

Number Talks: A Routine Empowering ALL Students

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Why Do Number Talks?

Consider...

$$\begin{array}{r} 17 \\ - 9 \\ \hline \end{array}$$

$$\begin{array}{r} \begin{smallmatrix} 0 & 1 \\ \cancel{1} & 7 \end{smallmatrix} \\ - 9 \\ \hline 8 \end{array}$$

Many who have taught middle school or high school mathematics have bemoaned their students' lack of facility with arithmetic. This is nothing new. Decades of research have shown that the traditional curriculum and instructional methods in the United States have left our students with fragile skills and shallow understanding (Hiebert 1999). And every teacher routinely sees students dependent on rote procedures that they apply mindlessly. Unfortunately, examples like this are common:

$$\begin{array}{r} 07' \\ - 9 \\ \hline 8 \end{array}$$

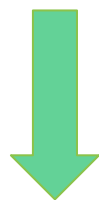
The work here isn't wrong; the algorithm is done correctly, and the answer is right. Yet, it is a bit disturbing that this student went immediately to the algorithm without first thinking

“Computational fluency is **strongly related to number sense** and involves so much more than the conventional view of it encompasses.

Developing students’ computational fluency **extends far beyond having students memorize facts** or a series of steps unconnected to understanding”
(Baroody 2006; Griffin 2005)

Consider...

