Building Fluency During Intervention with a Powerful Pair:
Visual Representations and Discourse

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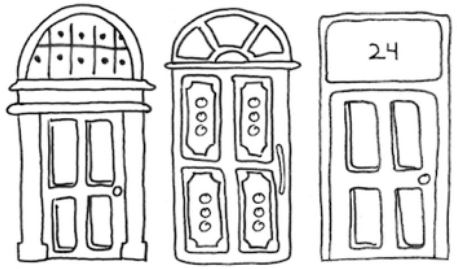
NCTM, 2017

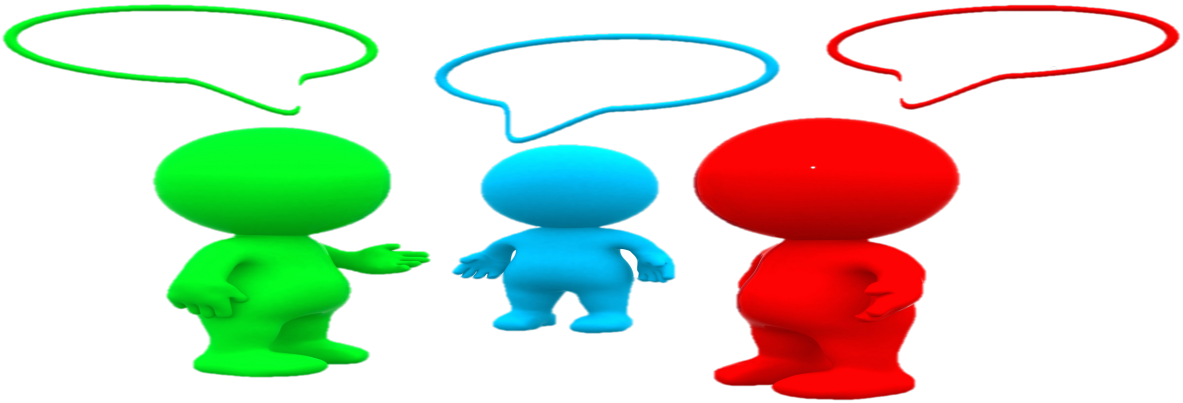


Today We Will Discuss…

- Learn how we can use representations more effectively to build a deeper understanding of mathematics.

- Learn how to build in strong mathematical discourse to the use of instructional strategies to build fluency.

What does it mean to have 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***.

NCTM, *Principles and Standards for School Mathematics*, pg. 152

Elements of Fluency

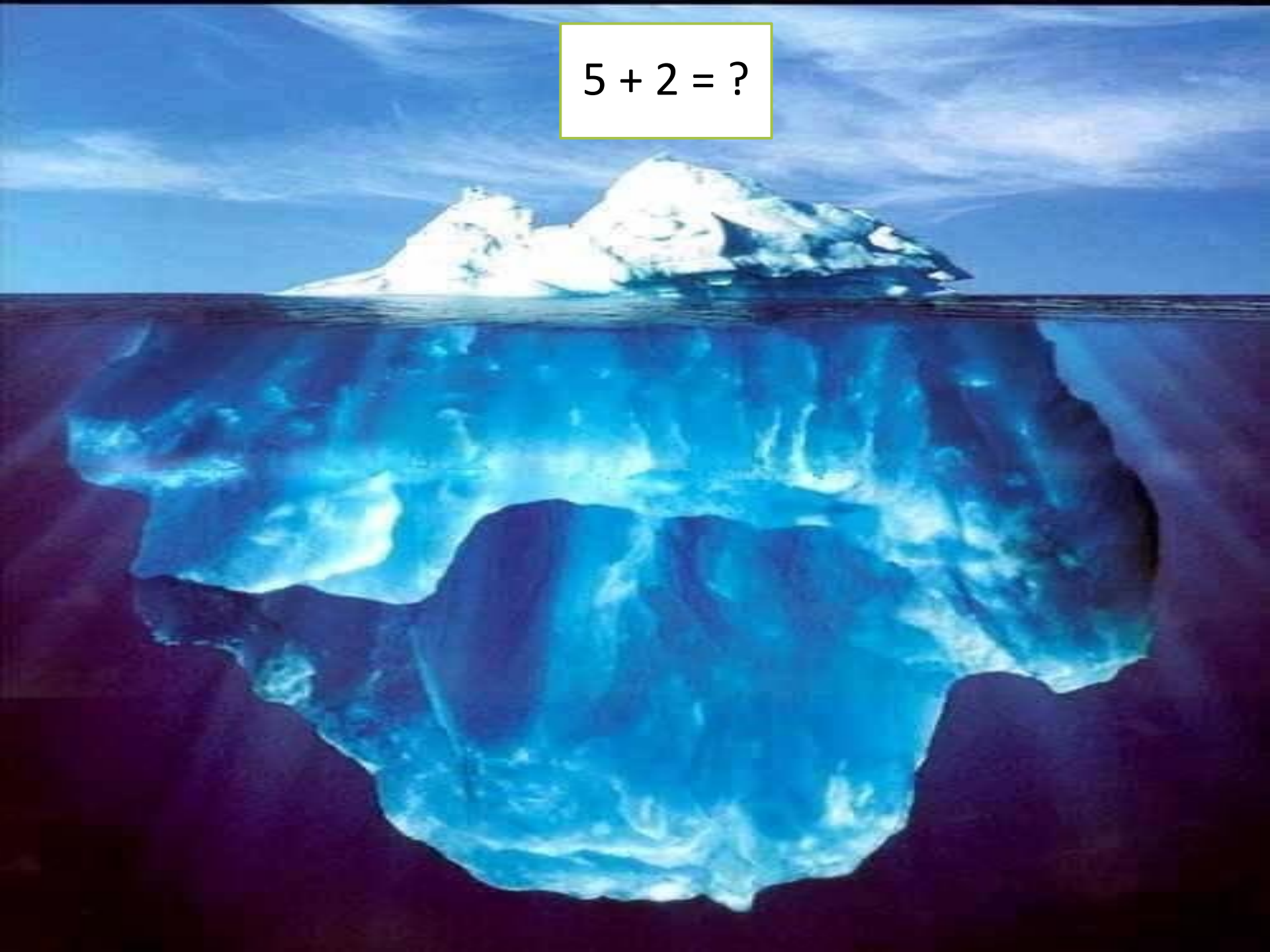
EFFICIENCY

ACCURACY

FLEXIBILITY

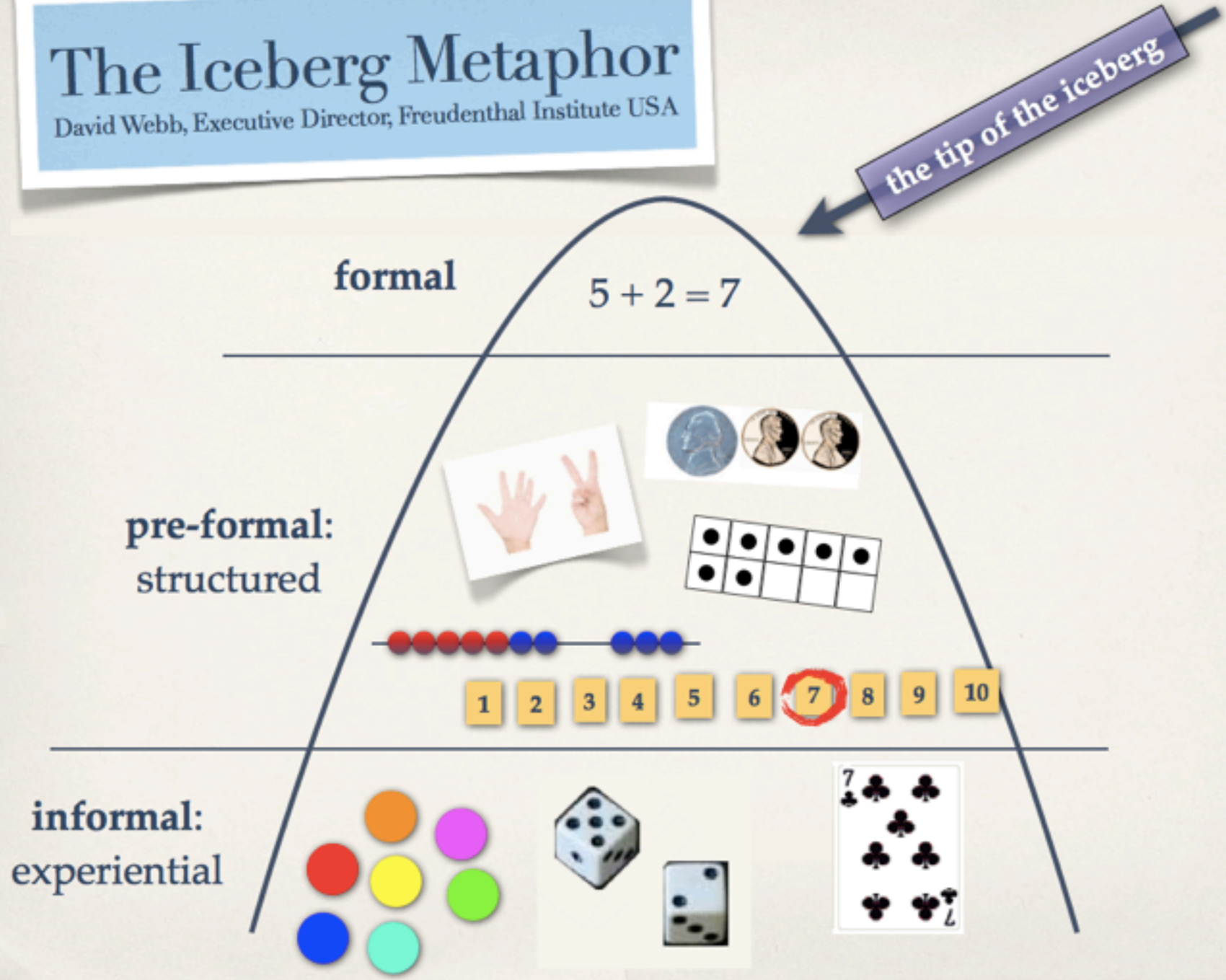
The Progression:

