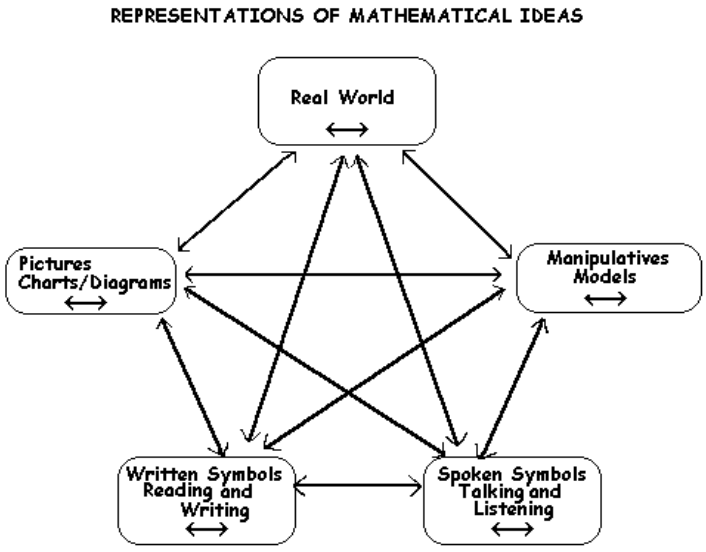
Common Core: Connecting Content Topics to Mathematical Practices

Let's Read Math: What We Are and What We Are Not

Common Core identifies math topics for *each* grade level, and mathematical practices to be included at *all* grade levels. Let's Read Math is not a full mathematics curriculum. It is a supplemental program where we provide quality mathematical experiences that will encourage children to think about math, do math activities, talk about math, and CONNECT their ideas. Each lesson involves reading a book that has an embedded math topic and links math to things that happen in the real world. We use pictorial representations and hands-on activities to involve students in mathematical conversations with each other. Occasionally we ask them to record their findings in writing, or present their ideas to others. And we suggest places they can go online to investigate further, or to practice related math skills. We have a light-hearted but serious approach to engaging children in the content and mathematical practices espoused in the Common Core State Standards.

Cognitive Underpinnings of the Let's Read Math Instructional Approach

We further believe that the recommended mathematical practices were included in the Common Core Standards are included for one important reason: These mathematical practices will help students attain the mathematical rigor and depth of understanding that, to date, has been so elusive in American classrooms. In designing our lessons for Let's Read Math, we have found the following diagram especially helpful in visualizing what needs to be done to build student understanding. The diagram demonstrates how closely the mathematical practices recommended in the Common Core State Standards are linked to what is known about cognitive growth in mathematics:



This "translation model" emerged from the work of the Rational Number Project (RNP) in this country, a project funded by the National Science Foundation since 1979. The RNP investigates student learning and teacher enhancement. The diagram shows how students who use multiple representations manifest a deeper conceptual understanding. Basically, students who can relate their math learning to real life situations and things that they read, who can create and interpret mathematical diagrams and models, and communicate their ideas to peers in writing or conversation, are demonstrating their depth of knowledge. It's all about MAKING CONNECTIONS.

Consider the ideas we have highlighted below, in a summary of the mathematical practices:

Common Core Standards for Mathematical Practice

How can students demonstrate their mathematical understanding?

1. Make sense of problems and persevere in solving them.
   …students start by explaining to themselves the meaning of a problem, and looking for entry points to its solution….explain correspondencies between equations, verbal descriptions, tables, and graphs… draw diagrams of important features and relationships…might rely on using concrete objects or pictures….continually ask themselves, "Does this make sense?" …understand approaches of others.

2. Reason abstractly and quantitatively.
   …ability to decontextualize – to abstract a given situation and represent it symbolically... –and the ability to contextualize to pause as needed during the manipulation process in order to probe into the referents [i.e., to go from real situations to symbols, work on the problem, then tell how the symbols (answers) refer to the real situation]

3. Construct viable arguments and critique the reasoning of others.
   Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams and actions....Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics.
   …apply the mathematics they know to solve problems arising in everyday life, society, and the workplace…identify important quantities in a practical situation… use tools such as diagrams, two-way tables, graphs, flowcharts, and formulas….interpret their mathematical results…reflect on whether the results make sense.

5. Use appropriate tools strategically.
   …consider the available tools when solving a mathematical problem…paper and pencil, concrete models, a ruler, a protractor…software…a website.

6. Attend to precision.
   … communicate precisely to others… use clear definitions in discussion with others and in their own reasoning… careful about specifying units of measure and labeling axes… give carefully formulated explanations to each other. [Note this is not just about getting the "right" answer!]

7. Look for and make use of structure.
   Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more…. [other examples for elementary grades: patterns in a hundred chart, skip counting on a multiplication chart, multiplication arrays and area, fraction strips and parts of a ruler, protractors and the hands on a clock, x-y tables and related graphs]

8. Look for and express regularity in repeated reasoning.
   …notice if calculations are repeated, and look for both general methods and for shortcuts. [For example, multiplication is a shortcut for repeated addition.] Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again.

Mathematical Practices in CCSS: Deepening Student Understanding

Helping students deepen their understanding of math topics "covered" in the curriculum is an ongoing challenge for mathematics educators. Those who contributed to the work of the Council of Chief State School Officers to develop the Common Core Standards for Mathematics realized that the standards had to be a balanced combination of procedure *and* understanding. They embraced the "processes" from the original NCTM standards (2000) and the "proficiencies" delineated by the National Research Council in 2001.) They explained their "expectations" as follows:

> *Expectations that begin with the word "understand" are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems, coherently justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.*

Let's Read Math is about doing standards-based math activities that are engaging and a bit fanciful. Please join us in our serious attempt to get children and adults to **HAVE FUN WITH MATH!**

-Claire Passantino, 2013