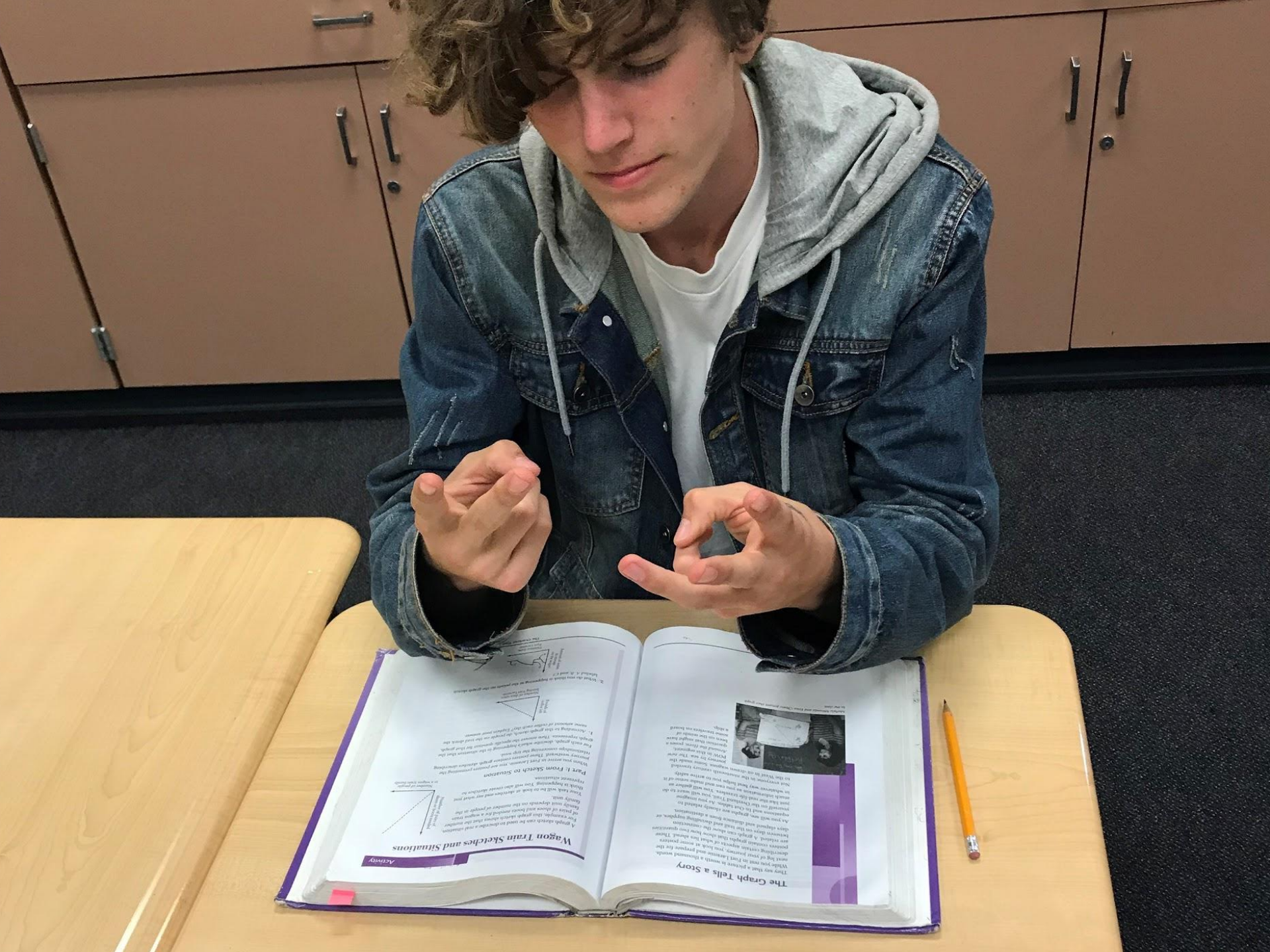
$$276 \div 12 = 23$$



$$(2x^2 + 7x + 6) \div (x + 2) = 2x + 3$$

“Arithmetic algorithms are remarkable tools; they are reliable and efficient and they work with all numbers. The trouble is that their very compactness hides the meaning and complexity of the steps involved” (Hyman Bass 2003, 323)

Our Story



Agenda

- ❑ Our Story
- ❑ Number Talk
- ❑ Challenges
- ❑ Outcomes
- ❑ Action Steps
- ❑ Resources



Problems We Observed

- 80% of our 6th graders lacked basic fact fluency
 - Lacking basic operation skills (addition, subtraction, multiplication, division)
 - No strategies for calculations
 - All known facts based on memory or counting.
-

Number Talk Rules

1. No pencils or paper
2. Silent thinking time
3. Place a fist on chest when thinking
4. Use your fingers to show how many strategies you have
5. We will not start until everyone has at least **1** strategy
6. No raising hands until after the first strategy is shared
7. Hold comments until the end of the Number Talk

Number Talk

112(2) 56(4) 28(8) 14(16)

How might this activity give
access to all students to
participate?

Equality



Equity



What did we do?

- Began in October
- Started with the addition strategy of Friendly 10's
- 10-15 mins daily (*almost*)



Friendly 10s

Katie

$$\begin{array}{r} 9 + 5 \\ 9 \quad 5 \\ \quad \wedge \\ \quad 4 \quad 1 \end{array}$$

$$\begin{aligned} 9 + 1 &= 10 \\ 10 + 4 &= 14 \end{aligned}$$

Connor

$$\begin{array}{r} 9 \\ + 5 \\ \hline 14 \end{array}$$

Brooklyn

$$\begin{aligned} 10 + 5 &= 15 \\ 15 - 1 &= 14 \end{aligned}$$

Rebecca

$$\begin{aligned} 19 + 8 \\ 19 + 1 &= 20 \\ 20 + 8 &= 28 \\ 28 - 1 &= 27 \end{aligned}$$

Shane

$$\begin{array}{r} 19 \quad 8 \\ \quad \wedge \\ \quad 7 \quad 1 \end{array}$$

$$\begin{aligned} 19 + 1 &= 20 \\ 20 + 7 &= 27 \end{aligned}$$

Simone

$$\begin{aligned} 20 + 8 &= 28 \\ 28 - 1 &= 27 \end{aligned}$$

$$28 + 39$$

Slater

$$\begin{array}{r} 28 \quad 39 \\ \wedge \quad \wedge \\ 20 \quad 8 \quad 30 \quad 9 \end{array}$$

$$\begin{aligned} 8 + 9 &= 17 \\ 20 + 30 &= 50 \\ 50 + 17 &= 67 \end{aligned}$$

Dylan

$$\begin{array}{r} 28 \\ + 39 \\ \hline 67 \end{array}$$

Kaydence

$$\begin{array}{r} 28 \quad 39 \\ \wedge \\ 27 \quad 1 \end{array}$$

$$\begin{aligned} 39 + 1 &= 40 \\ 40 + 27 &= 67 \end{aligned}$$

By mid-October...

Dylan

$$\begin{array}{r} 99 + 38 \\ 38 \downarrow \\ 99 + 1 = 100 \\ 100 + 37 = 137 \end{array}$$

Abby

$$\begin{array}{r} 99 \\ + 38 \\ \hline 137 \end{array}$$

← ten

Lily

$$\begin{array}{r} 99 + 38 \\ 100 + 40 = 140 \\ 140 - 3 = 137 \end{array}$$

Colin

$$\begin{array}{r} 98 + 47 \\ 45 \downarrow 2 \\ 98 + 2 = 100 \\ 100 + 45 = 145 \end{array}$$

Valentin

$$\begin{array}{r} 98 + 47 \\ 90 \quad 4 \quad 4 \quad 40 \quad 7 \\ 90 + 7 = 97 \\ 40 + 4 + 4 = 48 \\ 97 + 48 = 145 \end{array}$$

