



Winnetka Parents Institute Mathematics in the Winnetka Public Schools

**What does research say about best practices in
mathematics education?**

*...and why does math today look so different from when I was in
school?*

Wednesday, December 3, 2014

9:30 - 11:00 A.M.

Skokie School

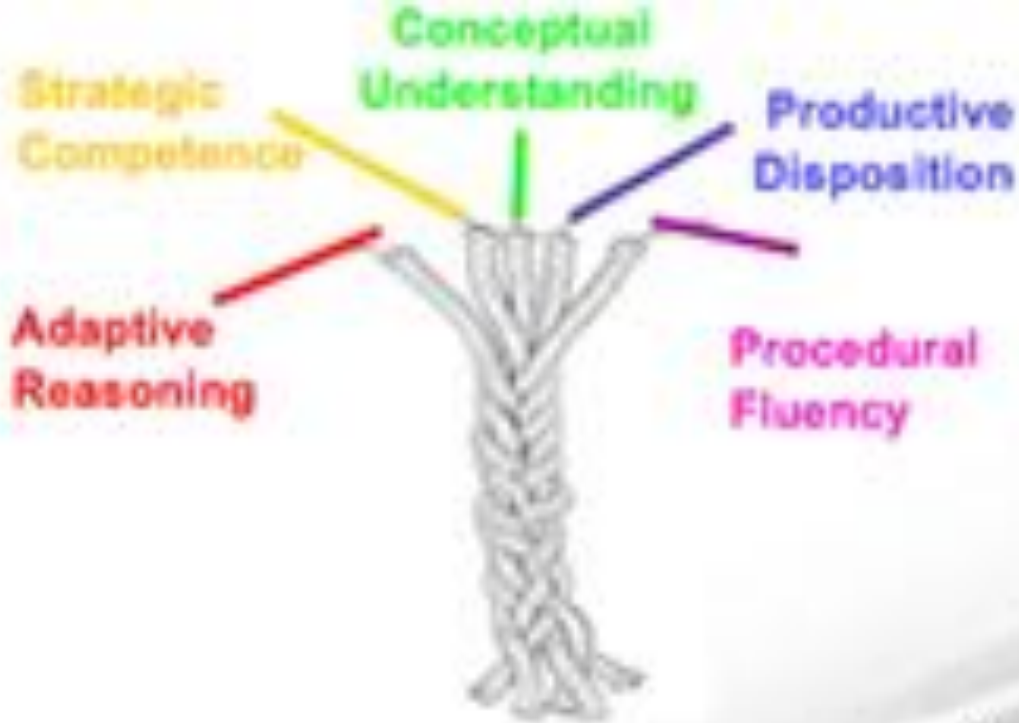
Introduction and Goals

- Address common questions parents have regarding today's math
 - Gain a better understanding of best practice and research in mathematics education
 - Gain a better understanding of the math our students will need in today's world

Our Decisions are Informed by Research

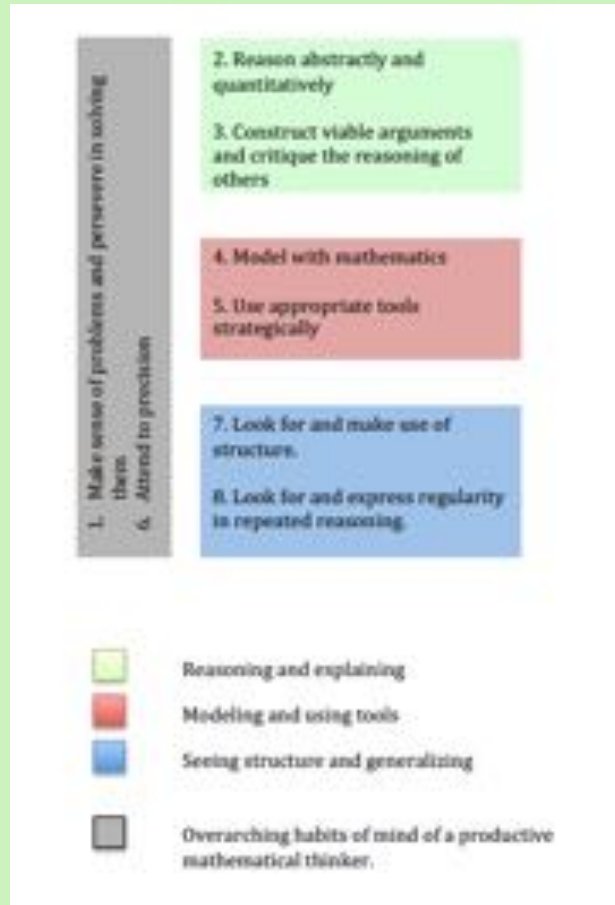
- National Council of Teachers of Mathematics
- National Council of Supervisors of Mathematics
- National Research Council
- National Academy of Sciences
- National Academy Press
- National Academy of Engineering
- Cathy Seeley, past President of NCTM
- Ruth Parker, Founder of Mathematics Education Collaboration
- Jo Boaler, Stanford University

