“So what’s up with math?”

Looking at the New Core and current instructional practices

Julie Peery - Dec. 5, 2012

New math core standards

How Was the Utah Core Developed?

- The Standards evolved from a carefully researched growing body of evidence.
- This evidence included scholarly research; surveys on what skills are required of students entering college and workforce training programs; assessment data identifying college and career ready performance; and comparisons to standards from high-performing states and nations.
- We need college and career ready standards. Data shows that even in high-performing states students are graduating and passing all the required tests and still require mediation in their post-secondary work. We need students moving from our colleges and universities into the workplace, ready to compete in the emerging global marketplace.

Strengths of the new Core

- Aligned with expectations for college & career success
- Consistent across all states
- Includes both content and application of knowledge through high-order skills
- Informed by other top performing countries, so that all students are prepared to succeed in our global economy and society.

Comparison between old and new mathematics core 5th grade example

Old Core – 54 math standards	New Core – 34 math standards
Recognize, describe, and determine surface area and volume of three- dimensional shapes.	**Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.**
- Quantify volume by finding the total number of same-sized units of volume needed to fill the space without gaps or overlaps. - Recognize that a cube having a 1unit edge is the standard unit for measuring volume expressed as a cubic unit. - Derive and use the formula to determine the volume of a right prism with a ~~triangular or~~ rectangular base. - ~~Relate the formulas for the areas of triangles, rectangles, or parallelograms to the surface area of a right prism.~~ ~~- Derive and use the formula to determine the surface area of a right prism and express surface area in square units.~~	- Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units. - Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. - Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. c. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. d. Apply the formulas V=l×w×h and V=b×h for rectangular prisms to find volumes of right rectangular prisms with whole- number edge lengths in the context of solving real world and mathematical problems. e. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

Another example:

Demonstrate proficiency with multiplication and division of whole numbers and compute problems involving addition, subtraction, and multiplication of decimals and fractions.	**Perform operations with multi-digit whole numbers and with decimals to hundredths.**
Divide multi-digit dividends by a one-digit divisor with fluency, using efficient procedures.	Find whole-number quotients of whole numbers with up to four-digit dividends and two-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.
*6th Grade: Divide a multi-digit number by a two-digit number.	*6th Grade: Fluently divide multi-digit numbers using the standard algorithm.

Practice standards

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**.

What about instruction and what does "inquiry" have to do with it?

Math instruction may not look like it did in the past. Teachers teach by:

- Building new knowledge from prior knowledge
- Providing students with opportunities to talk about mathematics
- Encouraging multiple approaches
- Treating errors as opportunities for learning
- Teaching through problem solving
  - "Students learn mathematics as a *result* of solving problems. Mathematical ideas are the *outcomes* of the problem-solving experience rather than elements that must be taught before problem-solving." - John Van De Walle

Let's compare…

A. You need to make cookies and the recipe calls for 5 cups of flour. You only have a ¾ cup measuring cup. How many ¾ cups of flour would you need to add?

$5 \div \frac{3}{4} =$

B. Lisa is going on a 3 ½ mile hike. She has already hiked 2 ¾ miles. How many more miles does she have left to hike?

$3\frac{1}{2} - 1\frac{3}{4} =$

C. 1,000 – 997 =

Which solution shows the most understanding of the meaning?

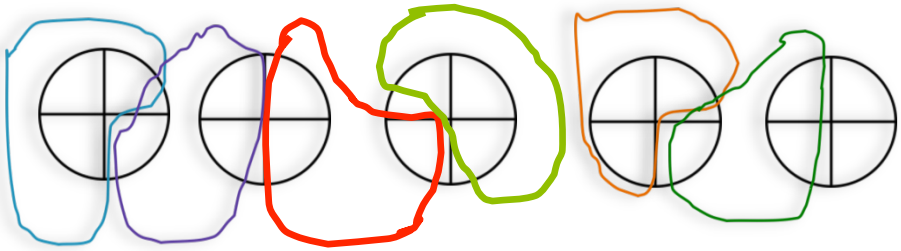
$5 \div \frac{3}{4} =$

Invert and multiply: $5 \times 4/3 = 20/3$

$20 \div 3 = 6 \text{ r } 2 \text{ or } 6\ 2/3$

OR…

$5 \div \frac{3}{4} =$



1 2 3 4 5 6 2/3

Which solution shows the most understanding of the meaning?

