in these standards to mean that students can explain the concept with mathematical reasoning, including concrete illustrations, mathematical representations, and example applications.

Students who understand a concept can

- (a) use it to make sense of and explain quantitative situations (see "Model with Mathematics" in Practices)
- (b) incorporate it into their own arguments and use it to evaluate the arguments of others (see "Construct viable arguments and critique the reasoning of others" in Practices)
- (c) bring it to bear on the solutions to problems (see "Make sense of problems and persevere in solving them")
- (d) make connections between it and related concepts

“Understand” Expectation

- At a given grade level, students demonstrate all of a. through d. over the collection of "understand" standards.
- For any given "understand" standard, students demonstrate at least two of a. through d.

Mathematical Understanding

- Applying Common Core's definition of Understanding forces us to move beyond algorithms, mnemonics and well rehearsed procedures (Doing Math)

Mathematical Understanding and FOIL



- Binomial Expansion can be accomplished using the following procedure, FOIL. Multiply the First, Outside, Inside and Last Term of the two expressions and add like terms
- EX $(2x + 3) * (4x + 1)$
 - First Term Product $2x * 4x = 8x^2$
 - Outside Term Product $2x * 1 = 2x$
 - Inside Term Product $3 * 4x = 12x$
 - Last term Product $3 * 1 = 3$
- Combining Like terms $8x^2 + (2x + 12x) + 3$
- The answer is $8x^2 + 14x + 3$

Mathematical Understanding

FOIL Continued



- Let me show you another example
- And another
- Any questions?
- Work these
 - $(5x + 2) * (6x + 5)$
 - $(3x + 1) * (7x + 9)$
 - $(2x + 4) * (3x - 2)$
 - And “fifty-leven” (yes that is a word) problems just like these
- Is there depth in this Process? Not sure? Just ask students to work this $(2x + 3) * (4x + 3y + 5)$

What If

- After FOIL, students were asked to look at the procedure I just outlined and explain why it worked?
 - Connect FOIL to multiplication of numbers using arrays?
1. A student wrote: $a(b + c) = ab + c$.
 - a. What mistake did the student make?
 - b. Sketch an area model to show why the student's equation is not true.

Common Core Mathematical Standards

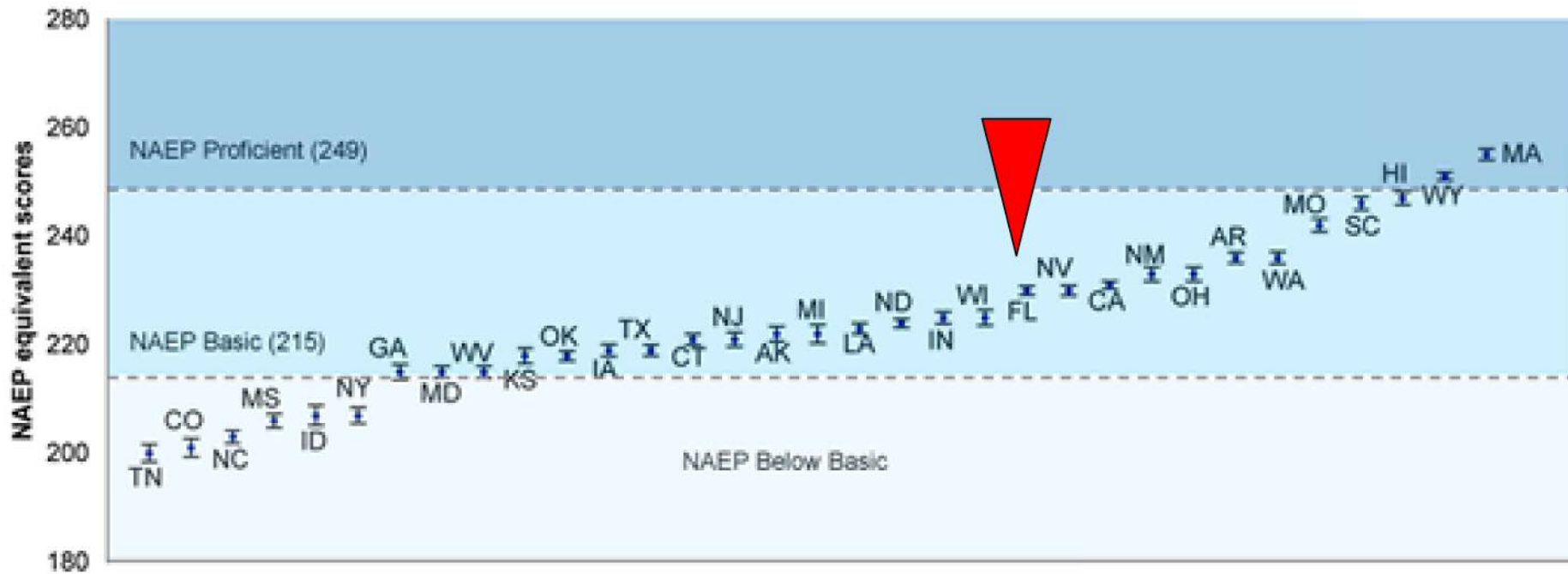


- By supporting states with a more focused, rigorous and more coherent curricula, the Common Core Initiative may be able to finally rise above the “mile wide, inch deep label”
- The Stakes are High

How big is the discrepancy?