Catie

$$\begin{array}{r} 98 + 47 \\ 90 \quad 8 \quad 90 \quad 7 \\ 90 + 40 = 130 \\ 8 + 7 = 15 \\ 130 + 15 = 145 \end{array}$$

Julien

$$\begin{array}{r} 99 + 98 \\ 1 \quad 97 \\ 99 + 1 = 100 \\ 100 + 97 = 197 \end{array}$$

Alain

$$\begin{array}{r} 99 \rightarrow 100 \\ 98 \rightarrow 100 \\ 100 + 100 = 200 \\ 200 - 3 = 197 \end{array}$$

Aria

$$\begin{array}{r} 99 + 98 \\ 90 \quad 9 \quad 90 \quad 8 \\ 90 + 90 = 180 \\ 9 + 8 = 17 \\ 180 + 17 = 197 \end{array}$$

Alyssa

$$\begin{array}{r} 99 + 99 + 5 \\ 100 + 100 = 200 \\ 200 + 5 = 205 \\ 205 - 2 = 203 \end{array}$$

Eva

$$197 + 6 = 203$$

Ian

$$\begin{array}{r} 99 + 99 + 5 \\ 113 \\ 100 + 100 = 200 \\ 200 + 3 = 203 \end{array}$$

- Decomposing
- Making Friendly 10s
- Compensating
- Standard Algorithm

By February...

Naveen

$$5 \times 5$$

5, 10, 15, 20, 25

Sofia

$$\begin{array}{r} 5 \times 5 \\ \quad \swarrow \searrow \\ \quad 3 \quad 2 \\ + 5 \times 3 = 15 \\ + 5 \times 2 = 10 \\ \hline 5 \times 5 = 25 \end{array}$$

Sean

$$5 \times 10$$
$$5 \times 1 = 5$$
$$= 50$$

Slater

$$5 \times 10$$
$$\begin{array}{r} \quad \swarrow \searrow \\ \quad 5 \quad 5 \\ 5 \times 5 = 25 \\ 25 \times 2 = 50 \end{array}$$

Andy

$$5 \times 29$$
$$5 \times 29$$
$$\begin{array}{r} 20 \quad 9 \\ 5 \times 9 = 45 \\ 5 \times 20 = 100 \\ \hline 5 \times 29 = 145 \end{array}$$

Brooklyn

$$5 \times 10 = 50$$
$$5 \times 10 = 50$$
$$\hline 5 \times 20 = 100$$
$$5 \times 9 = 45$$
$$\hline 5 \times 29 = 145$$