Grade Level	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20 Add/subtract within 100
3	Multiply/divide within 100 Add/subtract within 1000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division Multi-digit decimal operations


5 + 2 = ?

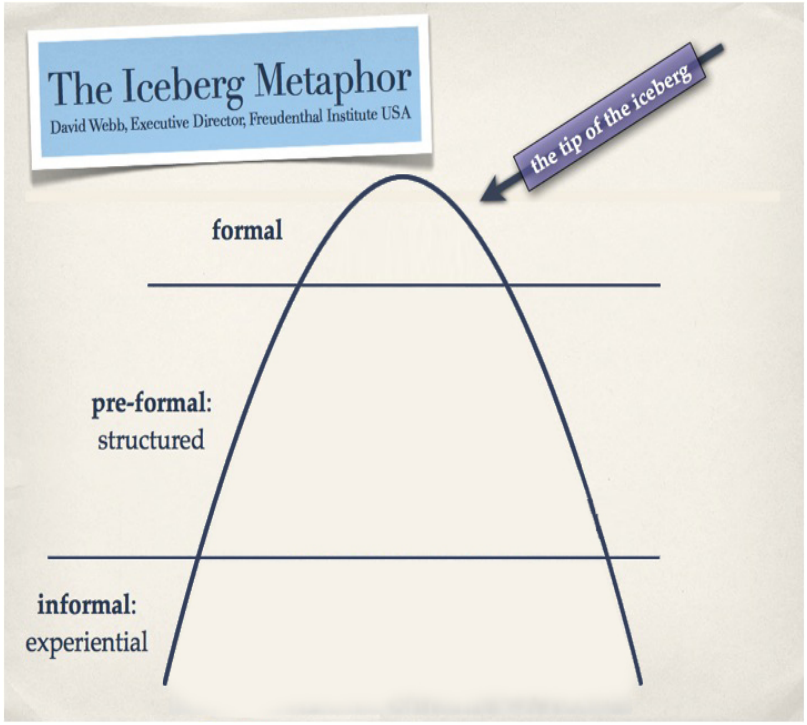
The Iceberg Metaphor

David Webb, Executive Director, Freudenthal Institute USA



What about students that don't make these cognitive connections?

How do we get them there?



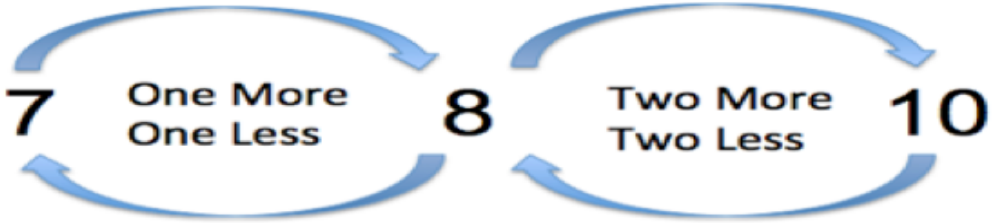
Developing Efficient Strategies

"A strategy is most useful to students when it is theirs, built on and connected to concepts and relationships they already own."

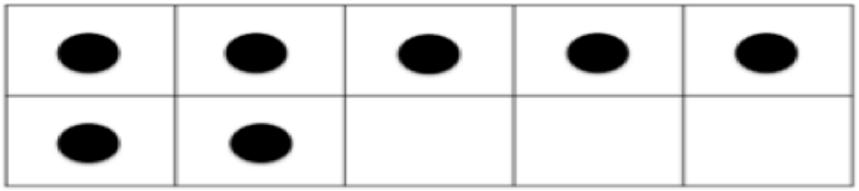
Van de Walle & Lovin, 2006, p. 96

Spatial Relationships

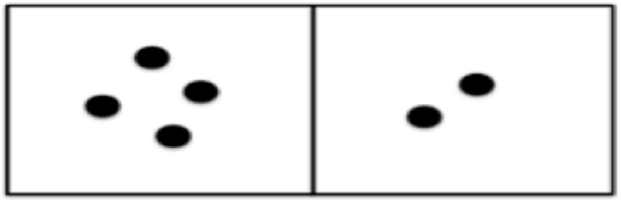
One More, Two More and One Less, Two Less



