Transitioning Elementary Schools to Common-Core MATH
Ross Brenneman
Assistant editor, Education Week Teacher

Follow Ross on Twitter: @itsapun
"Letting a thousand flowers bloom isn't consistent with ensuring that all teachers are using high-quality and well-aligned materials."
“Sham”
“I have seen kids get excited about math.”
Transitioning Elementary Schools to Common-Core Math

Expert Presenters:

Linda Gojak, president, National Council of Teachers of Mathematics

Elham Kazemi, professor, mathematics education, University of Washington
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
Implementing the Common Core Standards for Mathematics in K-5

Linda Gojak
President, National Council of Teachers of Mathematics
Overview

1) Instructional shifts
2) Content Standards: Critical areas for K-5
4) Getting started in K-5
5) Resources
Instructional Shift 1:

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

- 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.”
Instructional Shift 2: Coherence

• 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.
Instructional Shift 3: Rigor

- Applications
- Conceptual Understanding
- Procedural Skills
Conceptual Understanding...

• Explain it to someone else
• Represent it in multiple ways
• Apply it to solve problems
• Compare and contrast it to other concepts
  – How is multiplication like addition?
  – How is it different?
Mathematics | Grade 1
In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.
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.

Getting Started in K-5: Number Talks

- a powerful tool for helping students develop computational fluency
- short, daily routines that provide students with meaningful ongoing practice with computation.
- classroom conversations around purposefully crafted computation problems that are solved mentally
- designed to elicit specific strategies that focus on number relationships and number theory

http://www.mathperspectives.com/num_talks.html
2 + 5 + 8

5 + 7 + 3 + 5
Six step format of a number talk

1. Teacher presents the problem.
2. Students are given time to mentally figure out the answer.
3. Students share their answers. Four or five students volunteer to share their answers and the teacher records them on the board.
4. Students share their thinking. Three or four students volunteer to share how they got their answers. (Occasionally, students are asked to share with the person(s) sitting next to them.) The teacher records the student's thinking.
5. The class agrees on the answer for the problem.
6. The steps are repeated for additional problems.
76 – 48

75 – 48
The Teacher’s Role

- Facilitator
- Questioner
- Listener
- Learner
The Essentials

• No longer than 5 to 10 minutes daily.

• Select a designated location with close proximity to your students

• Quiet “signal” and appropriate wait time

• Accept, respect and consider ALL answers

• Teachers could be focusing on ONE or more strategies during the number talk.
Which is greater? How do you know?

\[
\frac{2}{3} \quad \frac{2}{5}
\]
Which is greater? How do you know?

\[
\begin{array}{c}
4 \\
5
\end{array}
\quad \begin{array}{c}
3 \\
5
\end{array}
\]
Think about other topics for number talks at your grade level.
NCTM Resources to Support Common Core Implementation

- [http://www.nctm.org/ccssmresources/](http://www.nctm.org/ccssmresources/)
  - Books and journals
- [Illuminations.nctm.org](http://www.nctm.org/illuminations)
- Teaching Children Mathematics
- Mathematics Teaching in the Middle School
DreamBox Combines Three Essential Elements to Accelerate Student Learning

**Rigorous Elementary Mathematics**
- Common Core State Standards
- Standards for Mathematical Practice

**Motivating Learning Environment**
- Student directed, empowering
- Gaming fundamentals, rewards

**Intelligent Adaptive Learning™ Engine**
- Millions of individualized learning paths
- Tailored to a student’s unique needs
Implementing the Common Core Standards for Mathematics K-5

Elham Kazemi
Professor, Mathematics Education
University of Washington
ekazemi@uw.edu
Overview

• My go to resources for understanding the meaning of common core standards
• Resources for learning about development of student thinking & instruction
• Processes for supporting teacher & leader learning
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: Commentary and Elaborations for K–5

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12 February 2014

Suggested citation:

For discussion of the Elaborations and related topics, see the Tools for the Common Core blog: http://commoncoretools.me
2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

- For example, to find the area of the floor of a rectangular room that measures 10 m. by 12 m., a student might represent the problem as an equation, solve it mentally, and record the problem and solution as $10 \times 12 = 120$. He has decontextualized the problem. When he states at the end that the area of the room is 120 square meters, he has contextualized the answer in order to solve the original problem. Problems like this that begin with a context and are then represented with mathematical objects or symbols are also examples of modeling with mathematics (MP.4).

