LEVERAGING STUDENT STRATEGIES

63rd Northwest Mathematics Conference · Whistler, BC

Sea to Sky
Landscapes for Learning Mathematics

Chad Williams

Slides: Handouts:

1

Welcome

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2

Prairie Spirit School Division — Learners for Life
Government of Saskatchewan — Ministry of Education
University of Saskatchewan
Beyond Leveled Books
Dyslexia Canada
Beyond the Algorithm
Saskatchewan Mathematics Teachers' Society
Pearson mathology
Represent

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HOW DO YOU PROGRESS TO ADDITION & SUBTRACTION?

4

LEARNING TRAJECTORY
EQUALITY
MODELS VS STRATEGIES

COUNTING PRINCIPLES → WAYS TO SHOW NUMBERS → ADDITION & SUBTRACTION

- Stable order
- Order irrelevance
- Conservation
- Subitizing
- One-to-one
- Cardinality
- Hierarchical Inclusion
- Unitizing

- Standard form
- Build It
- Base Ten Blocks
- Base Ten Name
- Expanded Form
- Place Value

- Meaning
- Relationships
- Ways to construct knowledge
- Children's inventions
- Strategies that have legs
- Properties
- Problem types
- Reasonableness

5

OUR JOURNEY TOGETHER

- What is Number Talks
- The Structure
- Tweak
- Extension
- Questions

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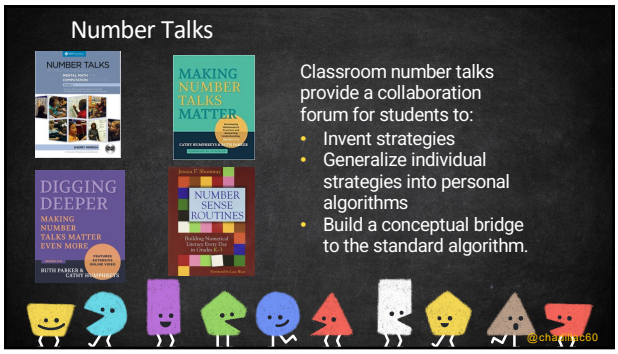
Number Talks
Classroom number talks provide a collaboration forum for students to:
• Invent strategies
• Generalize individual strategies into personal algorithms
• Build a conceptual bridge to the standard algorithm.
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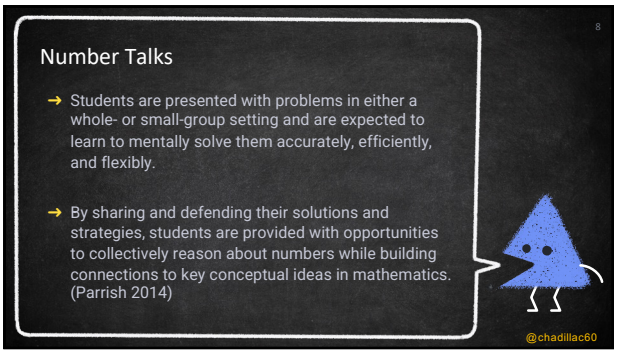
Number Talks
→ Students are presented with problems in either a whole- or small-group setting and are expected to learn to mentally solve them accurately, efficiently, and flexibly.
→ By sharing and defending their solutions and strategies, students are provided with opportunities to collectively reason about numbers while building connections to key conceptual ideas in mathematics. (Parrish 2014)
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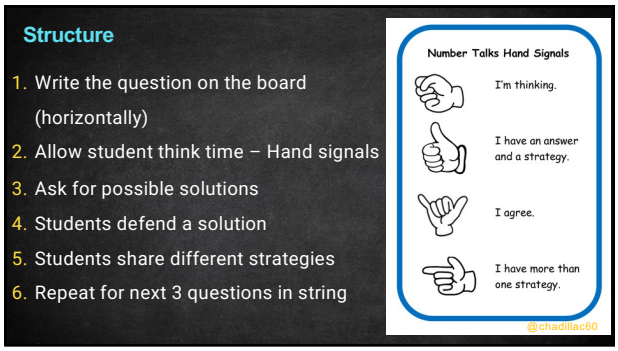
Structure
1. Write the question on the board (horizontally)
2. Allow student think time – Hand signals
3. Ask for possible solutions
4. Students defend a solution
5. Students share different strategies
6. Repeat for next 3 questions in string
Number Talks Hand Signals
I'm thinking.
I have an answer and a strategy.
I agree.
I have more than one strategy.
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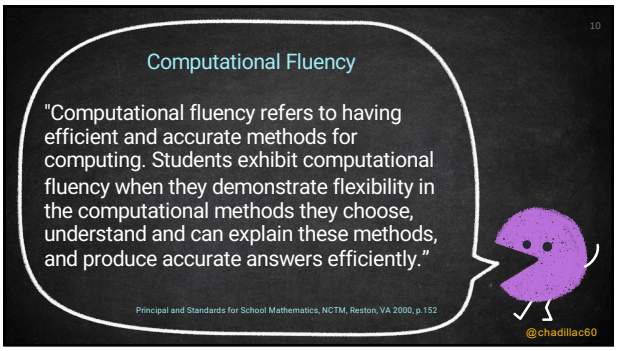
Computational Fluency
"Computational fluency refers to having efficient and accurate methods for computing. Students exhibit computational fluency when they demonstrate flexibility in the computational methods they choose, understand and can explain these methods, and produce accurate answers efficiently."
Principal and Standards for School Mathematics, NCTM, Reston, VA 2000, p.152
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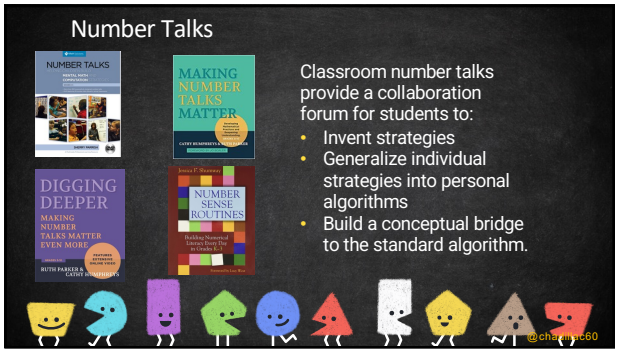
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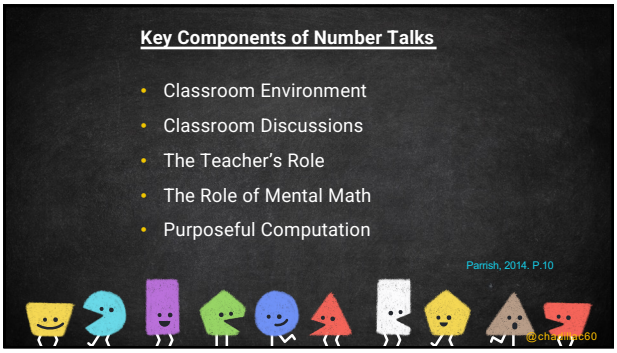
Key Components of Number Talks
• Classroom Environment
• Classroom Discussions
• The Teacher's Role
• The Role of Mental Math
• Purposeful Computation
Parrish, 2014. P.10
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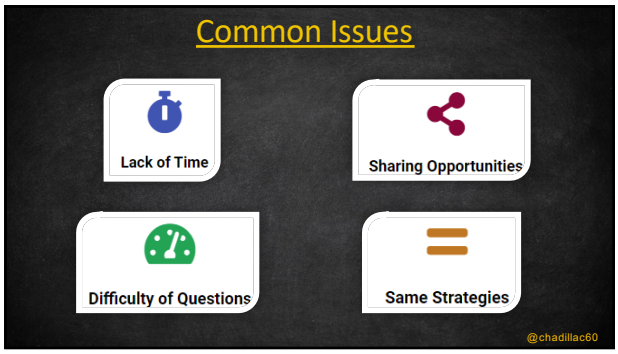