Benchmarks or Anchors to 5 and 10

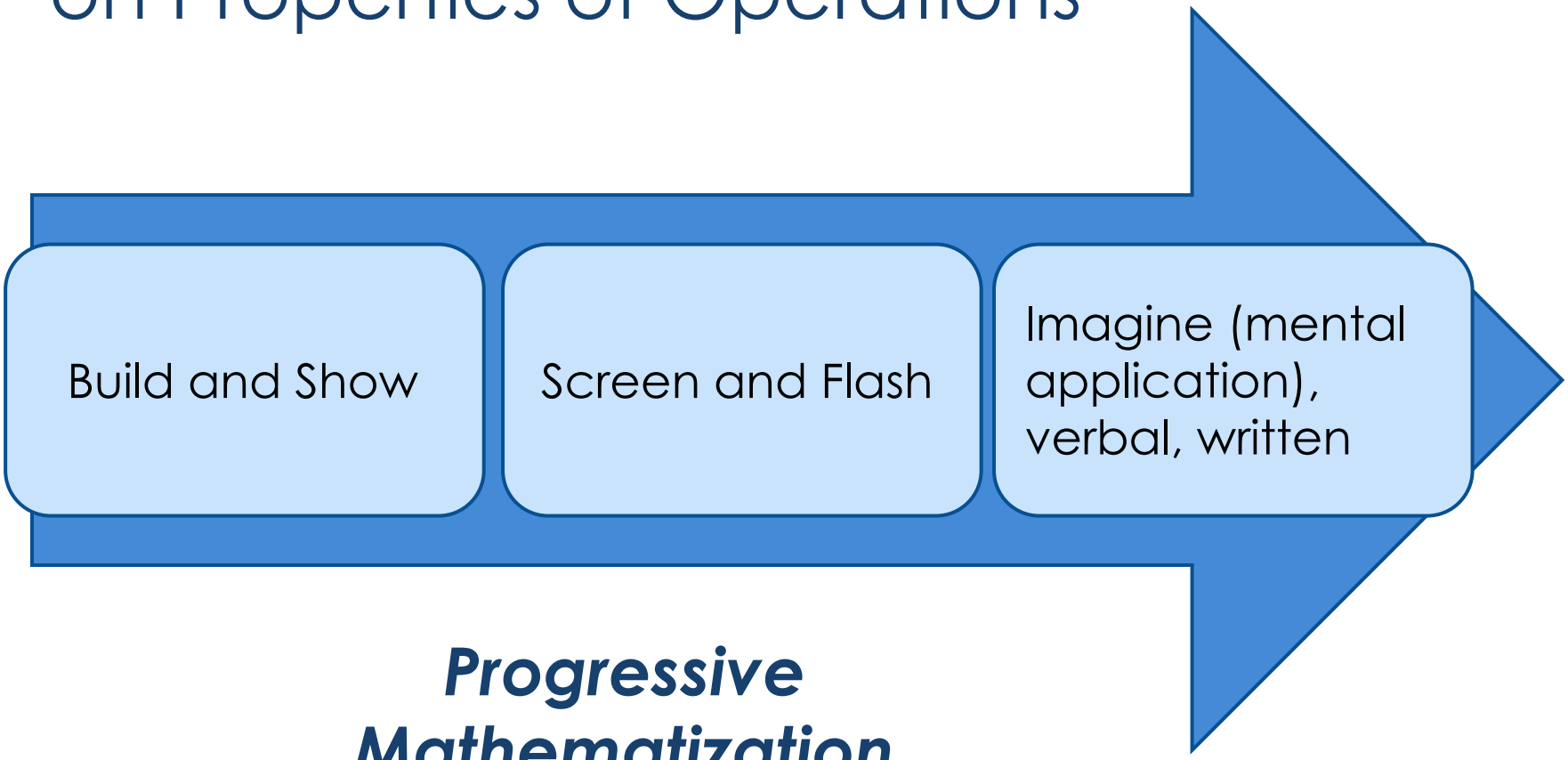


Part-Part-Whole



Goal:
Moving beyond counting by ones

Develop and Use Strategies Based on Properties of Operations

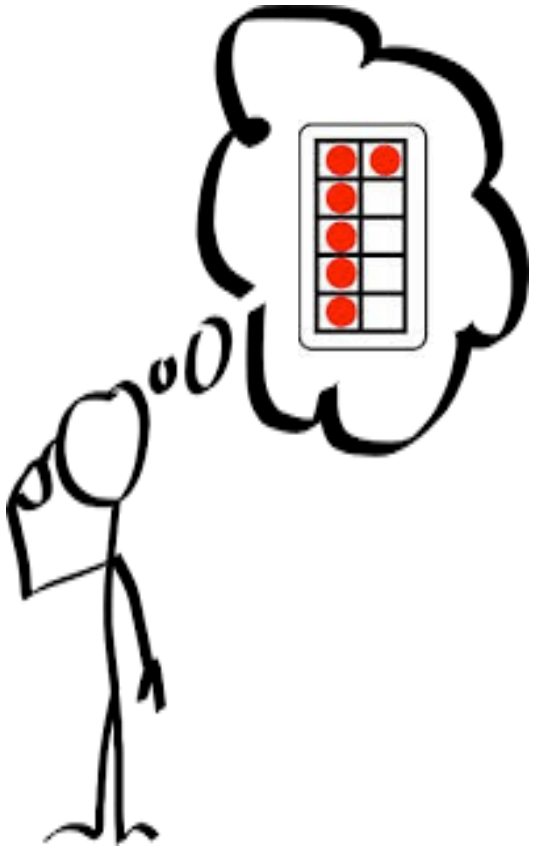


Progressive Mathematization

Figurative Thinking

6 + ? = 10

- Mental replay
- Means of finding the patterns that give meaning to experience
- Visual process of seeing patterns within shape, function, or operations



It is about pushing thinking in order to develop relational thinking!!

Facile mental computation develops by enriching math knowledge and mathematizing students' own mental strategies.

Wright, Ellemor-Colllins, Tabor, *Developing Number Knowledge: Assessment, Teaching & Intervention with 7-11 year olds,* pg. 99.

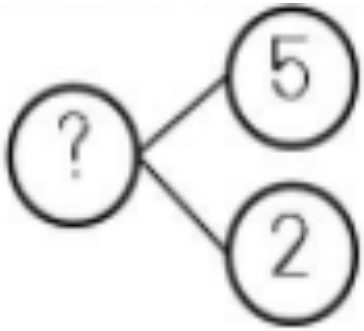
K-2 Visual Representations

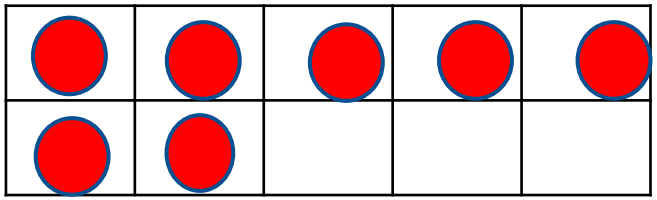
- What visual representations do we use in K-2?

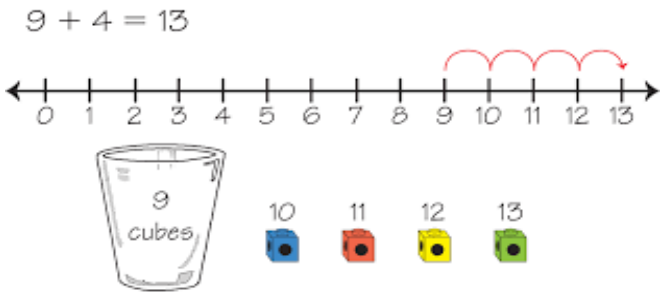
- Where and how does
- discourse occur?

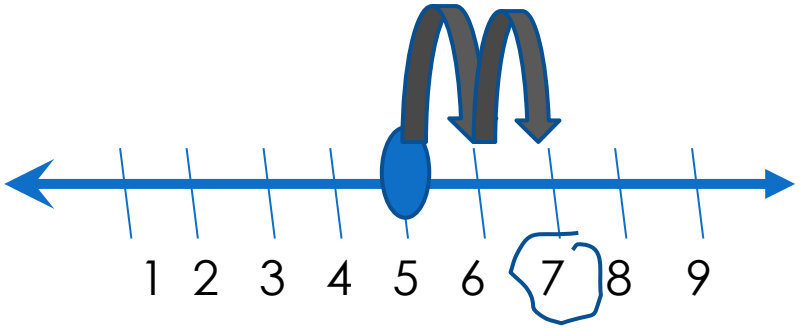
- Are kids making the connection? What stumbling blocks do you see?