What does it mean to be proficient in Mathematics?



NRC (2011). *Adding It Up*. Washington, D.C.: National Academies Press.

The Standards for Mathematical Practice



Math should be about learning...



Question #1

How and when
should students
learn their
“math facts”?



What does the research say?

- Math facts need to be connected to conceptual understanding of numbers.
- Math facts are best practiced in a progression through games and activities.
- Overemphasis on speed can lead to math anxiety.
- It is important to have definitive targets for mastery across grade levels.

Decomposing Numbers

How it grows k-5?



Grade 1

- Add and Sub within 10
- Finding all combinations that compose numbers to 10
- Thinking of 10 as a unit
- Fact Family w/in 10

Kindergarten

$$\begin{array}{r} + \\ 50 \\ - \\ \hline \end{array}$$

$$10$$

$$20$$

$$100$$

$$1,000$$

$$10,000$$

$$7,500$$

$$1000 = 100$$

Grade 2

- adding to 100
- subtracting from 100
- growing number string 5's and 10's
- fluency of counting money



Grade 3

- breaking apart by place value
- using benchmarks
- understanding multiplication through arrays + equal groups

$$\begin{array}{l} 74 + 23 = ___ \\ 70 + 20 = 90 \\ 4 + 3 = 7 \\ 90 + 7 = 97 \end{array}$$



$$23 \times 12 = 276$$

$$\begin{array}{r} 200 \\ + 40 \\ + 30 \\ + 6 \\ \hline 276 \end{array}$$

$$\begin{array}{l} \frac{3}{4} + \frac{3}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2} \\ 75 + 75 = 150 \end{array}$$

Grade 4

Grade 5

$$314 \times 37 = ___$$



$$32 \overline{) 697}$$

What does computational fluency have to do with math facts?

“Computation fluency is knowing how a number can be composed and decomposed and using that information to be flexible and efficient with solving problems.”

- Cathy Fosnot, Professor Emeritus of Childhood Education and the Founding Director of Mathematics in the City

Question #2

Why do we invest time in finding multiple ways to solve problems?



What does the research say?



What does the research say?

Characteristics of Mathematical Tasks at Four Levels of Cognitive Demand

- Lower-Level Demand (memorization, procedures without connection)
 - Ex: $3 \frac{3}{4} - 2 \frac{5}{6} =$
- Higher level demands (procedures with connections, requires complex and non-algorithmic thinking)
 - See student sample (Doceri project)

What does the research say?

- Teaching the algorithm prematurely often obscures place value relationships and can interfere with the development of children's ability to reason with numbers.
 - Ruth Parker, co-founder and CEO of Mathematics Education Collaborative

Best Buy Problem- Parents Do the Math

Maria's Pet Emporium: 20 cans for \$23

Bob's Best Buy: 12 cans for \$15

Which store has a better price? How do you know?

Question #3

Why are thinking and reasoning essential in today's math class?



Drew Faust: President of Harvard University

“We want to give students the abilities to think and reason and question for a lifetime.”



What does the research say?

- The goal of math education is to produce learners who are both competent and confident.
- Memorizing rules and procedures isn't enough.
 - Algorithms are important and students should learn them.
 - Mathematical competence comes from understanding mathematical relationships.

Sources: Ruth Parker, NCTM, National Research Council.