- For example, when a student sees the expression $40 - 26$, she might visualize this problem by thinking, if I have 26 marbles and Marie has 40, how many more do I need to have as many as Marie? Then, in that context, she thinks, 4 more will get me to a total of 30, and then 10 more will get me to 40, so the answer is 14. In this example, the student uses a context to think through a strategy for solving the problem, using the relationship between addition and subtraction and decomposing and recomposing the quantities. She then uses what she did in the context to identify the solution of the original abstract problem.
2. Reason abstractly and quantitatively.

Mathematically proficient students at the elementary grades make sense of quantities and their relationships in problem situations. They can contextualize quantities and operations by using images or stories. They interpret symbols as having meaning, not just as directions to carry out a procedure. Even as they manipulate the symbols, they can pause as needed to access the meaning of the numbers, the units, and the operations that the symbols represent. Mathematically proficient students know and flexibly use different properties of operations, numbers, and geometric objects.

Mathematically proficient students can contextualize an abstract problem by placing it in a context they then use to make sense of the mathematical ideas. For example, when a student sees the expression $40 - 26$, she might visualize this problem by thinking, if I have 26 marbles and Marie has 40, how many more do I need to have as many as Marie? Then, in that context, she thinks, 4 more will get me to a total of 30, and then 10 more will get me to 40, so the answer is 14. In this example, the student uses a context to think through a strategy for solving the problem, using the relationship between addition and subtraction and decomposing and recomposing the quantities. She then uses what she did in the context to identify the solution of the original abstract problem.

Mathematically proficient students can also make sense of a contextual problem and express the actions or events that are described in the problem using numbers and symbols. If they work with the symbols to solve the problem, they can then interpret their solution in terms of the context. For example, to find the area of the floor of a rectangular room that measures 10 m. by 12 m., a student might represent the problem as an equation, solve it mentally, and record the problem and solution as $10 \times 12 = 120$. He has decontextualized the problem. When he states at the end that the area of the room is 120 square meters, he has contextualized the answer in order to solve the original problem. Problems like this that begin with a context and are then represented with mathematical objects or symbols are also examples of modeling with mathematics (MP.4).
Mathematics | Grade 4
In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.
Use place value understanding and properties of operations to perform multi-digit arithmetic.

6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Grade 4

At Grade 4, students extend their work in the base-ten system. They use standard algorithms to fluently add and subtract. They use methods based on place value and properties of operations supported by suitable representations to multiply and divide with multi-digit numbers.

Generalize place value understanding for numbers. In the base-ten system, the value of each digit depends on its place. For example, multiplying by 10 yields a product in which each digit is shifted one place to the left. To read numerals between 1,000 and 10,000, students should understand the role of commas. Each comma made by commas is read as hundreds, tens, or the name of the appropriate base-thousand unit (billion, trillion, etc.). Thus, 457,000 is read "four hundred thousand." The same methods students used for rounding numbers in previous grades apply because of the uniformity of the base-ten system.

General methods for computing quotients of multi-digit numbers and one-digit numbers rely on the same understandings as for multiplication, but cast in terms of division. One component is quotients of multiples of 10, 100, or 1000 and one-digit numbers. For example, 42 ÷ 6 is related to 420 ÷ 6 and 4200 ÷ 6. Students can draw on their work with multiplication and they can also reason that 4200 ÷ 6 means partitioning 42 hundreds into 6 equal groups, so there are 7 hundreds in each group.

Another component of understanding general methods for multi-digit division computation is the idea of decomposing the dividend into like base-ten units and finding the quotient unit by unit, starting with the largest unit and continuing on to smaller units. As with multiplication, this relies on the distributive property. This can be viewed as finding the side length of a rectangle (the divisor is the length of the other side) or as allocating objects (the divisor is the number of groups). See the figures on the next page for examples.
Progression Documents
http://ime.math.arizona.edu/progressions/

Division as finding side length

966 ÷ 7 is viewed as finding the unknown side length of a rectangular region with area 966 square units and a side of length 7 units. The amount of hundreds is found, then tens, then ones. This yields a decomposition into three regions of dimensions 7 by 100, 7 by 30, and 7 by 8. It can be connected with the decomposition of 966 as $7 \times 100 + 7 \times 30 + 7 \times 8$. By the distributive property, this is $7 \times (100 + 30 + 8)$, so the unknown side length is 138. In the recording on the right, amounts of hundreds, tens, and ones are represented by numbers rather than by digits, e.g., 700 instead of 7.