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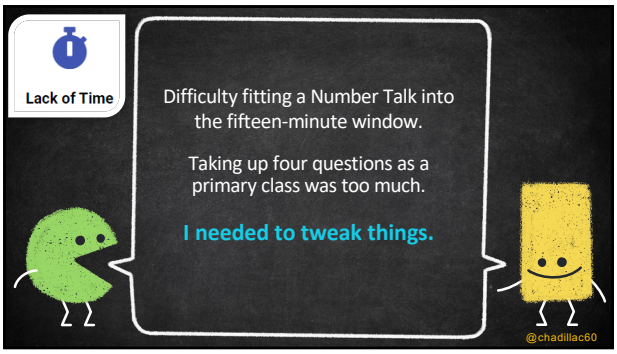

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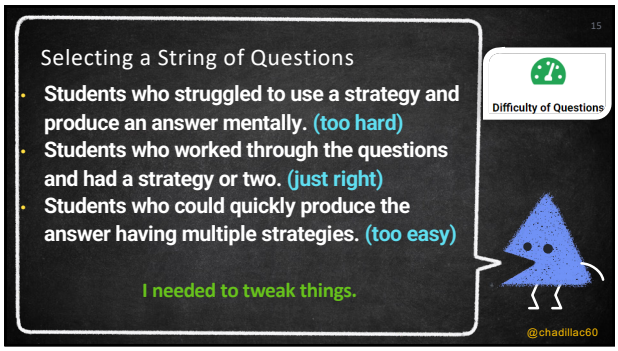

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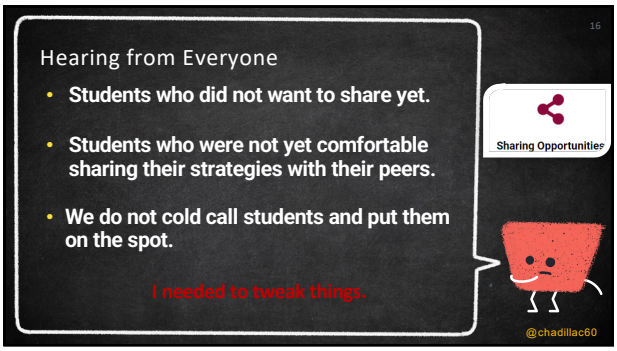

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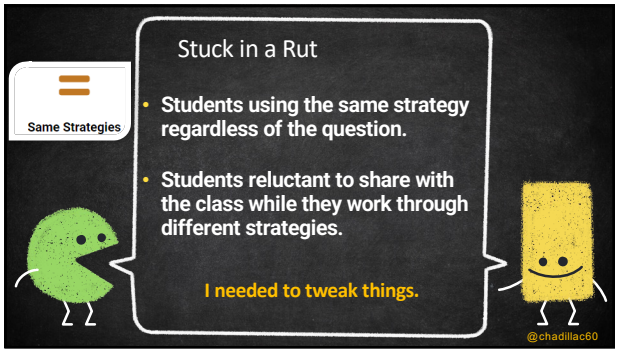

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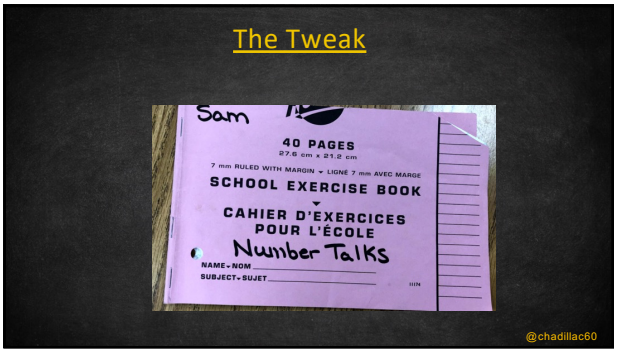

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Tweak to the Structure

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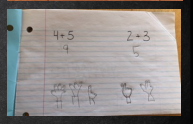
- As a class we do two questions on the board
- Students do two questions in the Number Talk Booklets
- Color coding makes it quicker and easier for students to grab them off of the table.
- Five minutes set (timer or keep track myself)
- Students hand in their booklets when they are finished
- Begin working on open ended task or get themselves ready for next lesson.



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The Number Talk Booklet

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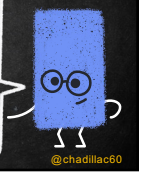
- Allows students to share strategies daily
- Ensures each students had 2 questions at their level
- Quickly see how students are solving particular questions
- Information given to plan next steps
- Shows growth and learning journey
- Nudge students in their thinking and different strategies
- Builds confidence in students to share
- A product of their thinking and learning



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Share Strategies

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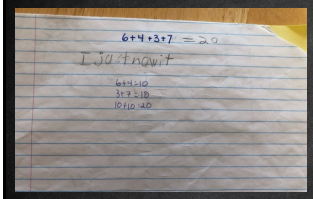

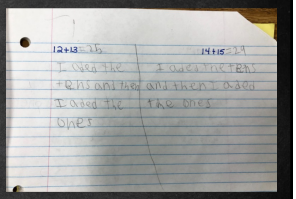

"The Number Talks booklet gives me a chance to share my strategy if I don't get to in class

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Personalized Questions

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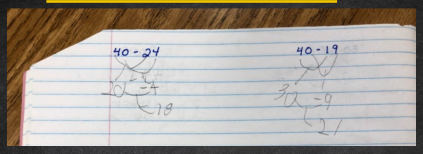

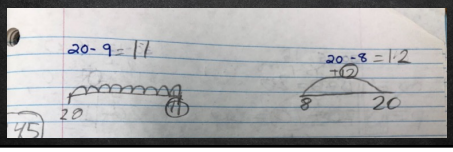

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A Glance at Strategies

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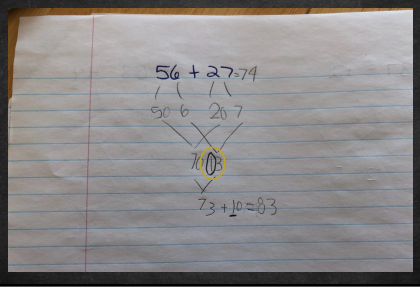