Kate

$$5 \times 30 = 150$$
$$- 5 \times 1 = 5$$
$$\hline 5 \times 29 = 145$$

In April, Fractions

Shane $\frac{2}{3}(54)$

$\frac{2}{3} \cdot \frac{54}{1} = \frac{108}{3}$

Noah $\frac{108}{3} = 36$

Katie $\frac{1}{3}(54)$

$\frac{1}{3} \cdot \frac{54}{1} = \frac{54}{3}$

Coltrane $36 \div 2 = 18$

$\frac{1}{3}$ is half of $\frac{2}{3}$

Alexis $54 \div 3 = 18$

Walter I heard you say, is

Yvona $\frac{1}{6}(54)$

$\frac{1}{6} \cdot \frac{54}{1} = \frac{54}{6}$

Ellie $54 \div 6 = 9$

Eva $18(\frac{1}{2}) = 9$

Katie $\frac{1}{3}(54) = 18$

$\frac{1}{6}$ is half of $\frac{1}{3}$

$18 \div 2 = 9$

$\frac{1}{3} \cdot \frac{1}{2} = \frac{1}{6}$

I'm wondering why

$\frac{4}{6} \div \frac{2}{2} = \frac{2}{3}$

$\frac{4}{6}(54)$

James $\frac{1}{6} \rightarrow \frac{4}{6}$

$9(4) = 36$

Kaylene $\frac{4}{6} \cdot \frac{54}{1} = \frac{216}{6}$

Slater $\frac{108(2) = 216}{3(2) = 6}$

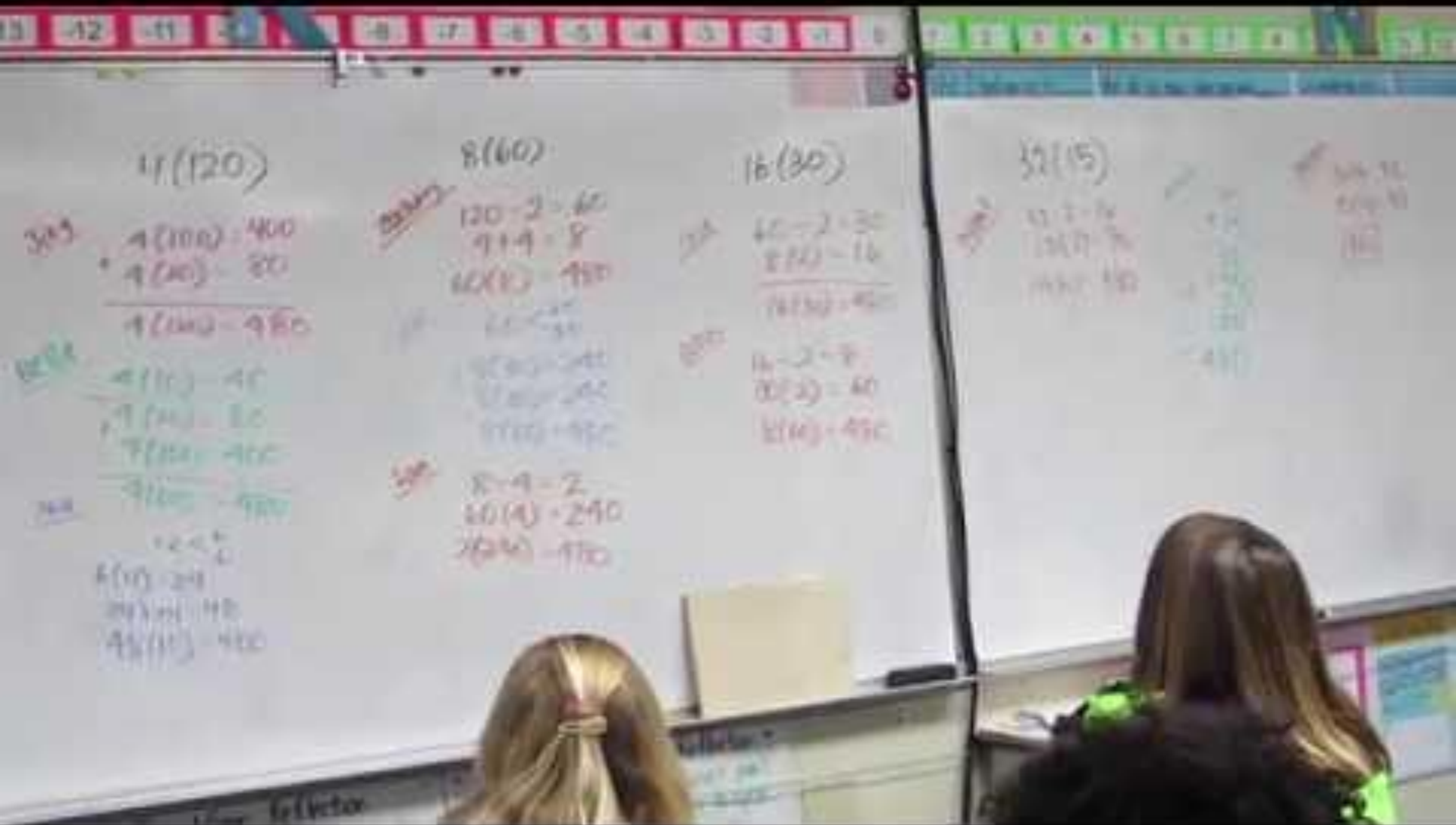
Alexis 18 is $\frac{1}{3}$ of 54

$18(2) = 36$

Where do
YOU see
gaps?

- Addition
 - Multiplication
 - Single-digit
 - Multi-digit
 - Subtraction
 - Division
 - Fractions
 - Decimals
-

Observations & Outcomes



$$4(120)$$

300
 $4(100) = 400$
 $4(20) = 80$
 $4(120) = 480$

100
 $4(10) = 40$
 $4(20) = 80$
 $4(30) = 120$
 $4(40) = 160$
 $4(50) = 200$

120
 $4(10) = 40$
 $4(20) = 80$
 $4(30) = 120$
 $4(40) = 160$
 $4(50) = 200$

$$8(60)$$

120
 $120 - 2 = 118$
 $9 + 9 = 18$
 $60(1) = 60$
 $60(2) = 120$
 $60(3) = 180$
 $60(4) = 240$
 $60(5) = 300$
 $60(6) = 360$
 $60(7) = 420$
 $60(8) = 480$

8
 $8 - 4 = 4$
 $60(4) = 240$
 $2(60) = 120$

$$16(30)$$

120
 $120 - 2 = 118$
 $8(10) = 80$
 $8(20) = 160$
 $8(30) = 240$
 $8(40) = 320$
 $8(50) = 400$
 $8(60) = 480$
 $8(70) = 560$
 $8(80) = 640$
 $8(90) = 720$
 $8(100) = 800$