Division as finding group size

745 ÷ 3 can be viewed as allocating 745 objects bundled in 7

<table>
<thead>
<tr>
<th>Thinking:</th>
<th>3 groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divided 7 hundreds, 4 tens, 5 ones equally among 3 groups, starting with hundreds.</td>
<td></td>
</tr>
<tr>
<td>745 ÷ 3 =?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hundr.</td>
<td>2 hundr. + 4 tens</td>
<td>2 hundr. + 4 tens + 8</td>
</tr>
<tr>
<td>2 hundr.</td>
<td>2 hundr. + 4 tens</td>
<td>2 hundr. + 4 tens + 8</td>
</tr>
<tr>
<td>2 hundr.</td>
<td>2 hundr. + 4 tens</td>
<td>2 hundr. + 4 tens + 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7 hundreds ÷ 3</th>
<th>14 tens ÷ 3</th>
<th>25 - 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>each group gets 2 hundreds</td>
<td>each group gets 4 tens</td>
<td>each group gets 8</td>
</tr>
<tr>
<td>1 hundred is left</td>
<td>2 tens are left</td>
<td>1 is left</td>
</tr>
</tbody>
</table>

| 2 |
| 3 |
| 2 |
| 3 |

| 2 |
| 3 |
| 2 |

| 2 |
| 3 |
| 2 |

Unbundle 1 hundred. Now I have 10 tens + 4 tens = 14 tens

| 2 |
| 3 |

Unbundle 2 tens. Now I have 20 + 5 = 25 left.

| 2 |
| 3 |
| 2 |

Each group got 248 and 1 is left.
Resources on children’s thinking

Cognitively Guided Instruction

Developing Mathematical Ideas

Young Mathematicians at Work
How can job-embedded professional development support teacher and leader learning?

Use common instructional activities

Leadership that supports teachers and presses for collaboration and innovation

Build shared school-wide vision, skills, and knowledge

Collaborators: Allison Hintz, Lynsey Gibbons, Kendra Lomax, Becca Lewis, Ruth Balf, Emily Shahan Lakeridge, Campbell Hill & Roxhill Elementary Schools
Innovate and build shared vision through collective experimentation

Professional Norms

- Be willing to take risks with new ideas.
- Listen actively & generously.
- Be careful about side conversations.
- Give each other time to think & process ideas.
- Build on others’ ideas.
- Invite others to participate.
- It’s ok to share ideas in progress & revise your thinking.
- Take it to the source.
- Describe what you see, rather than labeling.
- Accept learners where they are.

- Summer Retreat
- Math Labs
- Participatory Coaching
- Common Planning Time
Math Labs

Experience

Observe

Try-Out

Co-plan & Rehearse

Debrief & Plan
Practices of Ambitious Teaching

• Beginning and closing activity to facilitate entry & summary of work
• Working towards a mathematical goal
• Eliciting and responding to students’ mathematical contributions
• Representing student thinking verbally and on the board
• Orienting students to one another’s ideas and to the mathematics
• Positioning students as competent mathematical thinkers
• Assessing student understanding
• Managing time, space, voice, manner

Mathematical Instructional Activities

• Well-developed suite of practices (identified and field-tested) core to rigorous and equitable teaching
• Mediating increasingly sophisticated forms of academic talk and activity by students
• Promote robust forms of reasoning about complex concepts
• Engage learners in practices of the discipline
• Central to the work of teaching, can be routine
• Provide focal point for collective learning

Chapin, O’Connor & Anderson

Norms for supporting productive work; teacher moves for orchestrating a discussion

Smith & Stein

5 practices for orchestrating productive discussions

Wedekind

Math Exchanges – Creating classroom systems for classroom discussions
WORD PROBLEMS

STRINGS

NUMBER TALKS
True or False?

$$80 \div 4 = (80 \div 2) + (80 \div 2)$$

Practice & Domain Standards + Student Thinking

Norms for productive disciplinary engagement

Routine instructional activity to support teacher, leader, and student learning
Search “Lakeridge Elementary School” at Teaching Channel: Lynn Simpson, Drew Crandall, Stephanie Latimer, Laretha Todd, Theresa Tse
Kazemi & Hintz, 2014, Intentional Talk
DreamBox Lessons & Virtual Manipulatives