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Vital Information

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Name	23 + 15	56 + 27	26 + 58
Jaslyn	Count on	BTB	-----
Precious	PV	*PV	PV
Jerome	Chunk	Comp	BA

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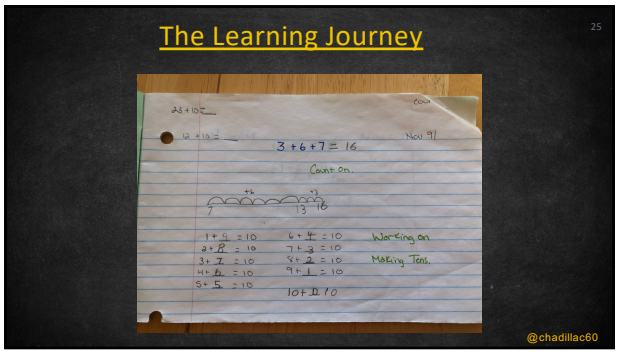

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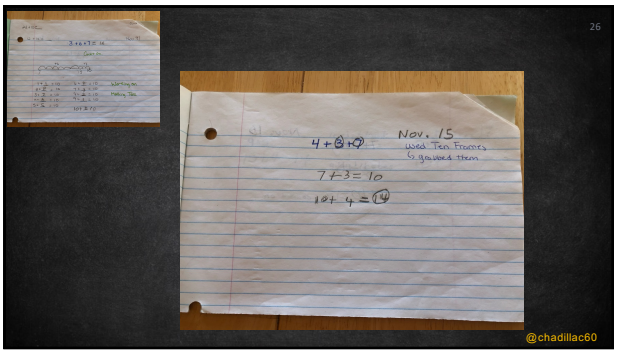

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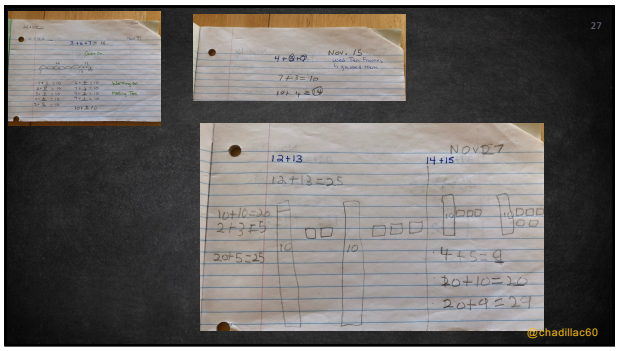

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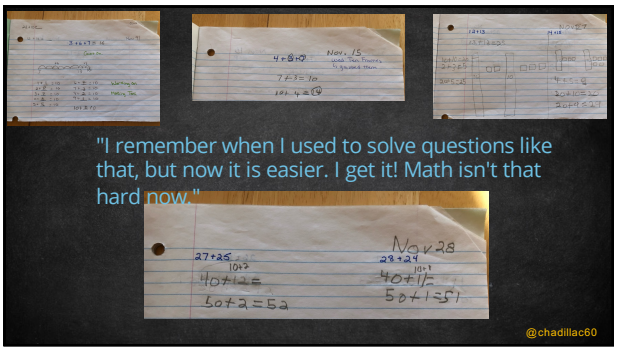

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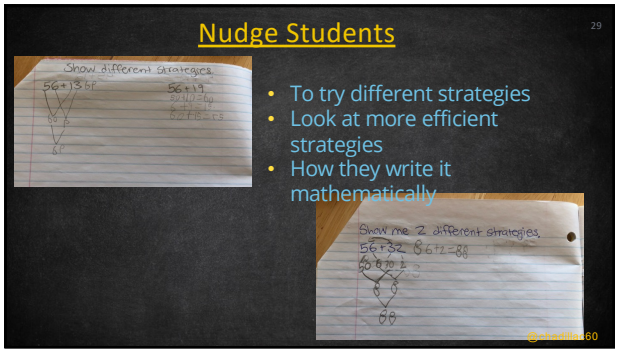

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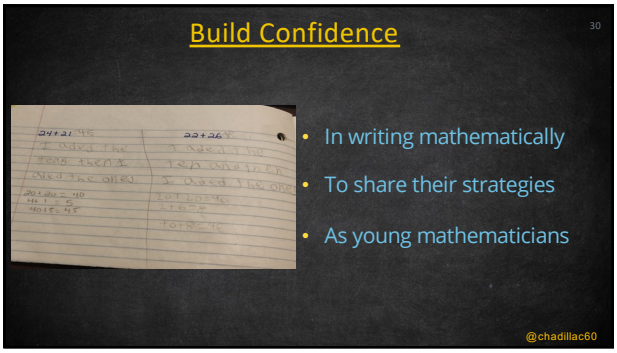

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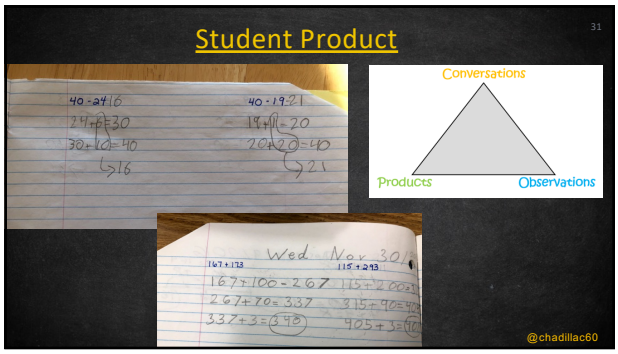

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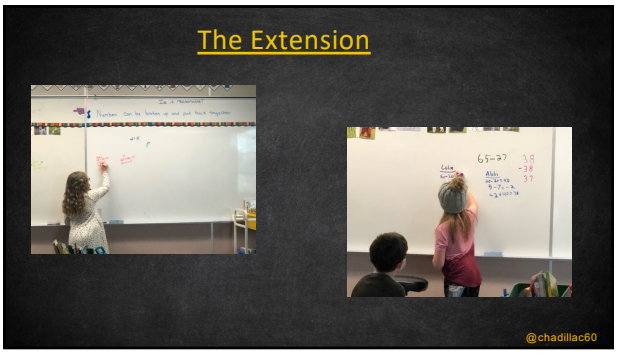

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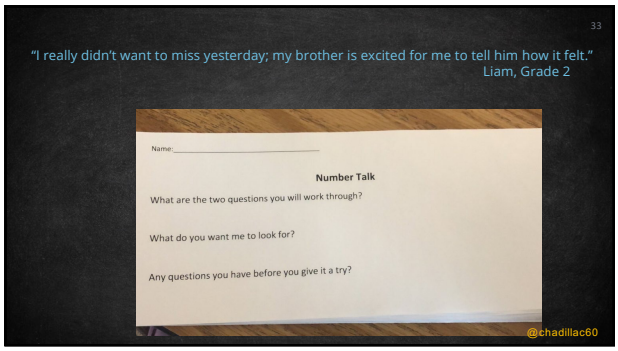

