Cutting to the Core with the Standards for Mathematical Practice

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Houston, we have a problem!

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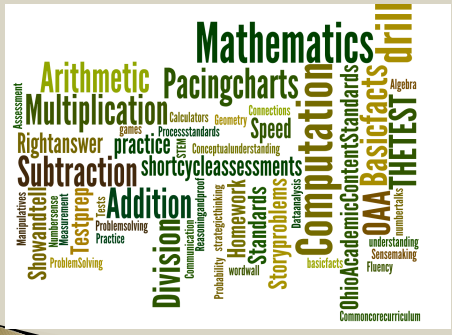
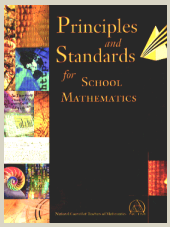


- Problem solving be the focus of school mathematics
- Basic skills -- more than computational facility
- Power of calculators and computers at all grade levels
- Stringent standards of both effectiveness and efficient
- Student learning be evaluated by a wider range of measures than conventional testing
- More mathematics for students
- High level of professionalism
- Public support for mathematics

1989 NCTM Curriculum and Evaluation Standards



2000 NCTM Principles and Standards for School Mathematics

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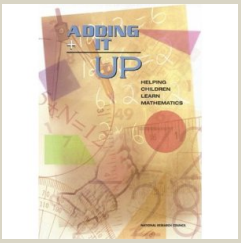
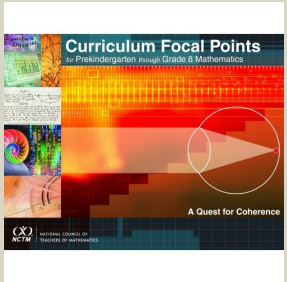
NCTM Process Standards

- Connections
- Communication
- Problem Solving
- Reasoning and Proof
- Representation

How do the processes impact instruction?



2001 National Research Council
www.nap.edu



2006 NCTM

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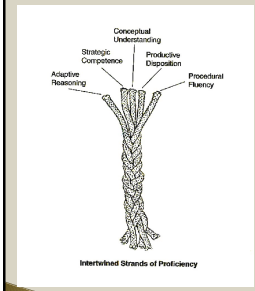
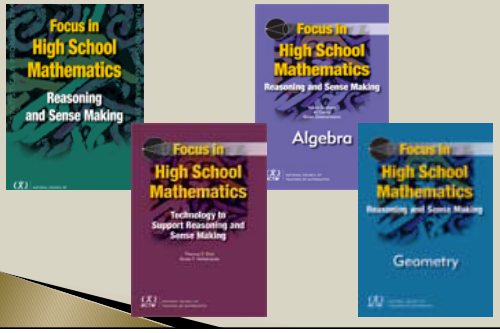
National Research Council's Strands of Proficiency

Adding It Up, 2001



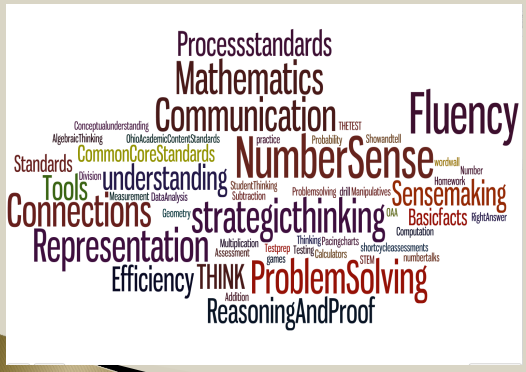
- Adaptive Reasoning
- Strategic Competence
- Conceptual Understanding
- Productive Disposition
- Procedural Fluency

High School



NCTM Process Standards and the CCSS Mathematical Practice Standards

NCTM Process Standards	CCSS Mathematical Practices
Problem Solving	• Make sense of problems and persevere in solving them. • Use appropriate tools strategically
Reasoning and Proof	• Reason abstractly and quantitatively. • Critique the reasoning of others. • Look for and express regularity in repeated reasoning
Communication	• Construct viable arguments
Connections	• Attend to precision. • Look for and make use of structure
Representations	• Model with mathematics.



How do we incorporate the processes/practices into our everyday instruction?

Every student must believe….

"Everything you do in mathematics should make sense to you!"

Number Talk

- A Number Talk is a short, ongoing daily routine that provides students with meaningful ongoing practice with computation
  - helping students develop computational fluency
  - the expectation is that they will use number relationships and the structures of numbers as well as reasoning and sense making to develop a deeper understanding of mathematical ideas

The Goal of Number Talks

- Develop conceptual understanding and computational fluency.
- Student think and reason like mathematicians.
- Students make connections and look for relationships
- Student share their strategies, learning to clarify and express their thinking which leads to developing mathematical language.