$3\frac{1}{2} - 1\frac{3}{4} =$

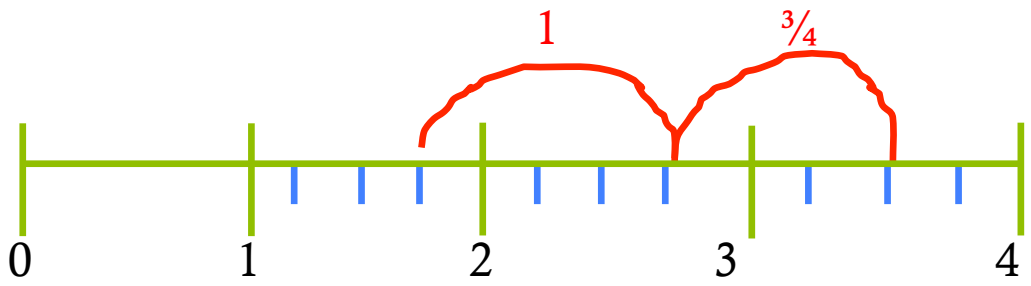
$3\frac{1}{2}$ $\quad 3\,2/4$ $\quad 3 - 2\,4/4 + 2/4 = 2\,6/4$

$-\ 1\frac{3}{4}$ $\quad 1\,3/4$ $\quad -1\,3/4$

$1\,3/4$

OR…..

3 ½ - 1 ¾ =



And finally…

1,000 – 997 =

$$\begin{array}{r} 1{,}000 \\ -\ \ 997 \\ \hline \end{array}$$

$$\begin{array}{r} {\scriptstyle 9\ \ 9} \\ {\scriptstyle \cancel{10}\ \cancel{10}10} \\ 1\cancel{,000} \\ -\ \ 997 \\ \hline 003 \end{array}$$

A typical math lesson of the past:

1. Teacher tells students what they will be doing for the lesson and has students write down the definitions of vocabulary terms.	**2. Teacher demonstrates on the board how to do each step to complete the procedure.**	**3. Teacher has students practice the procedure several times exactly like she demonstrated.**	**4. Students practice the procedure on a worksheet or page in the book by completing many problems (often skipping the word problems due to difficulty).**	**5. Teachers check practice work to see which answers were correct and which were wrong to determine if students understand.**

A typical inquiry math lesson:

1. Give students a problem to solve involving rich math concepts and usually in real life context (word problem).	**2. Allow students to work on the problem, solving it in several ways that make sense to them. Teacher asks questions to guide their thinking and understand their solution method.**	**3. Teacher has selected which students to share their strategies based on the important ideas or methods that the teacher wants to be emphasized. Students compare strategies and make sense of each.**	**4. Teacher helps students make connections between the ideas, teaches students the correct vocabulary to go with the math concept, asks questions to make sure students understand the concept.**	**5. Students practice by using a strategy that makes sense, that they can explain and represent their thinking with, and that they can use to improve accuracy and efficiency.**

Using inquiry helps students:

1. Develop their own understanding of the concept before being introduced to a standard procedure.
2. Remember what they learned because it made sense to them.
3. Solve problems in many ways…not just a procedural way before they are ready to understand it.
4. Reason, make sense of, and explain their thinking.
5. Not be afraid of word problems or new problem situations.
6. Become thinkers…not memorizers! Become confident mathematicians!

How can parents help at home?

1. Send positive messages about math and discuss the value of education for their future.
2. Look for math around you and talk about the math you do in real life (every day at home or in your job).
3. Help students learn to persevere (stick to it and not give up).
4. Ask students to start with what they know and let them solve problems in ways that may be different than how you would solve it. Think about how you would solve a problem in real life without knowing a set of steps.
5. Be comfortable with not knowing everything your son or daughter is studying.
6. If you have questions about the math they are doing, talk to the teacher to better understand.
7. Check Brookside's website…an upcoming addition with have FAQ's about math and what the terms and strategies you may see mentioned on homework mean.