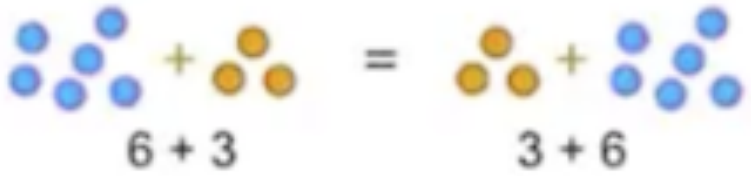
K-2 Visual Representations



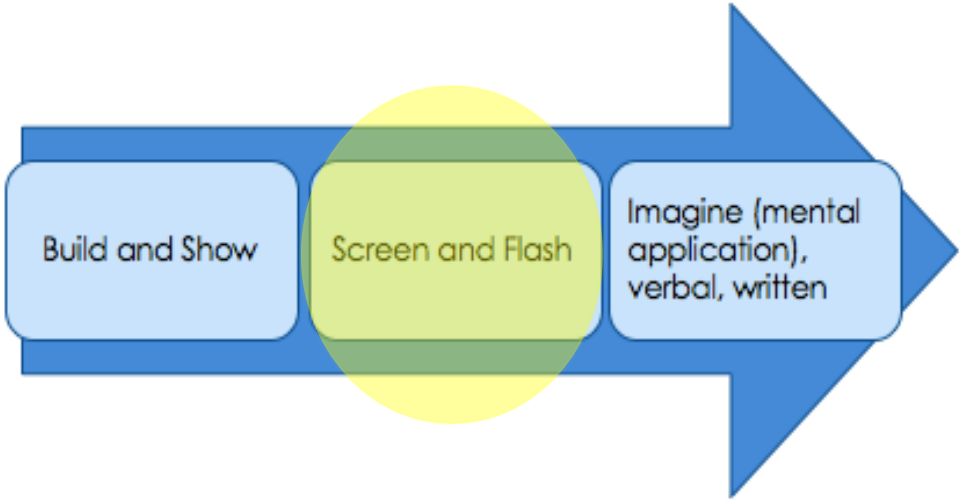


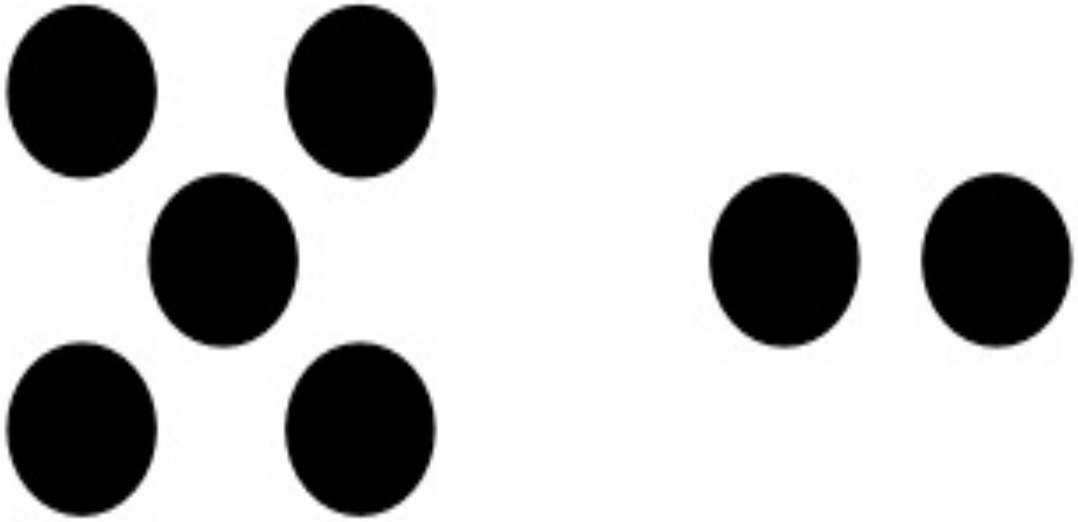




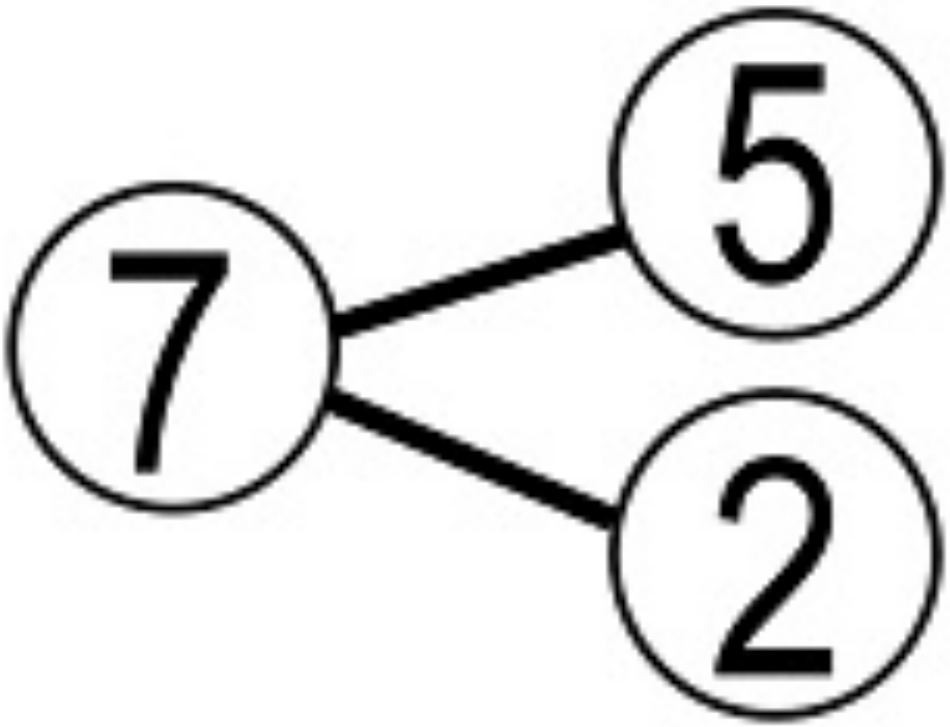


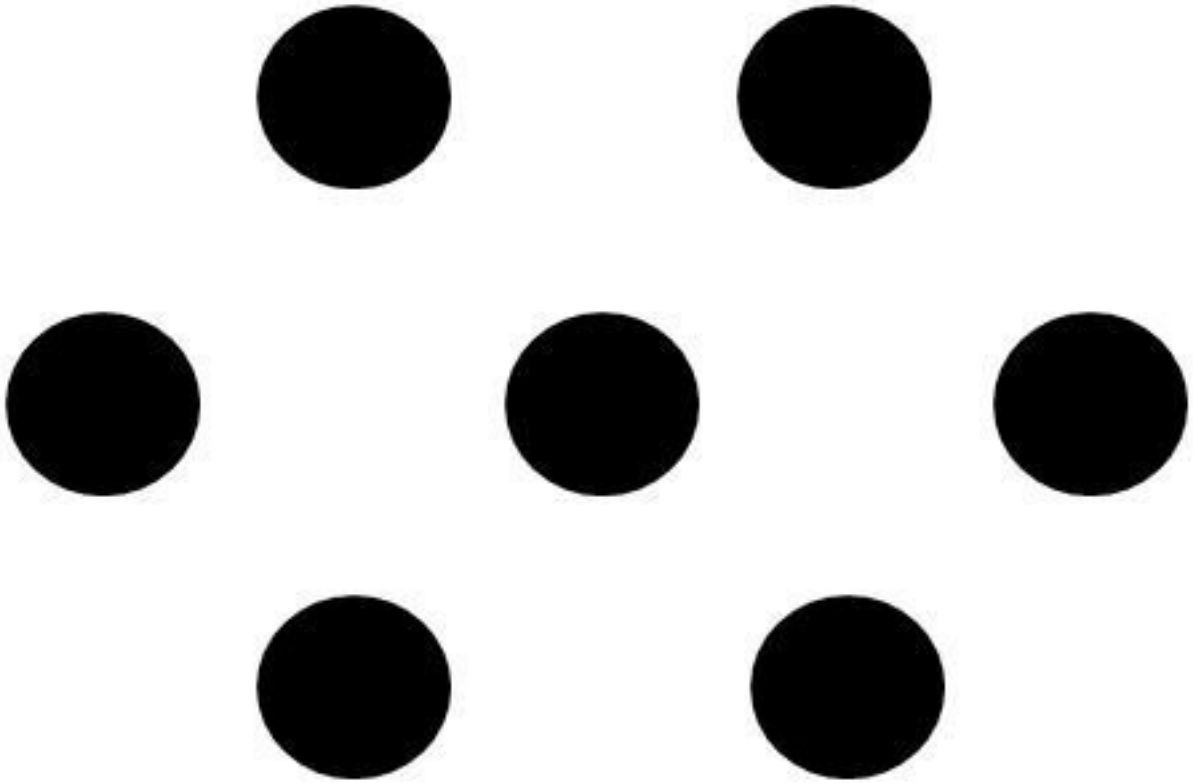
Number Bonds / Dot Images

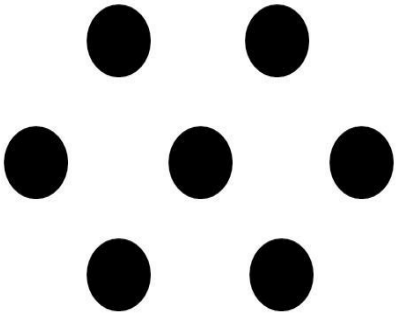


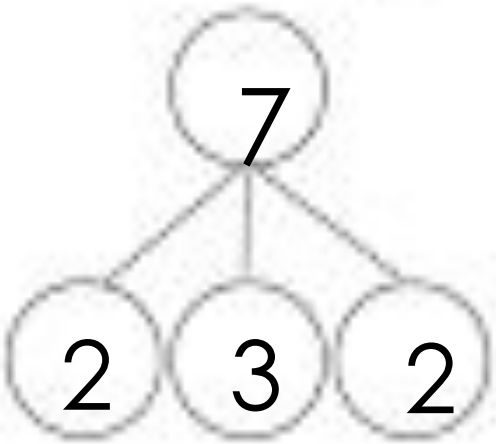


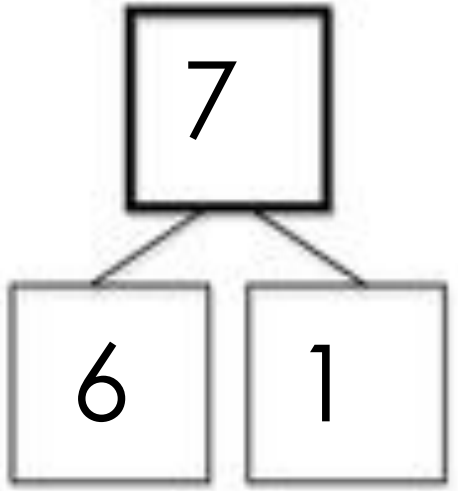
Teacher Notates Student Thinking During Discourse