16
 $16 - 2 = 14$
 $30(2) = 60$
 $30(4) = 120$
 $30(6) = 180$
 $30(8) = 240$
 $30(10) = 300$
 $30(12) = 360$
 $30(14) = 420$
 $30(16) = 480$
 $30(18) = 540$
 $30(20) = 600$

$$32(15)$$

120
 $120 - 2 = 118$
 $16(10) = 160$
 $16(20) = 320$
 $16(30) = 480$
 $16(40) = 640$
 $16(50) = 800$
 $16(60) = 960$
 $16(70) = 1120$
 $16(80) = 1280$
 $16(90) = 1440$
 $16(100) = 1600$

32
 $32 - 2 = 30$
 $15(2) = 30$
 $15(4) = 60$
 $15(6) = 90$
 $15(8) = 120$
 $15(10) = 150$
 $15(12) = 180$
 $15(14) = 210$
 $15(16) = 240$
 $15(18) = 270$
 $15(20) = 300$

16
 $16 - 2 = 14$
 $32(10) = 320$
 $32(20) = 640$
 $32(30) = 960$
 $32(40) = 1280$
 $32(50) = 1600$
 $32(60) = 1920$
 $32(70) = 2240$
 $32(80) = 2560$
 $32(90) = 2880$
 $32(100) = 3200$

What was our Number Talk targeting?

$$4(120)$$

Jay

$$\begin{array}{r} 4(100) = 400 \\ + 4(20) = 80 \\ \hline 4(120) = 480 \end{array}$$

Bella

$$\begin{array}{r} 4(10) = 40 \\ + 4(20) = 80 \\ + 4(100) = 400 \\ \hline 4(120) = 480 \end{array}$$

Ava

$$\begin{array}{r} 12 < \underset{6}{6} \\ 6(4) = 24 \\ 24 + 24 = 48 \\ 48(10) = 480 \end{array}$$

$$8(60)$$

Zachary

$$\begin{array}{r} 120 \div 2 = 60 \\ 4 + 4 = 8 \\ 60(8) = 480 \end{array}$$

Catie

$$\begin{array}{r} 60 < \underset{30}{30} \\ + 8(30) = 240 \\ 8(30) = 240 \\ \hline 8(60) = 480 \end{array}$$

Ian

$$\begin{array}{r} 8 \div 4 = 2 \\ 60(4) = 240 \\ 2(240) = 480 \end{array}$$

$$16(30)$$

Aria

$$\begin{array}{r} 60 \div 2 = 30 \\ 8(2) = 16 \\ \hline 16(30) = 480 \end{array}$$