Intelligently adapt & individualize to:

- Students’ own intuitive strategies
- Kinds of mistakes
- Efficiency of strategy
- Scaffolding needed
- Response time
# Robust Reporting

## Classroom Summary Report

<table>
<thead>
<tr>
<th>Student</th>
<th>Grade</th>
<th>Kindergarten Curriculum</th>
<th>1st Grade Curriculum</th>
<th>2nd Grade Curriculum</th>
<th>3rd Grade Curriculum</th>
<th>Time on Task (HH:MM)</th>
<th>Notifications</th>
<th>Student Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17:55</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Alexi K</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14:04</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Billy R</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14:14</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Brianna S</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>51:43</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Cassandra H</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18:02</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Erinne N</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20:42</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Jayce D</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28:13</td>
<td></td>
<td>Weekly Detail</td>
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<tr>
<td>Josephine J</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15:59</td>
<td></td>
<td>Weekly Detail</td>
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<tr>
<td>Kevin M</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18:18</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Kylee P</td>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10:24</td>
<td></td>
<td>Weekly Detail</td>
</tr>
<tr>
<td>Linda C</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>36:10</td>
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<td>Weekly Detail</td>
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<tr>
<td>Marianne I</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15:58</td>
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<tr>
<td>Mario E</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23:44</td>
<td></td>
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<tr>
<td>Michael B</td>
<td>1</td>
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<td></td>
<td></td>
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<td>28:40</td>
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<tr>
<td>Ramona G</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11:00</td>
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<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Rilee L</td>
<td>1</td>
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<td></td>
<td>13:18</td>
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<tr>
<td>Roberta A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sakurah P</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>00:16</td>
<td></td>
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<tr>
<td>Solomon O</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>09:57</td>
<td></td>
<td>Weekly Detail</td>
</tr>
</tbody>
</table>

**Symbol Legend**

- **Gray Box**: Skipped based on initial placement
- **Blue Box**: Passed in unit pretest
- **Orange Box**: Completed curriculum
- **Red Box**: Pending assessment

- **Needs assistance**
- **Working inefficiently**
**Strong Support for Differentiation**

**Concept: Multiplication: Double & Halve**

Students use known basic facts and double one factor and halve the other to determine the product of a more challenging problem.

<table>
<thead>
<tr>
<th># Completed with Proficiency</th>
<th># In Progress</th>
<th># Not Started</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 students</td>
<td>10 students</td>
<td>9 students</td>
</tr>
<tr>
<td>John P (about 1 month ago)</td>
<td>Avaneesh S (71%)</td>
<td>Anthony P</td>
</tr>
<tr>
<td>Jacob C (about 1 month ago)</td>
<td>Charles K (71%)</td>
<td>Brittany B</td>
</tr>
<tr>
<td>Rebceah D (about 1 month ago)</td>
<td>Emmanuel M (71%)</td>
<td>Christina P</td>
</tr>
<tr>
<td>Julian B (about 1 month ago)</td>
<td>Luke R (71%)</td>
<td>Emily C</td>
</tr>
<tr>
<td>Edgar H (about 1 month ago)</td>
<td>Alanna M (64%)</td>
<td>Karly H</td>
</tr>
<tr>
<td>Pedro S (2 months ago)</td>
<td>Domenic G (64%)</td>
<td>Leah P</td>
</tr>
<tr>
<td>Daniel C (3 months ago)</td>
<td>Daniel S (57%)</td>
<td>Michael D</td>
</tr>
<tr>
<td></td>
<td>Dominique S (28%)</td>
<td>Samantha S</td>
</tr>
<tr>
<td></td>
<td>Suna C (28%)</td>
<td>Vanessa C</td>
</tr>
<tr>
<td></td>
<td>Caitlin S (21%)</td>
<td></td>
</tr>
</tbody>
</table>
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www.dreambox.com/free-trial
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Transitioning Elementary Schools to Common-Core Math

Required Reading from *Education Week*:

**Spotlight on Math and the Common Core**
The transition to the common-core math standards has resulted in shifts in classroom teaching and course materials. In this Spotlight, take a look at how the common core is influencing math instruction, see how teachers are preparing at-risk students for the standards, and examine early assessments aligned to the common core.