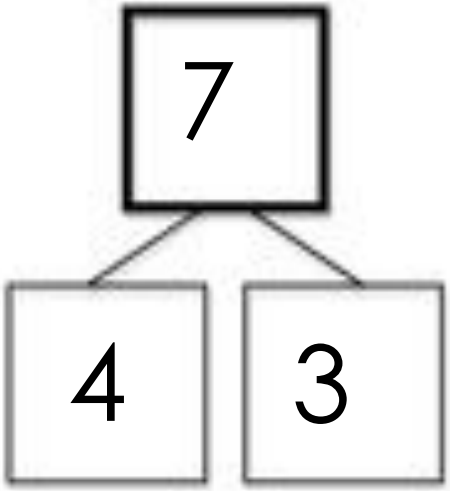


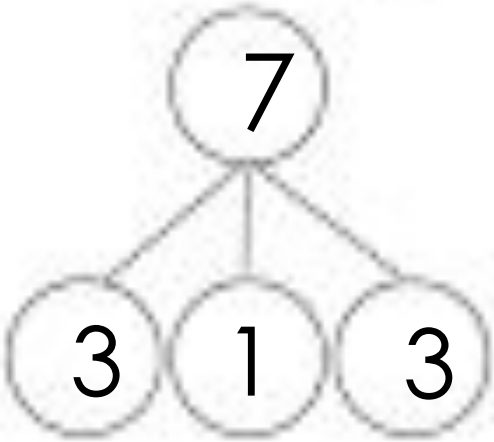


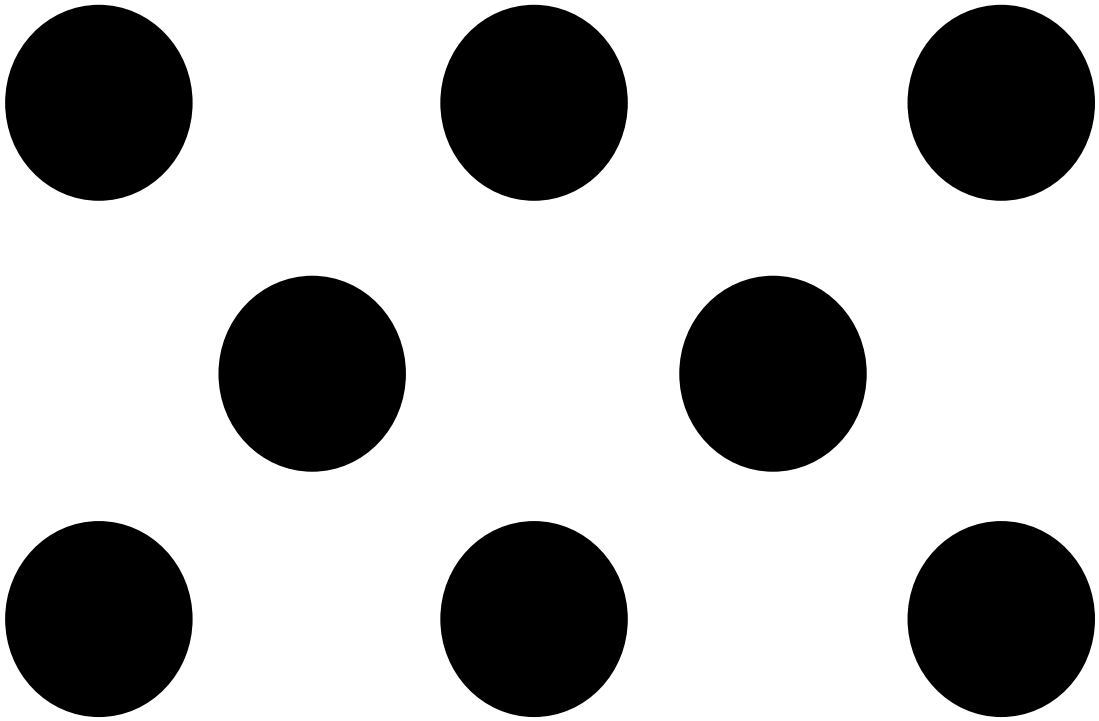


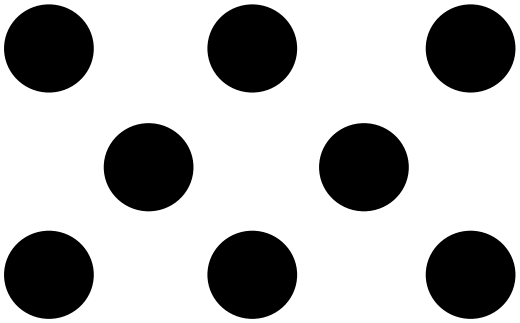

7
2
3
2


7
6
1

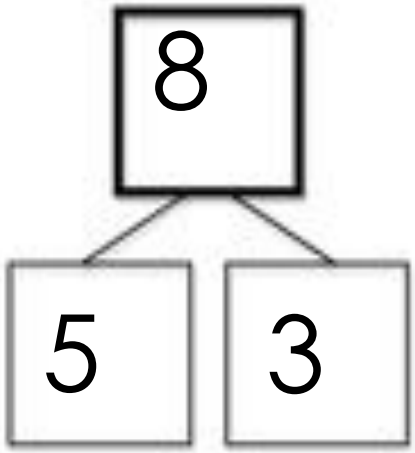

7
4
3

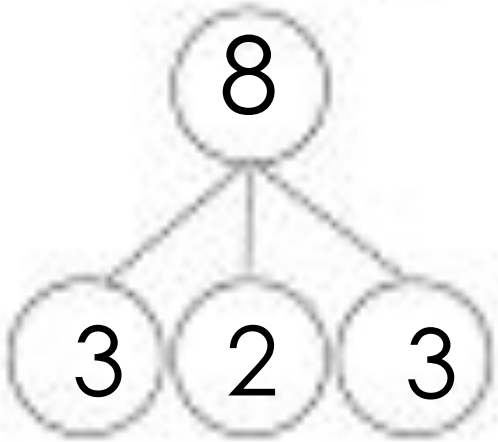

7
3
1
3

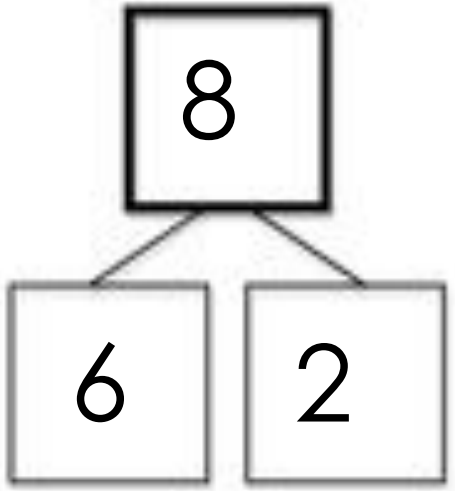




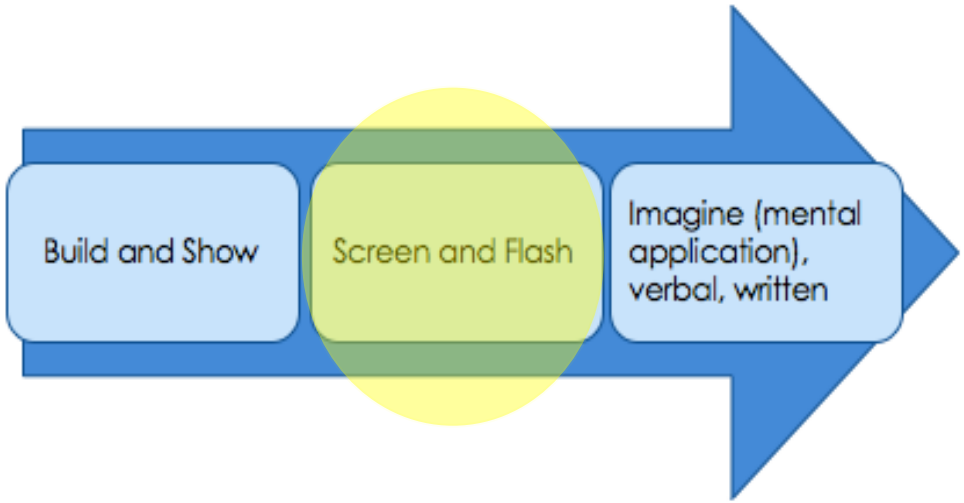