Colin

$$\begin{array}{r} 16 \div 2 = 8 \\ 30(2) = 60 \\ 8(60) = 480 \end{array}$$

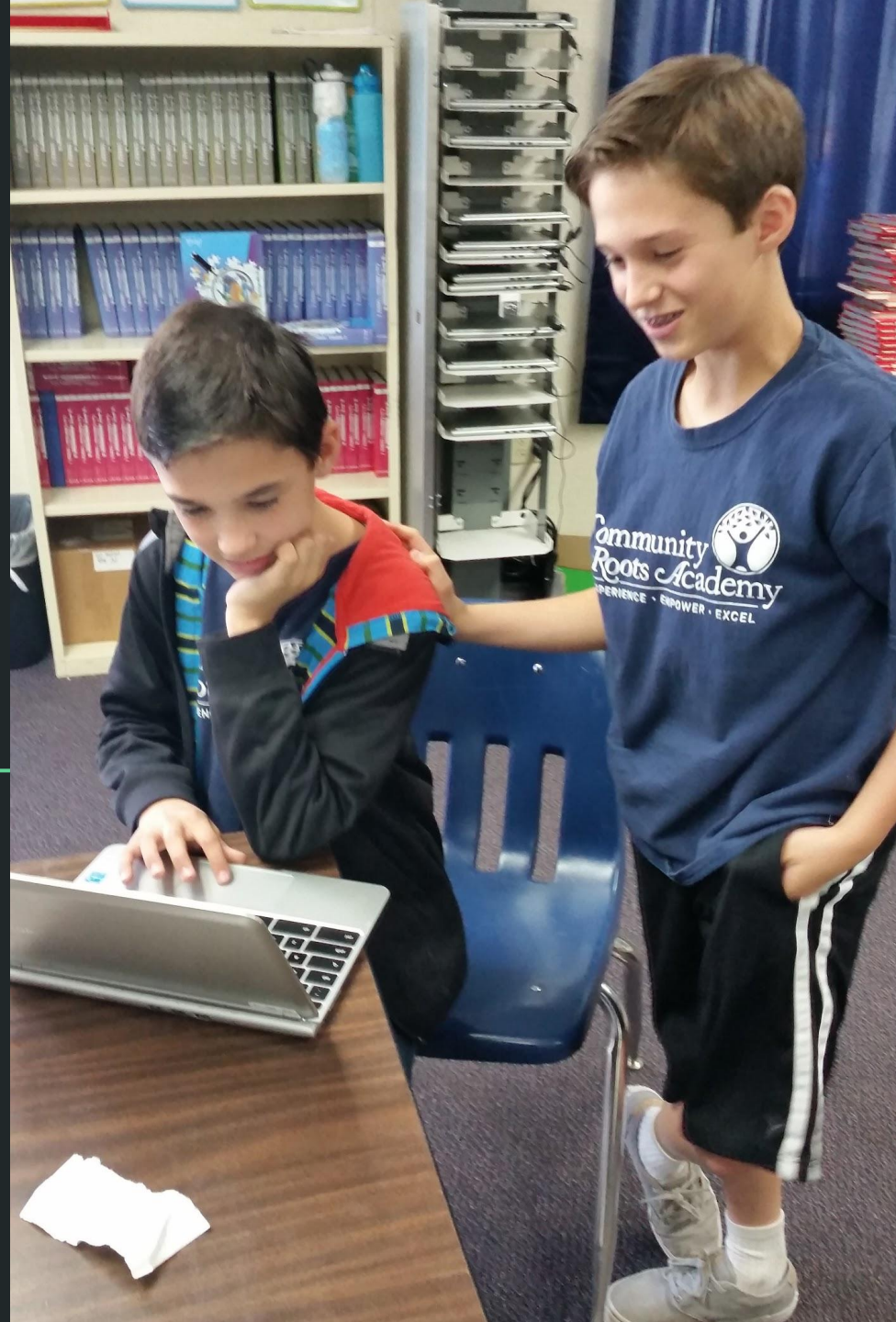
$$32(15)$$

Dylan F.

$$\begin{array}{r} 32 \div 2 = 16 \\ 15(2) = 30 \\ 16(30) = 480 \end{array}$$

Alexis

$$\begin{array}{r} 32 \\ \times 15 \\ \hline 160 \\ + 1920 \\ \hline 480 \end{array}$$



Outcomes

- Strategies for approaching problems
- Number sense
- Use of academic language
 - Place value
 - Making one vs. canceling out
- Understanding of standard algorithms
- Access to grade level math
- Addresses misconceptions
- Confidence



75% of our
students were
FLUENT in their
facts by the end
of the year!

- Strategies for approaching

er se
mic language

vs.

ing of standard

to grade-level math

Adds misconceptions

- Confidence

Application

Notating Student Strategies

67(8)

Notating Student Strategies

Shane

$$67(8)$$

$$67 \overset{60}{<} 7$$

$$\begin{array}{r} 60(8) = 480 \\ + \quad 7(8) = 56 \\ \hline 67(8) = 536 \end{array}$$

$$\begin{aligned} &60(8) + 7(8) \\ &= 480 + 56 \\ &= 536 \end{aligned}$$

Sample Pre-Plan

112(2)

$$112 + 112 = 224$$

$$\begin{array}{r} 100(2) = 200 \\ + 10(2) = 20 \\ \hline 2(2) = 4 \\ \hline 112(2) = 224 \end{array} \quad \begin{array}{r} 100(2) + 10(2) + 2(2) \\ = 200 + 20 + 4 \\ = 224 \end{array}$$

$$\begin{array}{r} 112 \\ \times 2 \\ \hline 224 \end{array}$$

$$\begin{array}{r} 112 \\ \times 2 \\ \hline 224 \end{array}$$

56(4)

$$\begin{array}{r} 50(4) = 200 \\ + 6(4) = 24 \\ \hline 56(4) = 224 \end{array} \quad \begin{array}{r} 50(4) + 6(4) \\ = 200 + 24 \\ = 224 \end{array}$$

$$56(2) = 112 > 112(2) = 224$$

$$4 \div 2 = 2$$

$$\begin{array}{r} 56 \\ \times 4 \\ \hline 224 \end{array}$$

$$\begin{array}{r} 56 \\ \times 4 \\ \hline 224 \end{array}$$

28(8)

$$\begin{array}{r} 20(8) = 160 \\ + 8(8) = 64 \\ \hline 28(8) = 224 \end{array} \quad \begin{array}{r} 20(8) + 8(8) \\ = 160 + 64 \\ = 224 \end{array}$$