Math Grade 4

Figure 1
Mapping state standards to the NAEP scale: Math Grade 4 2005

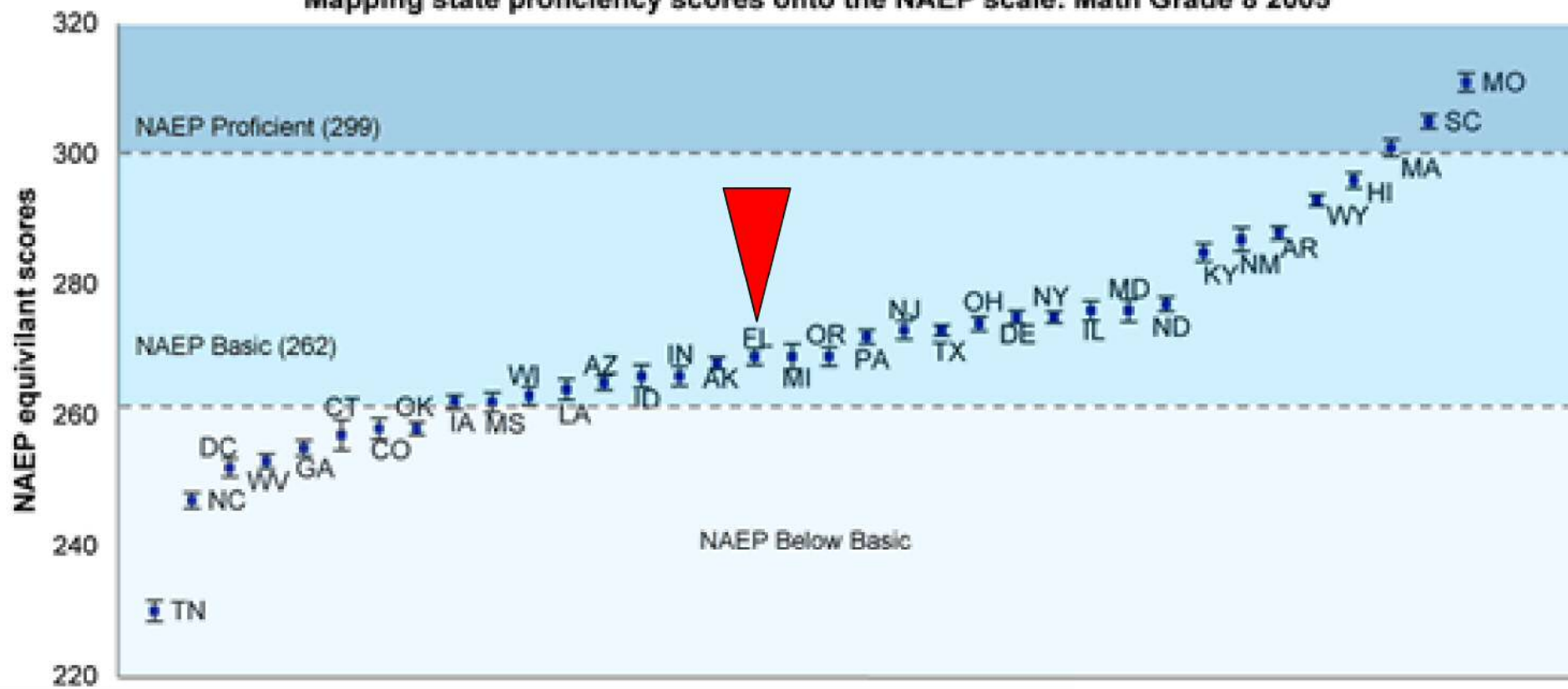


Source: NCES (2007) Mapping 2005 State Proficiency Standards Onto the NAEP Scales (NCES 2007-482)

015

How big is the discrepancy? Math Grade 8

Figure 2
Mapping state proficiency scores onto the NAEP scale: Math Grade 8 2005



Source: NCES (2007) Mapping 2005 State Proficiency Standards Onto the NAEP Scales (NCES 2007-482)

All rights reserved.

Common Core My Fear



- The rigor of the assessments used in 2014 will be comparable if not higher than NAEP.
- If students are not successful in 2014, the Common Core Standards may become a political issue rather than an educational issue

The Time is Now

- We have an opportunity to change the face of education in this country.
- Seize the moment
- Its best for teachers
- Its best for students

- Thank You
- Enjoy the rest of the Conference

1