(5 + 5) - 2

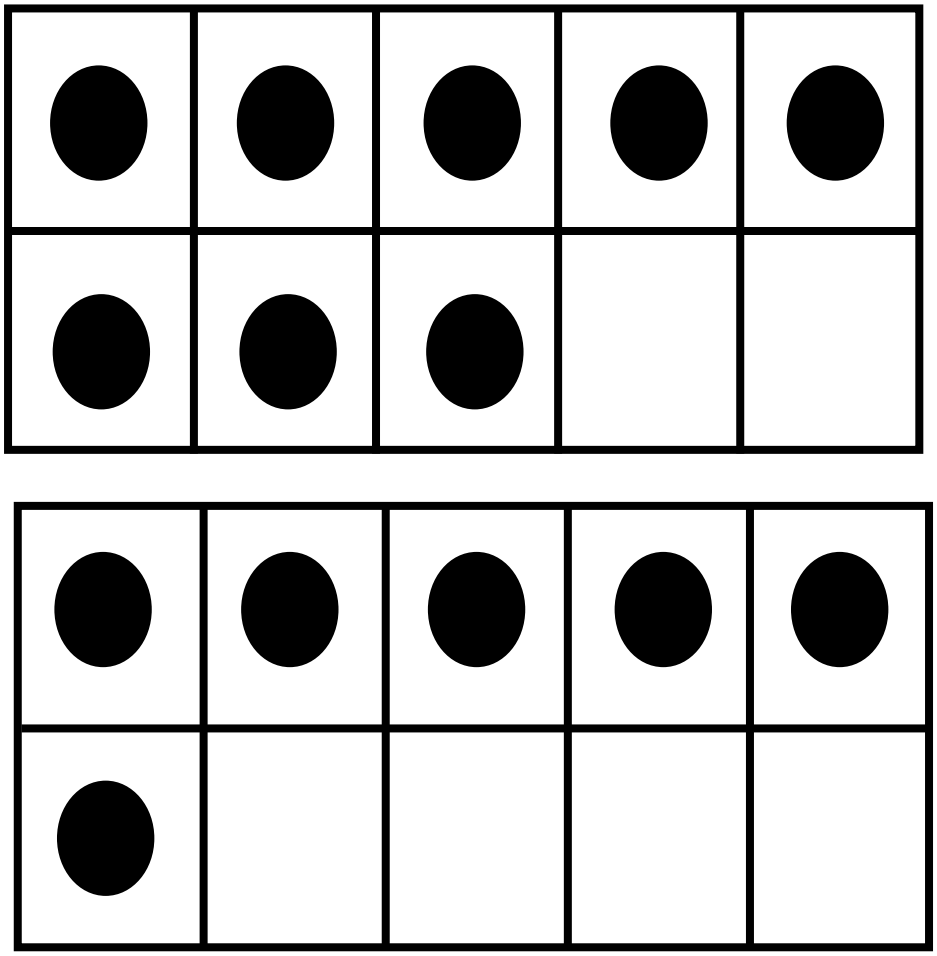


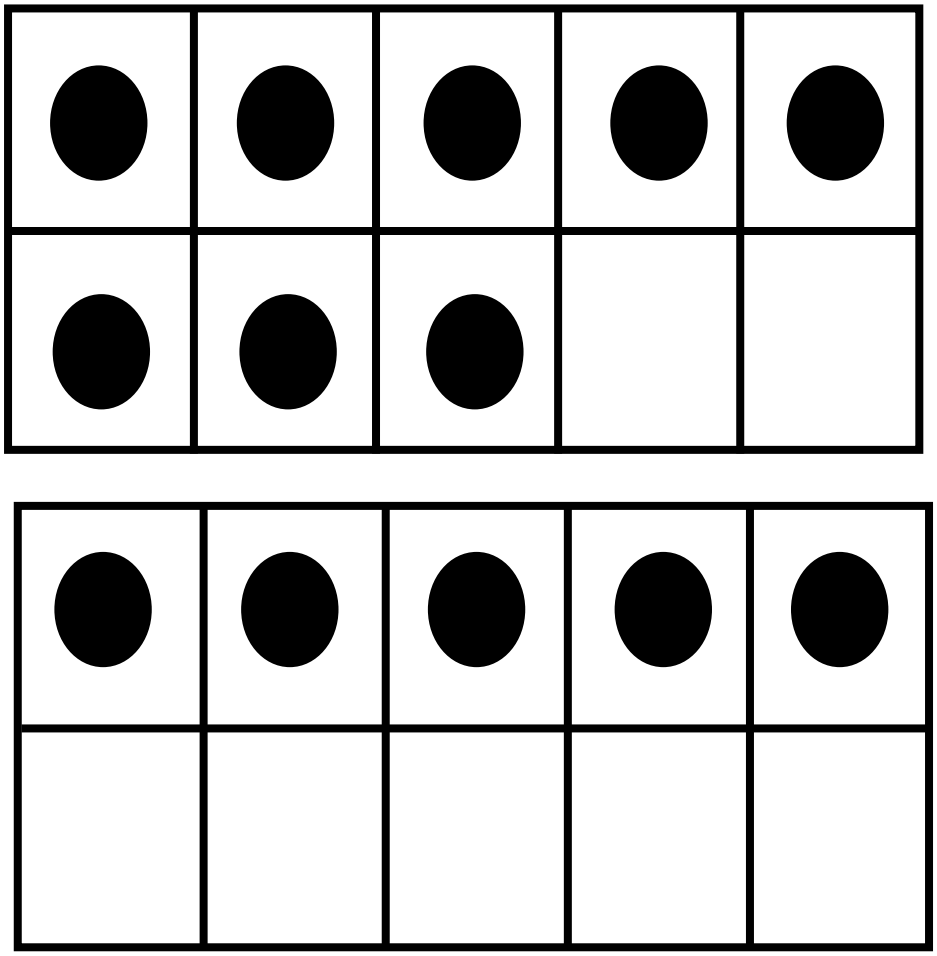




10-frames


Build and Show
Screen and Flash
Imagine (mental application), verbal, written





How Many Dots?

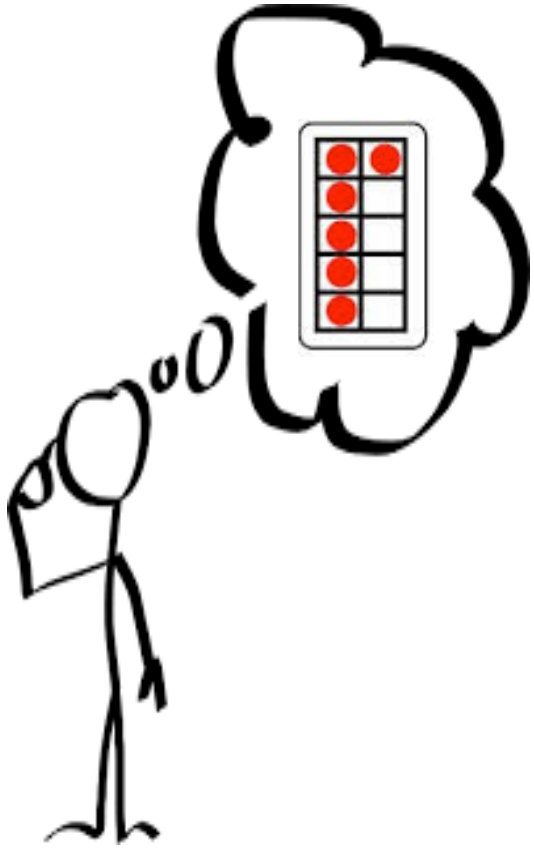
Now take away 6….

How many now?

How do you know?

What would that look like?

When do we stop using frames?