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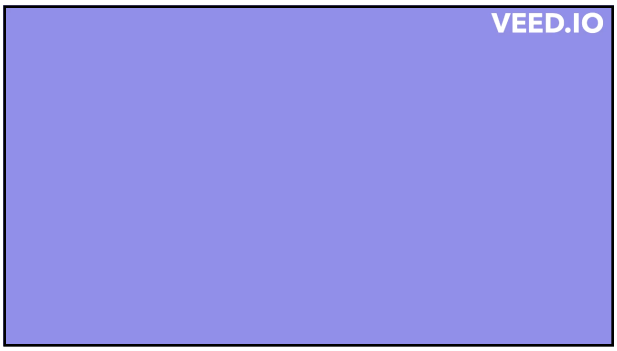

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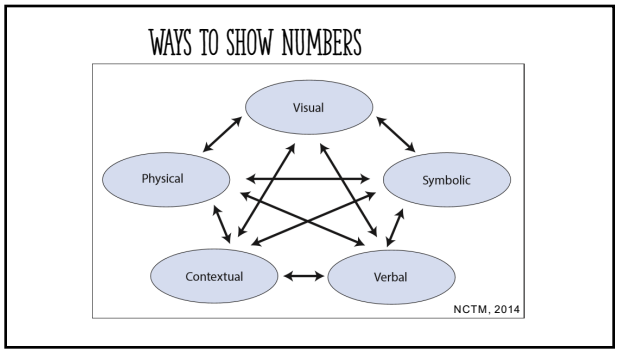

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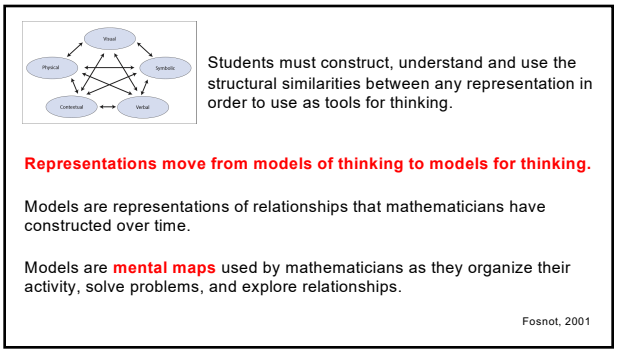

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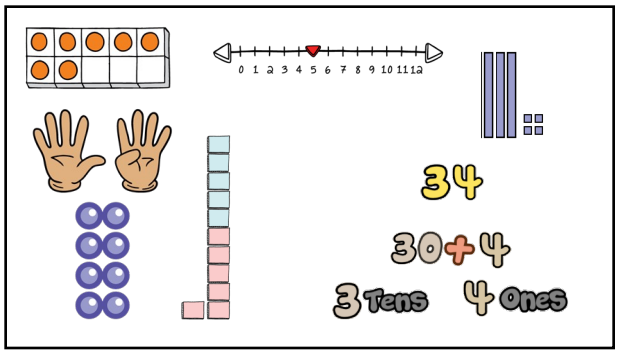

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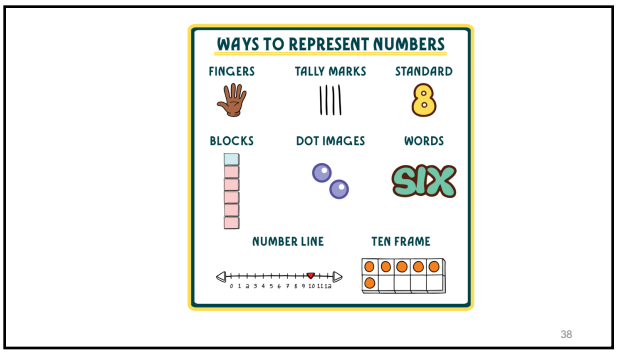

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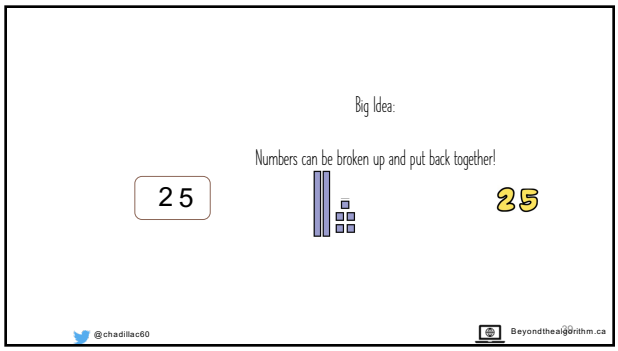

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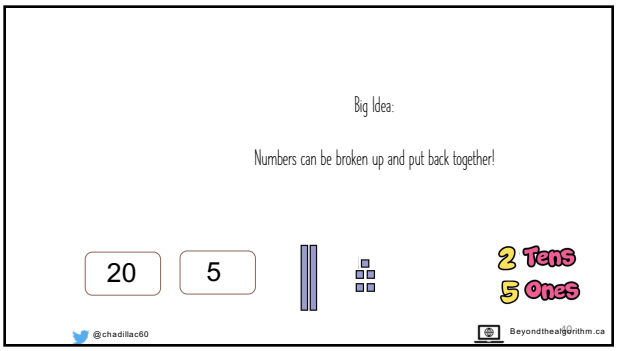

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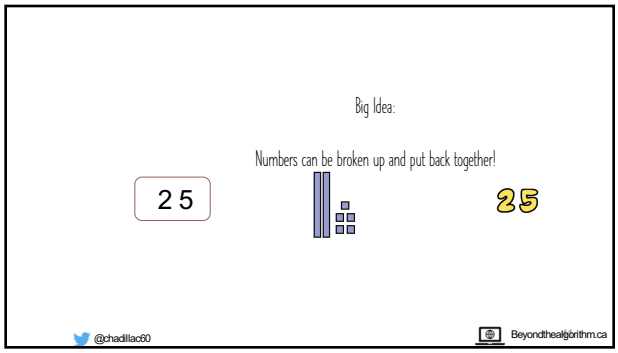

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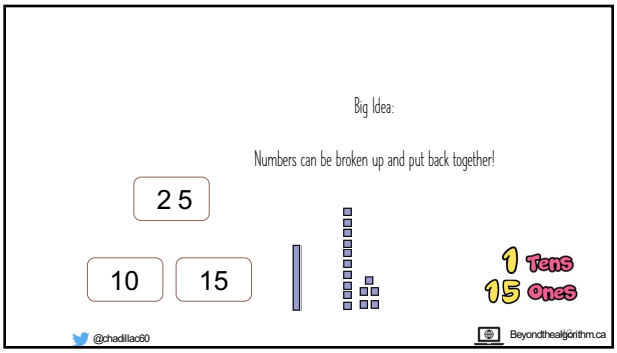