$$28(2) = 56 > 56(4) = 224$$

$$8 \div 2 = 4$$

$$28(4) = 112 > 112(2) = 224$$

$$8 \div 4 = 2$$

$$\begin{array}{r} 28 \\ \times 8 \\ \hline 224 \end{array}$$

$$\begin{array}{r} 28 \\ \times 8 \\ \hline 224 \end{array}$$

14(16)

$$\begin{array}{r} 14(10) = 140 \\ + 14(6) = 84 \\ \hline 14(16) = 224 \end{array} \quad \begin{array}{r} 14(10) + 14(6) \\ = 140 + 84 \\ = 224 \end{array}$$

$$\begin{array}{r} 10(16) = 160 \\ + 4(16) = 64 \\ \hline 14(16) = 224 \end{array} \quad \begin{array}{r} 10(16) + 4(16) \\ = 160 + 64 \\ = 224 \end{array}$$

$$14(2) = 28 > 28(8) = 224$$

$$16 \div 2 = 8$$

$$14(4) = 56 > 56(4) = 224$$

$$16 \div 4 = 4$$

$$14(8) = 112 > 112(2) = 224$$

$$16 \div 8 = 2$$

$$\begin{array}{r} 14 \\ \times 16 \\ \hline 224 \end{array}$$

$$\begin{array}{r} 14 \\ \times 16 \\ \hline 224 \end{array}$$

key

- ☒ Repeated addition
- ☒ Decomposing / Distributive Property
- ☒ Standard Algorithm
- ☒ Standard Algorithm w/ Place value
- ☒ connection to previous problem

Number Talks - Tips

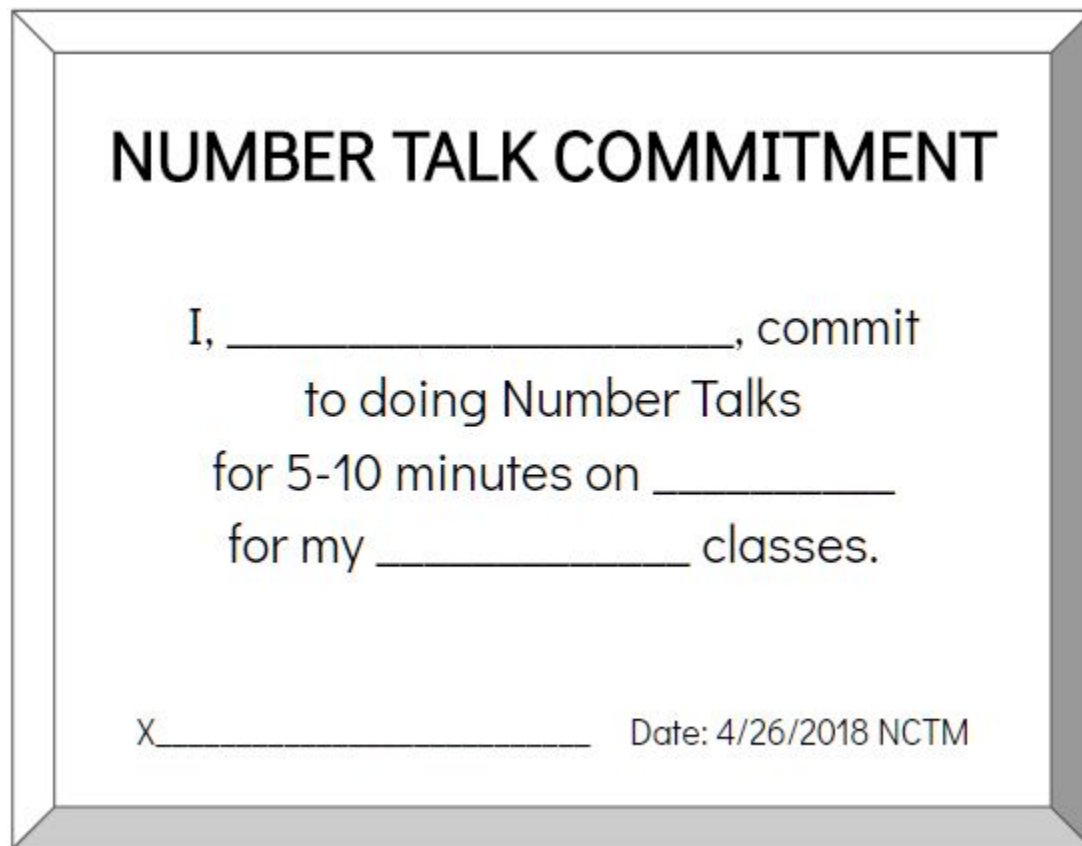
- Commit the time **daily** for at least 2 weeks.
- **Pose** a problem in written form.
- Provide appropriate **wait time** for students to access the problem.
- **Accept**, **respect** and **consider** all answers.
- Encourage student **communication** throughout the talk.