Sebastian Thrun on the math people need for the world:



For many kids math provokes an allergic reaction. Yet it is perhaps the single most important skill to have if you want to find a job in Silicon Valley. To me, math is all about problem solving, reasoning, using intuition, and making connections. It's not about memorizing formulas. The world is mathematical. I am excited to see so much innovation in the teaching of math. I believe every student deserves to be a math hero. And I believe every student has the potential.

What does it look like in Winnetka?

- We spent time with students as they attempted to solve several addition and multiplication problems.
- We will ask you to take a moment to solve each problem yourself (mentally).
- Then, we'll watch students in grades 3-8 approach this problem.
- Please notice how their approaches progress over time.

Addition Problem

- Please solve this problem mentally:

$$7 + 18$$

- Now, watch how some Winnetka [First](#) and [Second](#) Graders approach the problem

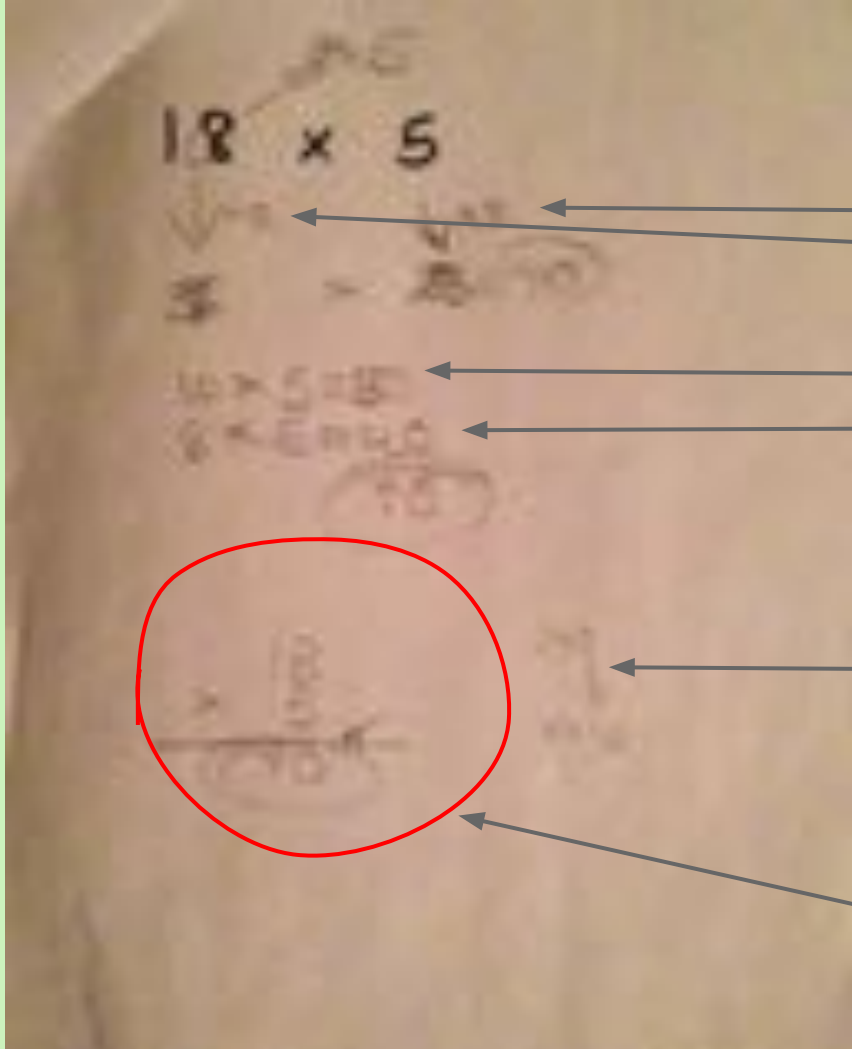
Multiplication Problem

- Please solve this problem mentally:

$$18 \times 5$$

- Now, watch as Winnetka [Third](#), [Fourth](#), Sixth, and [Eighth Graders](#) solve the problem. How do their approaches differ from each other's? Yours?