Here is a sample:

76 – 54
76 – 55
76 – 48
75 – 48

How to do a number talk

- Number talks should be structured as short sessions alongside the ongoing curriculum.
- 5 to 10 minutes each -- daily
- Not intended to replace current curriculum.
- Most effective when done everyday.

Six step format of a number talk

1. Teacher presents the problem. Problems are presented in many different ways
2. Students are given time to figure out the answer.
3. Students share their answers.
4. Students share their thinking.
5. The class agrees on the "real" answer for the problem.
6. The steps are repeated for additional problems.

The teacher asks questions:

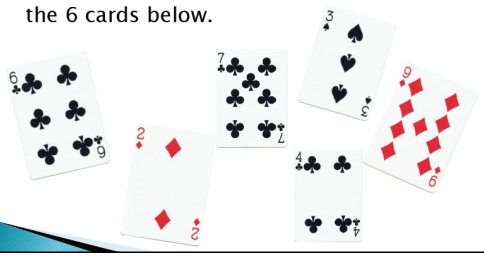
- Who would like to share their thinking?
- Who did it another way?
- How many people solved it the same way as Billy?
- Does anyone have any questions for Billy?
- Billy, can you tell us where you got that 5?
- How did you figure that out?
- What was the first thing your eyes saw, or your brain did?

Show and Tell Addition

$$\begin{array}{r} 32 \\ +\ 26 \\ \hline \end{array} \qquad \begin{array}{r} 46 \\ +\ 59 \\ \hline \end{array}$$

Close to 100

Write an equation using 2 two digit numbers with a sum that is closest to 100. Use 4 of the 6 cards below.



a. $\begin{array}{r} 43 \\ \times\ 2 \\ \hline \end{array}$	b. $\begin{array}{r} 37 \\ \times\ 9 \\ \hline \end{array}$	c. $\begin{array}{r} 20 \\ \times\ 8 \\ \hline \end{array}$
d. $\begin{array}{r} 58 \\ \times\ 7 \\ \hline \end{array}$	e. $\begin{array}{r} 65 \\ \times\ 8 \\ \hline \end{array}$	f. $\begin{array}{r} 32 \\ \times\ 5 \\ \hline \end{array}$
g. $\begin{array}{r} 99 \\ \times\ 4 \\ \hline \end{array}$	h. $\begin{array}{r} 87 \\ \times\ 3 \\ \hline \end{array}$	i. $\begin{array}{r} 42 \\ \times\ 7 \\ \hline \end{array}$
j. $\begin{array}{r} 38 \\ \times\ 4 \\ \hline \end{array}$	k. $\begin{array}{r} 13 \\ \times\ 5 \\ \hline \end{array}$	l. $\begin{array}{r} 39 \\ \times\ 6 \\ \hline \end{array}$
m. $\begin{array}{r} 89 \\ \times\ 7 \\ \hline \end{array}$	n. $\begin{array}{r} 74 \\ \times\ 3 \\ \hline \end{array}$	o. $\begin{array}{r} 62 \\ \times\ 7 \\ \hline \end{array}$

Less … is More

Have a conversation about students' thinking.

28 x 7 =

Growing an idea…

3 x 6
3 x 60
3 x 62
3 x 68
3 x 70

Reasoning with Fractions

$$\frac{1}{2} + \frac{2}{3} =$$

Reasoning with Fractions

$$\begin{array}{r} 5 \\ -2\frac{3}{5} \\ \hline \end{array}$$

Connections: Division of Fractions

$$\frac{4}{5} \div \frac{2}{5}$$

$$\frac{5}{4} \times \frac{2}{5}$$

$$\frac{4}{5} \times \frac{5}{2}$$

Connections: Division of Fractions

$$\frac{4}{5} \div \frac{2}{5}$$

Making Connections

7.836 X 4.92 = 3855312

534.6 X 0.545 = 291357

51.1875 ÷ 1.05 = 4875

3.75 ÷ .05 = 750

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Deal or No Deal

- Marty offers his parents a new deal for his allowance. Rather than getting $5 a week, he suggests they give him 1¢ for the first day, 2¢ for the second day, 4¢ for the third day and so on for the entire month of February. Should Marty's parents accept his deal?

What are the odds?

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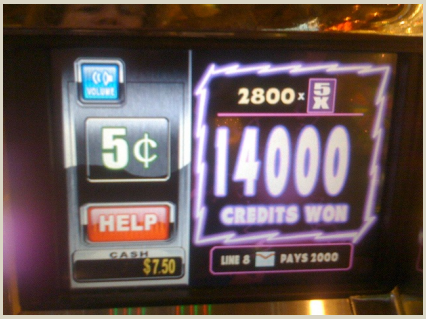
VOLUME
5¢
HELP
CASH
$7.50
2800 x 5
14000
CREDITS WON
LINE 8 PAYS 2000

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