Source: *Number Talks* by Sherry Parrish

How can you start?

1. Look for gaps
 - a. Formative assessments
 - b. Classwork
 - c. “Show your work”
 2. Consider which topic or operation to start with
 3. Consider what strategies students may come up with
 4. Commit 10-15 mins of your class time DAILY!
-

Let's put it into action NOW!



NUMBER TALK COMMITMENT

I, _____, commit
to doing Number Talks
for 5-10 minutes on _____
for my _____ classes.

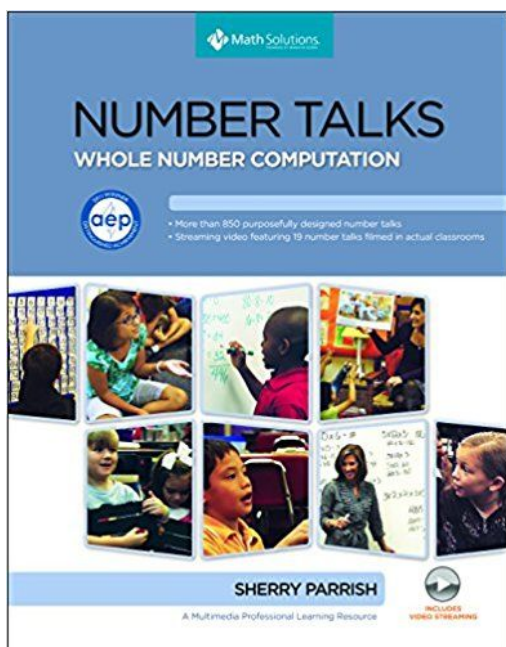
X_____ Date: 4/26/2018 NCTM

Resources

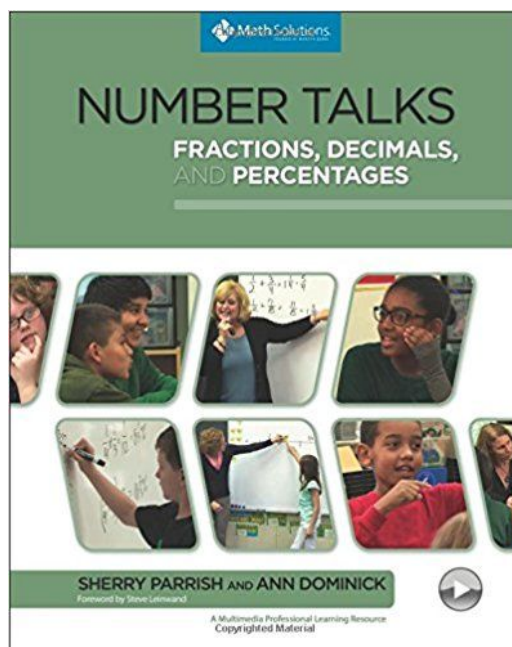
FactsWise

by Val Henry

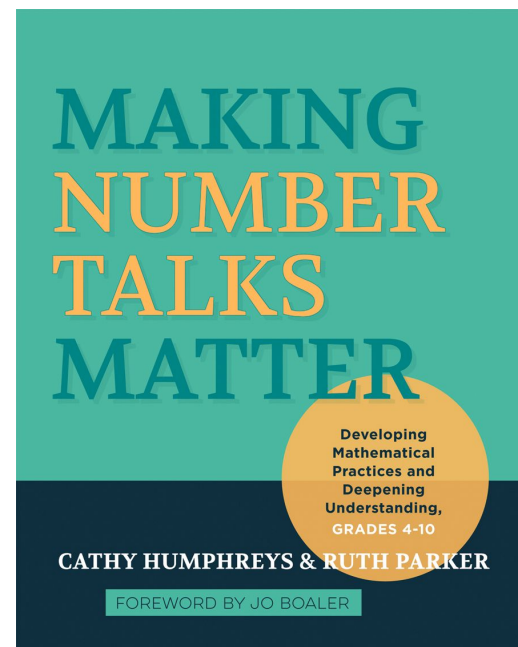
factswise.blogspot.com



<http://a.co/hrycagv>



<http://a.co/2XQszuW>



<http://a.co/2V5cXSL>

Music by our students! Search **Mt. Pool** on Spotify!



Connection to the Standards

Common Core Math 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

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