STUDENT #1: Skokie 6th Grader, Male



Strategy #1: Doubling and halving, used as a mental strategy

Strategy #2: Units of 10 & 5, breaking apart 18, multiplying each part by 5, used as a mental strategy

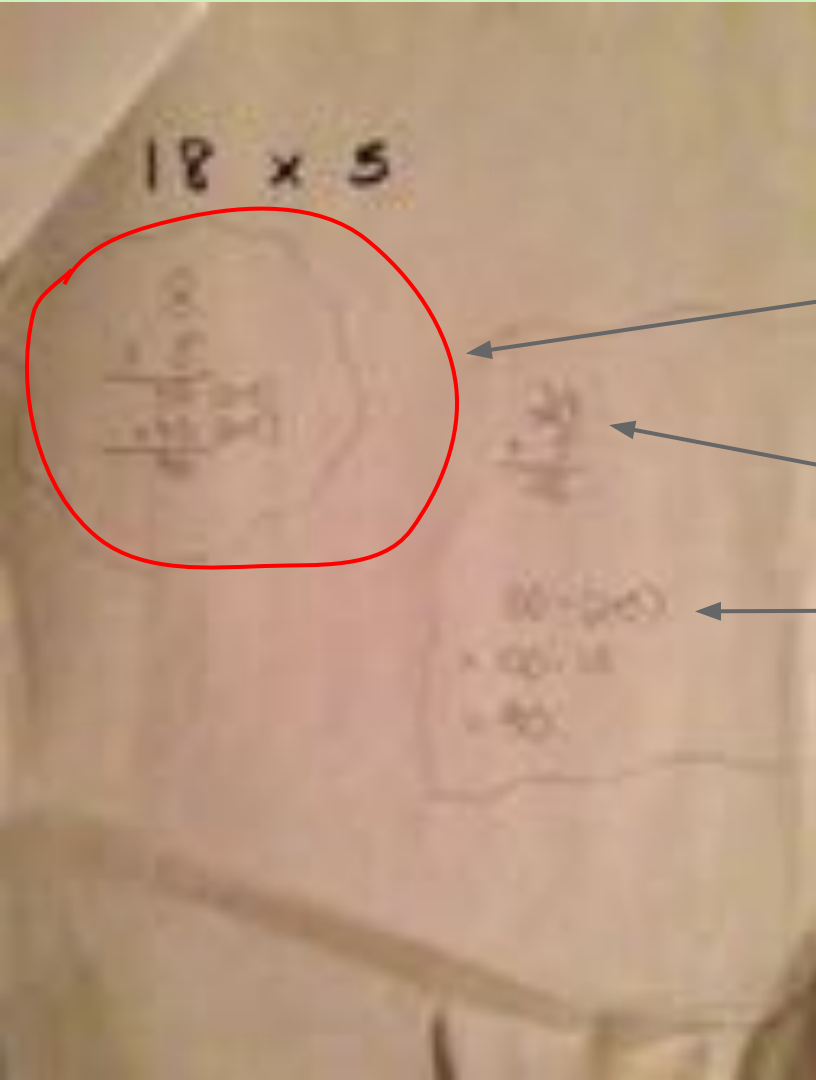
Strategy #3: Dividing and multiplying by 3, then counting by/multiplying by 15s, used as a mental strategy

Strategy #4: Written as traditional algorithm, pattern not shown

**STUDENT #2: Skokie 6th Grader,
Female**

Strategy #2: Prefaced as
"standard algorithm"--doesn't
follow traditional pattern,
demonstrates understanding of
place value, true number sense

Strategy #1: Round up, subtract
extra 5s, used as mental math



Multiplication Problem

- Please try solving the following problems mentally, and then using paper:

$$24 \times 16$$

$$46 \times 13$$

- Now, watch Winnetka Eighth Graders work their way through this problem.

**What do our 8th graders
have to say about
their Winnetka Math Experience?**

Tying It All Together

- High-quality math programs in the 21st century promote mathematical power. This includes:
 - Computational fluency
 - Problem-solving using multiple strategies
 - Reasoning and critical thinking
 - Viewing the world through a mathematician's eyes

Parent Resources

- NCTM: Back to School-The Time to Engage Parents and Families
- Fluency Without Fear: Research Evidence on the Best Ways to Learn Math Facts
- Thinking about Alternative Procedures and Algorithms for Computation
- Common Core Math: A Grade-by-Grade View for Parents

Questions and Exit Slip