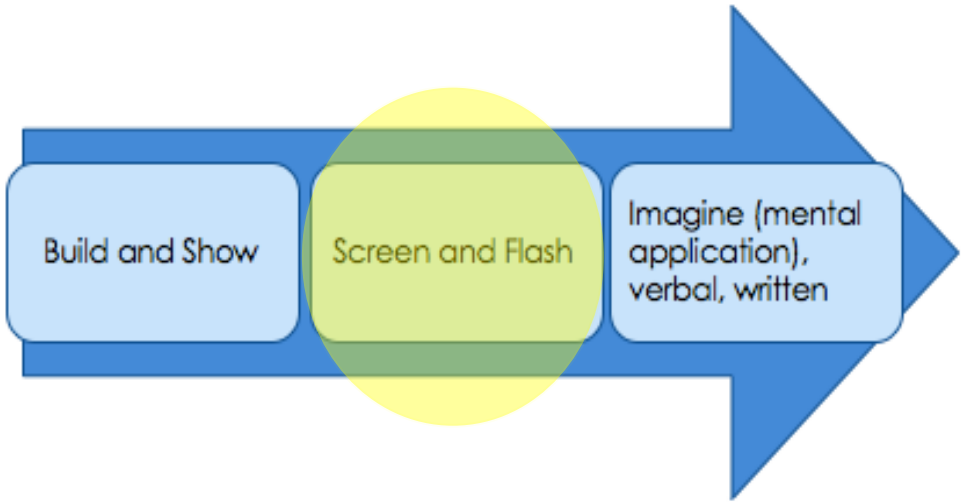


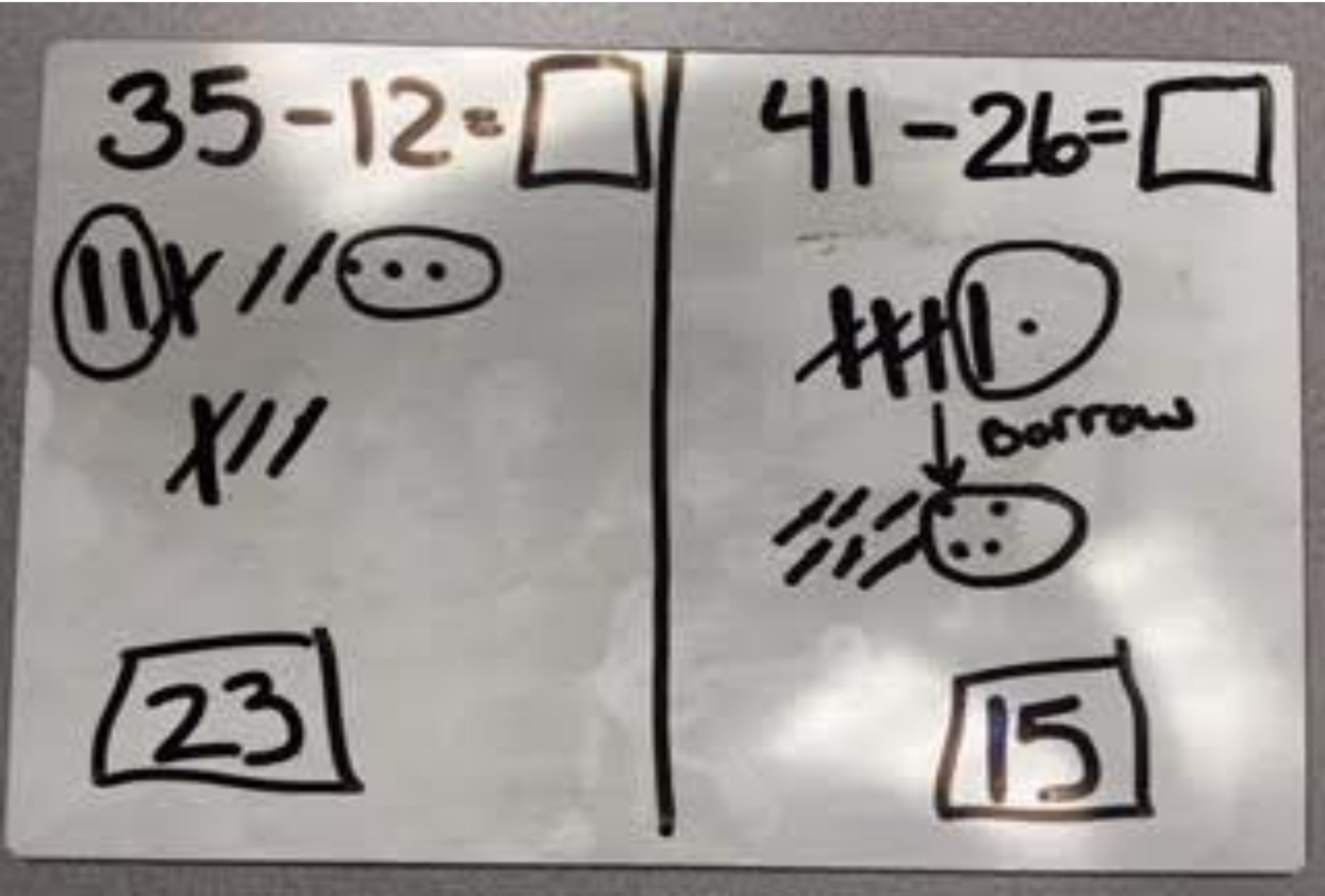
Professional Noticing

What teacher movements support this student's mathematical development?

How can this promote fact fluency and conceptual understanding?