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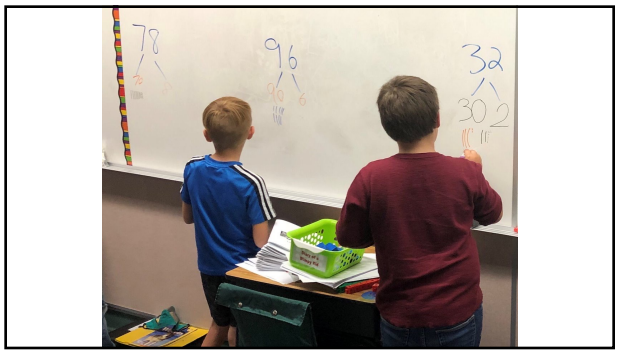

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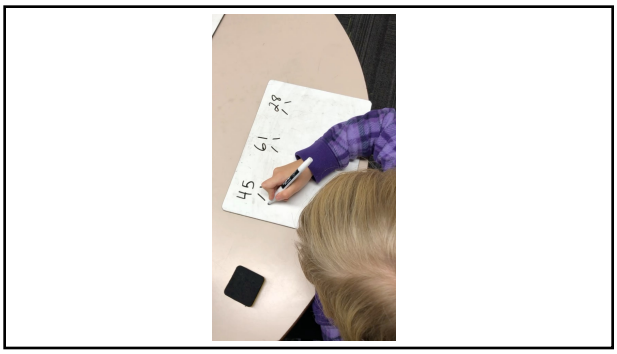

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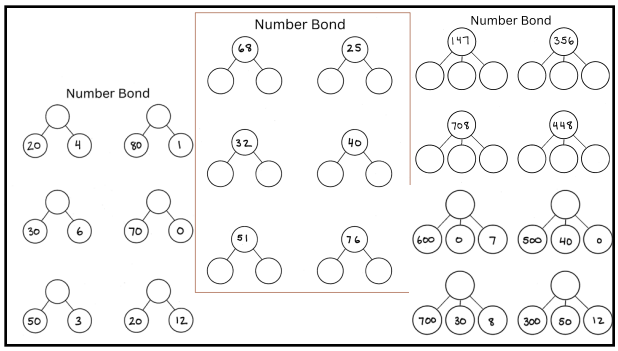

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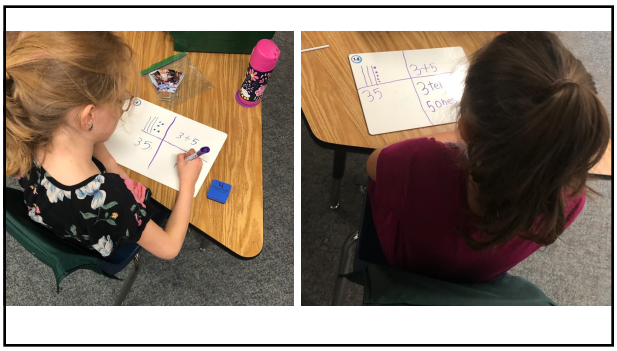

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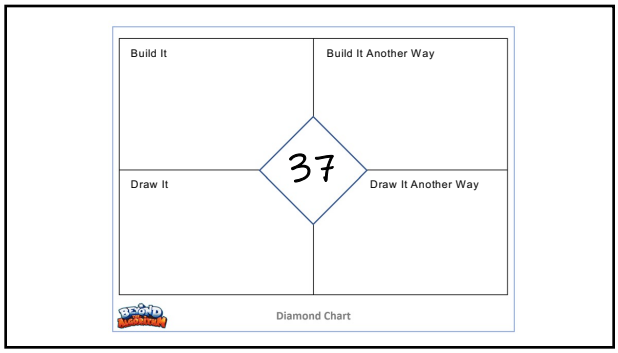

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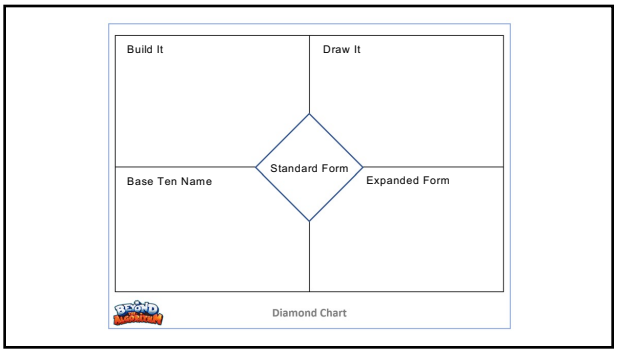

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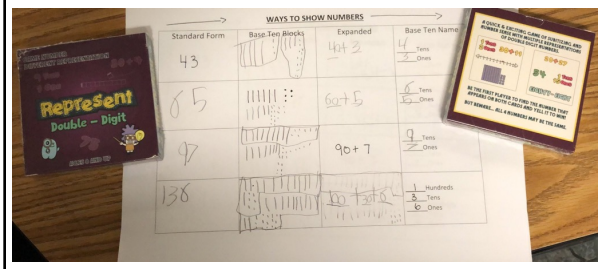

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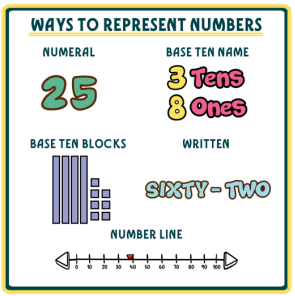

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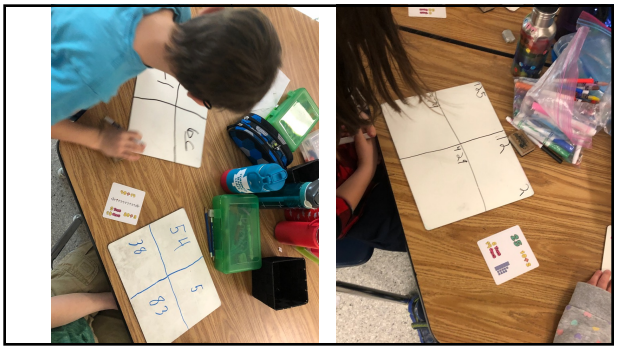

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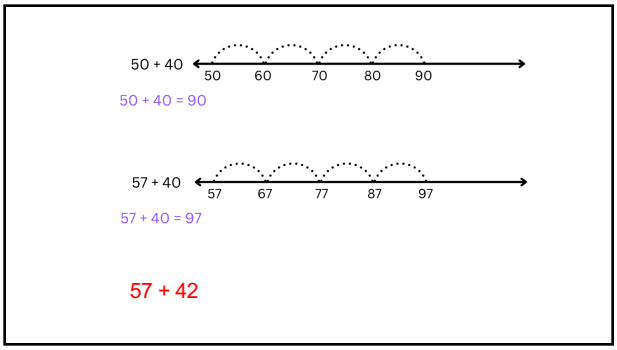

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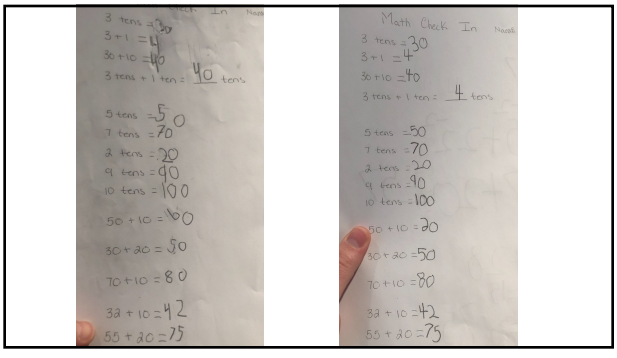

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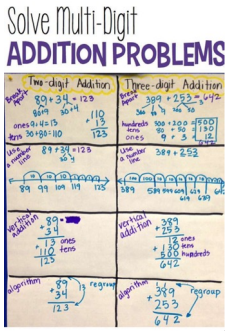
Strategies and models are not the same thing when solving a math problem. When we solve problems mentally, we need a way to show others how we solved the problem which we do through models.

A **strategy** is how you solve the problem.

A **model** is how you show the problem or your strategy.



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"Teachers often **confuse tools with strategies**. Unifix cubes or base ten blocks or paper and pencil are not different strategies. They are different tools. **Representing** the problem with stacks of Unifix cubes grouped into tens, or with base ten blocks, or by writing "10" seven times are all the **same mathematically**. No benefit is derived by changing tools unless the new tool helps the child develop a **higher level of schematizing**..."

Fosnot and Dolk,
Young Mathematicians at Work: Constructing Number Sense, Addition, and Subtraction, p. 21

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ADDITION

What is Addition?

Addition is the process of combining two or more things together.

Addend + Addend = Sum

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What are the Common Properties of Addition?

COMMUTATIVE	ASSOSCIATIVE
The order of the addends **does not** matter when finding the sum. If you count 5 buttons first, then three buttons it **is the same amount** as if you counted 3 buttons first then five buttons. Ex) 5 + 3 = 3 + 5	The sum is the same regardless how the addends are grouped. If you add 4 blocks and two blocks together, then add one more you get the same amount as if you add 2 blocks and 1 block together, then add 4 more blocks. Ex) (4 + 2) + 1 = 4 + (2 + 1)

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Which strategies have legs?

Count On

Standard / Expanded Algorithm

Partial Addends / Place Value

Making Tens

Doubles / Near Doubles

Break Apart Only One Number

Friendly Numbers

Known Facts

Count All 3 Times

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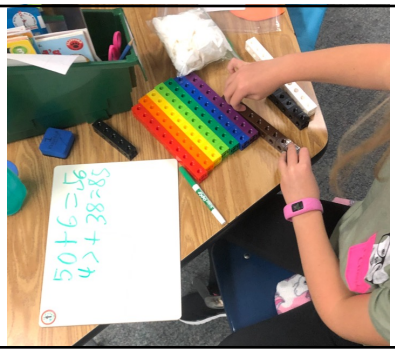

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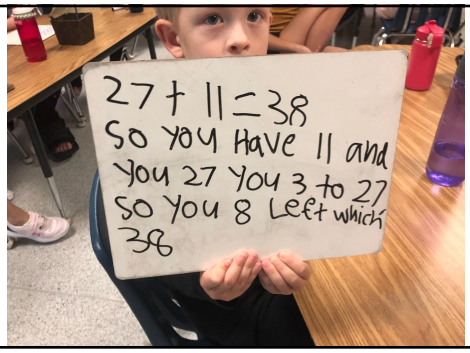

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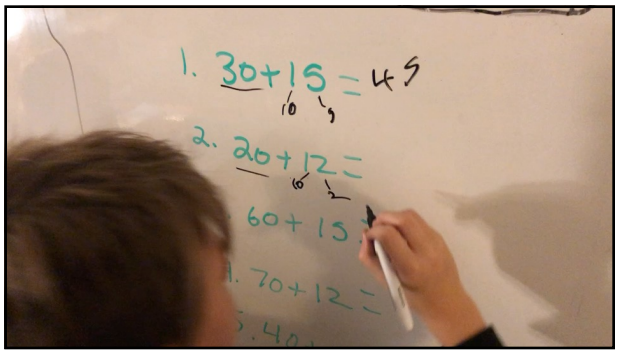

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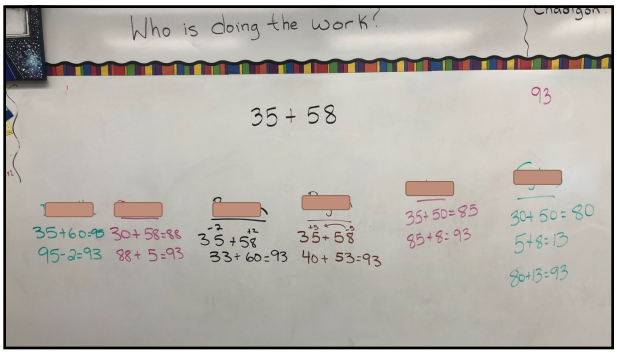

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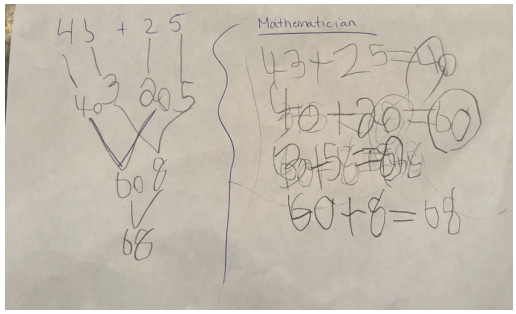

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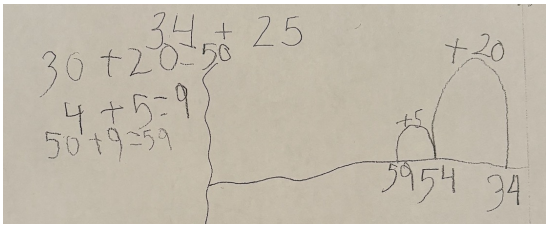

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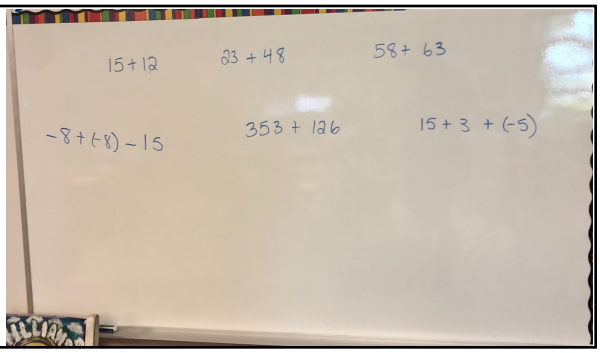

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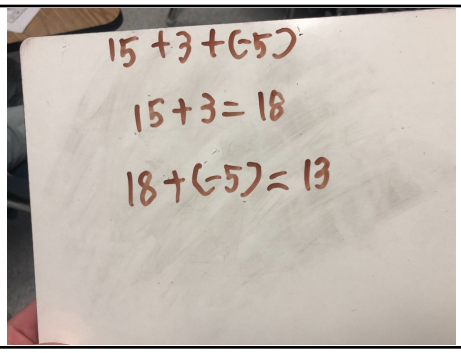

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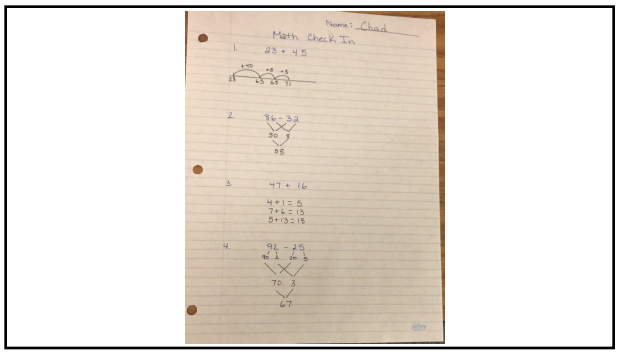

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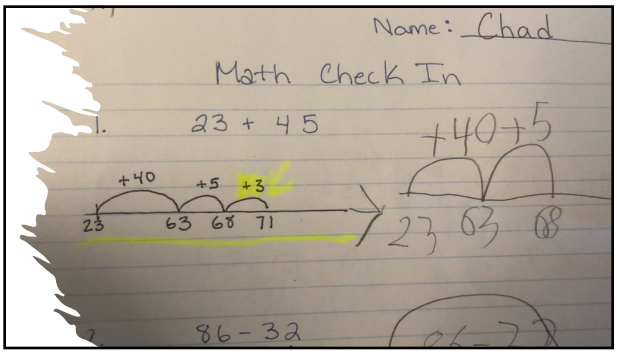

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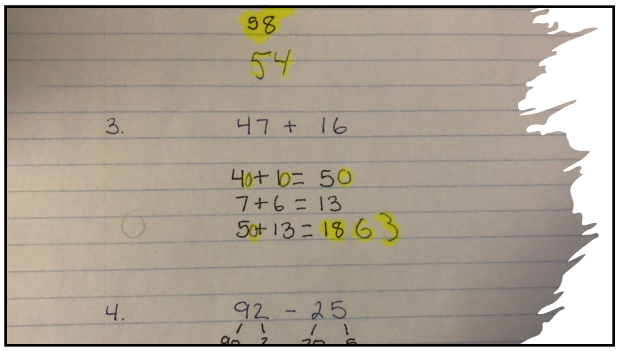

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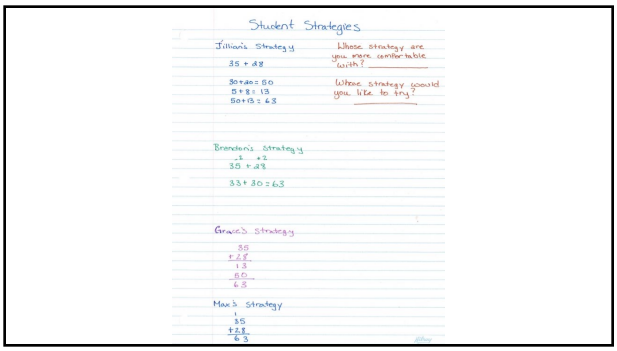

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SUBTRACTION

What is Subtraction?

Subtraction is the "inverse" of addition and it undoes what addition accomplishes. Subtraction is finding the difference between two quantities. Subtraction can be interpreted the following ways: 1) take away, 2) comparison, and 3) the distance between two thing 4) missing addend (addition).

Minuend - Subtrahend = Difference

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What are the Common Properties of Subtraction?

COMMUTATIVE	ASSOCIATIVE
The order **does** matter when you subtract. If you have 5 buttons and remove 3 buttons **it is not the same** amount as if you had 3 buttons and removed 5 buttons. Ex) 5 - 3 ≠ 3 - 5	The difference **is not the same** regardless how the quantities are grouped. Ex) (4 - 2) - 1 ≠ 4 - (2 - 1) (3) – 1 ≠ 4 – (1) 2 ≠ 3

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Which strategies have legs?

Count Back

Standard / Expanded Algorithm

Constant Difference

Place Value

Negative Numbers

Adding Up

Adjusting One Number

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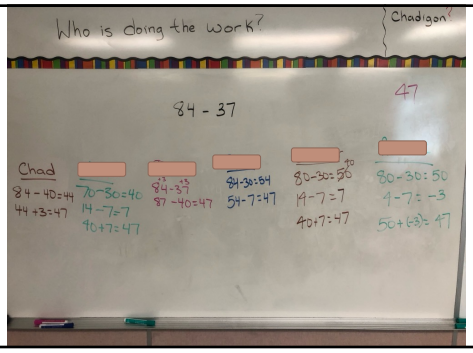

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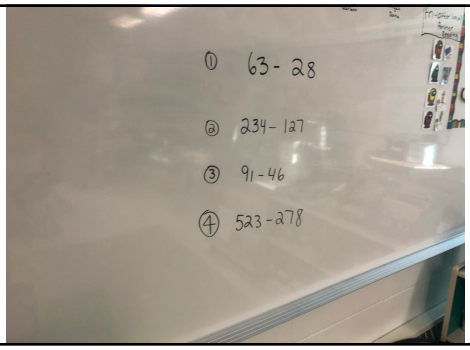

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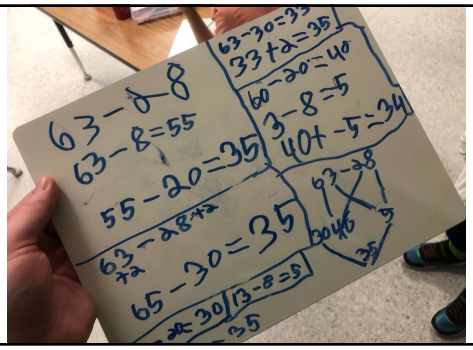

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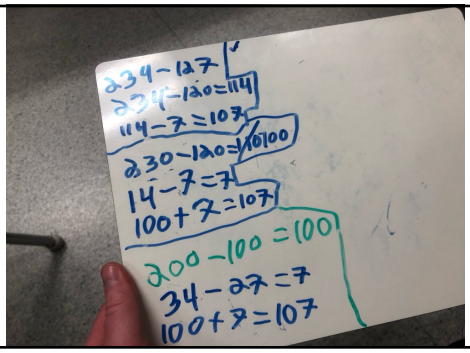

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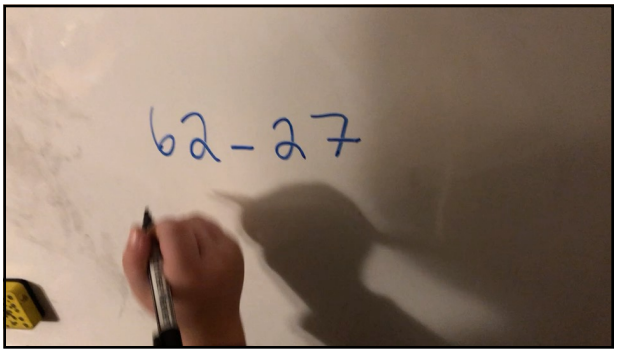

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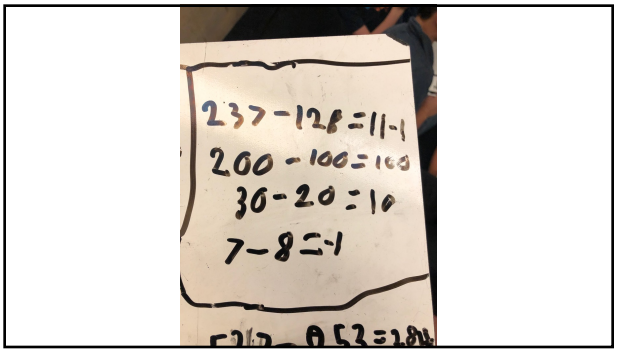

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LEARNING TRAJECTORY | EQUALITY | MODELS VS STRATEGIES

COUNTING PRINCIPLES | WAYS TO SHOW NUMBERS | ADDITION & SUBTRACTION

- Stable order
- Order irrelevance
- Conservation
- Subitizing
- One-to-one
- Cardinality
- Hierarchical Inclusion
- Unitizing

- Standard form
- Build It
- Base Ten Blocks
- Base Ten Name
- Expanded Form
- Place Value

- Meaning
- Relationships
- Ways to construct knowledge
- Children's inventions
- Strategies that have legs
- Properties
- Problem types
- Reasonableness

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PROGRESSION

- Number Talks
- Patterning | Ways to Show # | Add & Sub
- Fact Fluency
- Problem Solving

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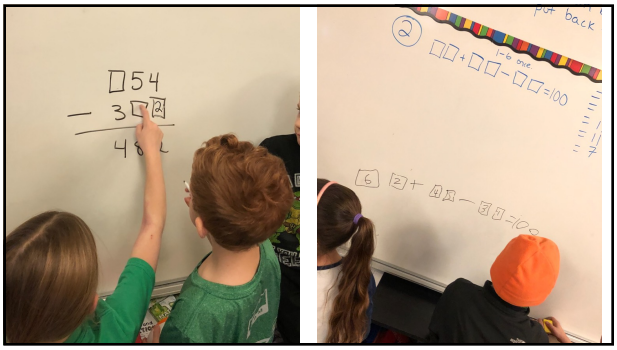

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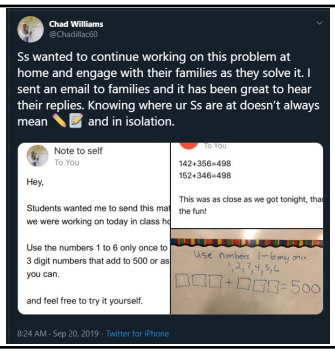

Use the digits 1-6 only once to come up with two 3-digit numbers that add up to 500 or as close as you can.

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Sent: Monday, September 23, 2019 8:17:00 PM
To: Chad Williams <chad.williams@spiritsd.ca>
Subject: Re: Math Problem from today.

The question is.. is this actually possible?

On Mon, Sep 23, 2019 at 8:18 PM Chad Williams <chad.williams@spiritsd.ca> wrote:

> Hmm.. Good question, might be worth trying to figure out why it doesn't work then... lol
>
> If it doesn't work then how close can you get to 500.
>
> Chad Williams
>
> Clavet Composite School

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2019-09-23 8:20 PM

To: Chad Williams

Well that isn't helpful 😔😡 498... my husband is an engineer.. and it's driving him nuts haha

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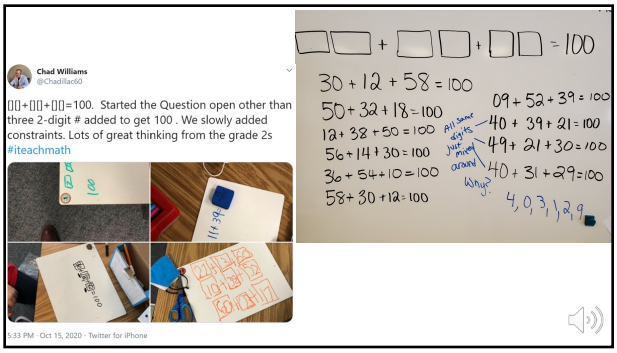

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Numbers Menu Task:

Build as *few* of numbers with base ten blocks as possible to satisfy each constraint at least once.

A.	Use more than 10 base ten blocks	B.	The number is less than 50
C.	Includes one of each hundred flat, ten rod and one unit.	D.	The number is greater than 100
E.	Has more ten rods than one units.	F.	Contains exactly 7 one units

Which constraints pair nicely?
Which constraints cannot be paired?
Is it possible to solve in 2, 3, or 4 numbers?

Describe how and why you built each numbers.
Be sure to identify which groups of numbers satisfy which constraints.

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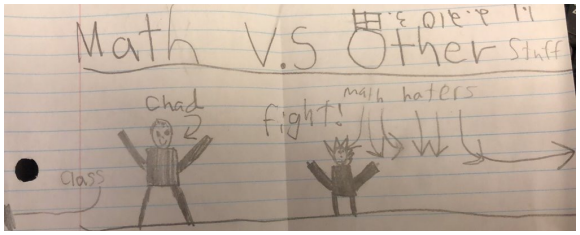

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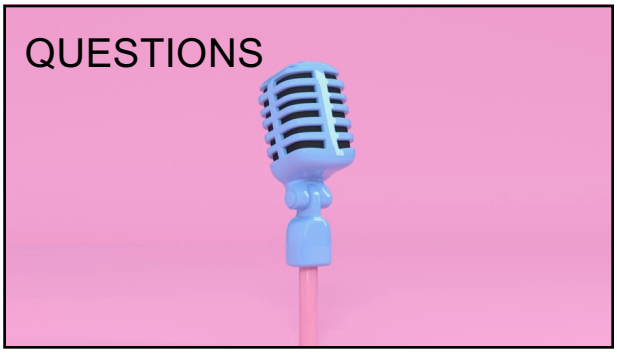

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Thank You

Chad Williams

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Beyondthealgorithm.ca
Beyondleveledbooks.com

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