Sticks and Dots



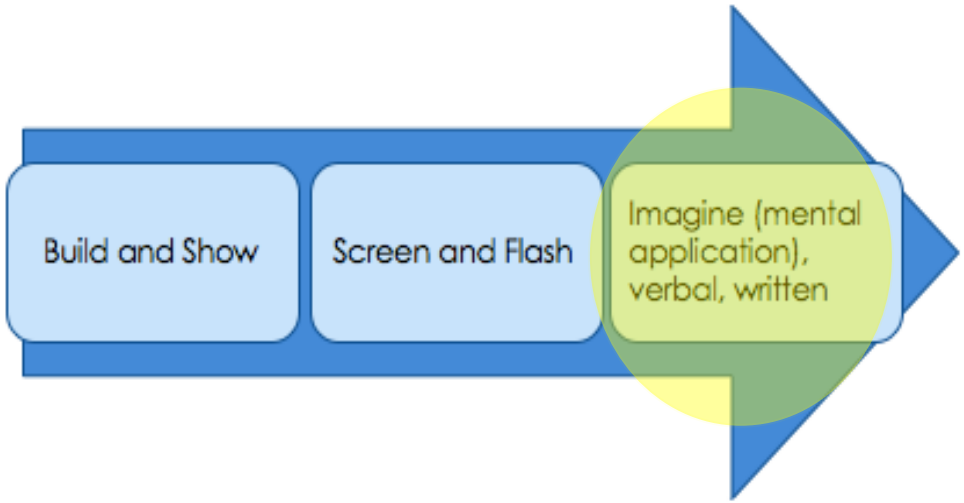

35 - 12 = □
11
23
41 - 26 = □
borrow
15

Professional Noticing

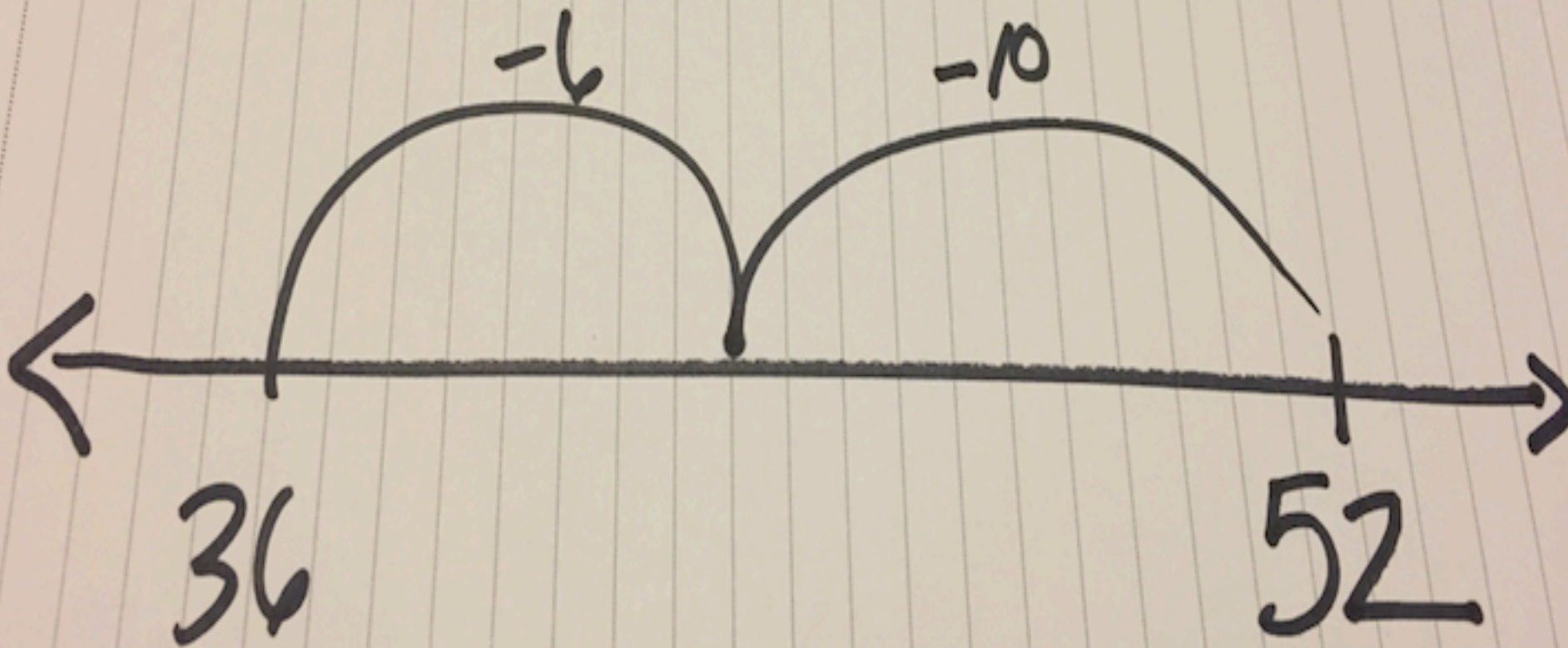
What teacher movements support this student's mathematical development?

How can this promote fact fluency and conceptual understanding?

Empty Number Lines



$$52 - 16 = \boxed{36}$$



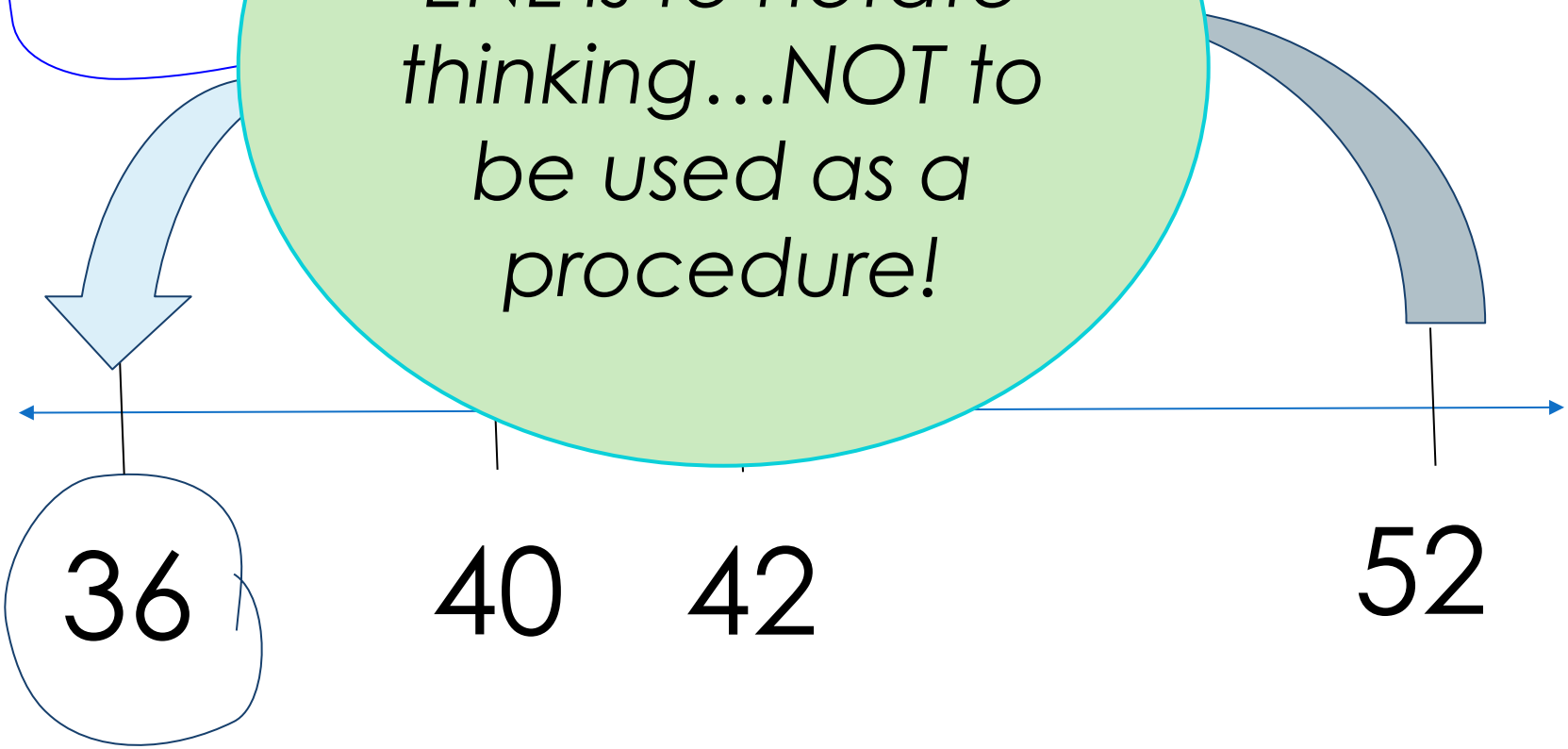
Mental Calculation:

_____

52 – 16 = ?

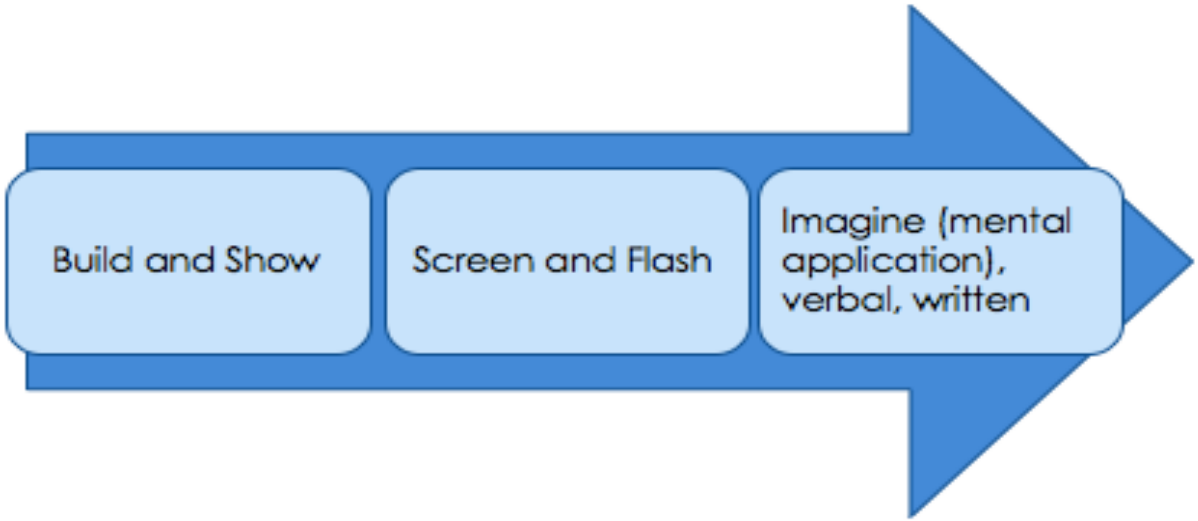
-

The purpose of ENL is to notate thinking…NOT to be used as a procedure!



"It's not what is poured into a student that counts but what is planted." Linda Conway

It is our job to connect plant meaningful discussion seeds to help students make connection to visual representations and build application on properties of operation to build fluency.



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Resources / References: