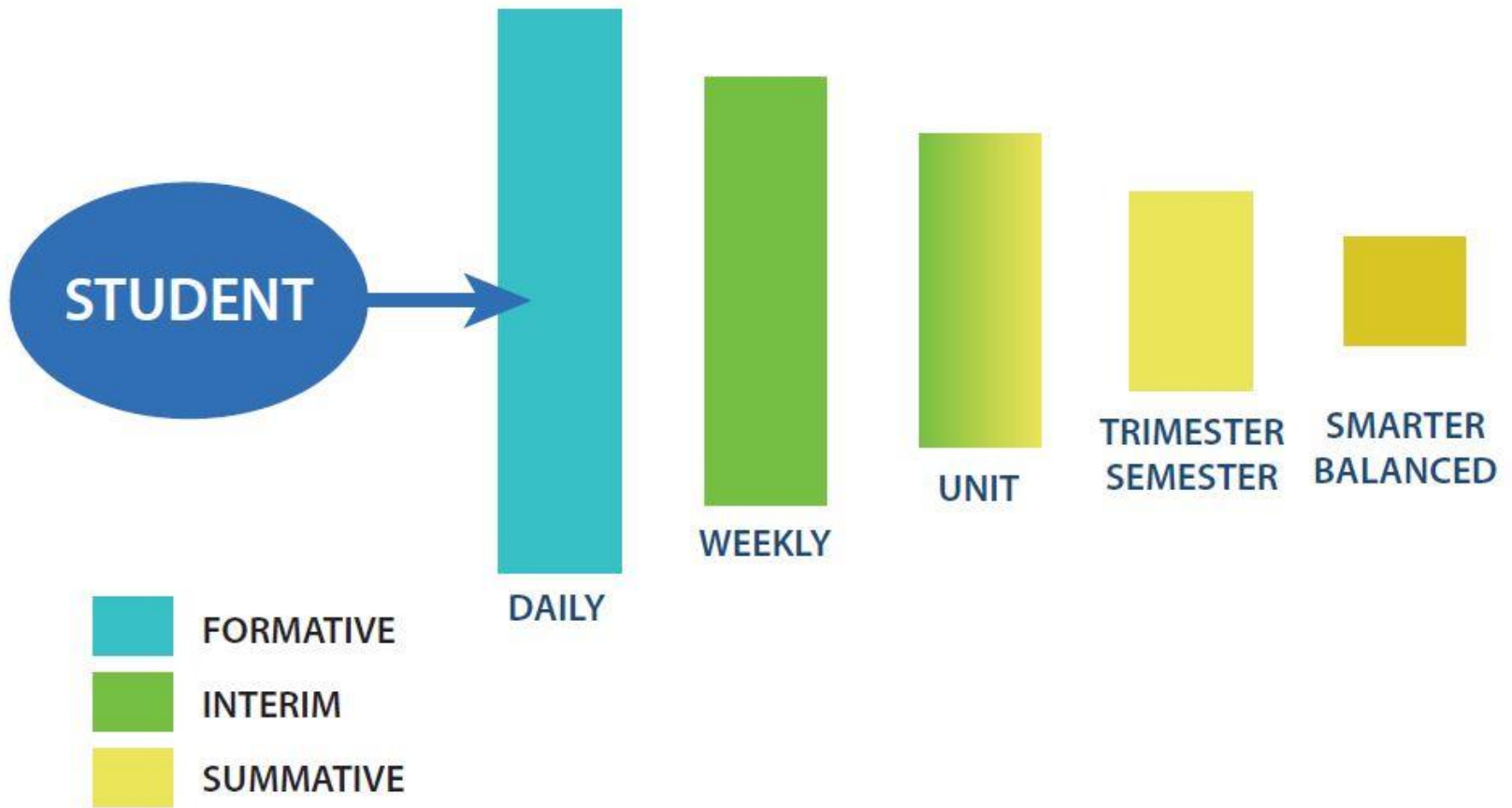


# Student Presentations

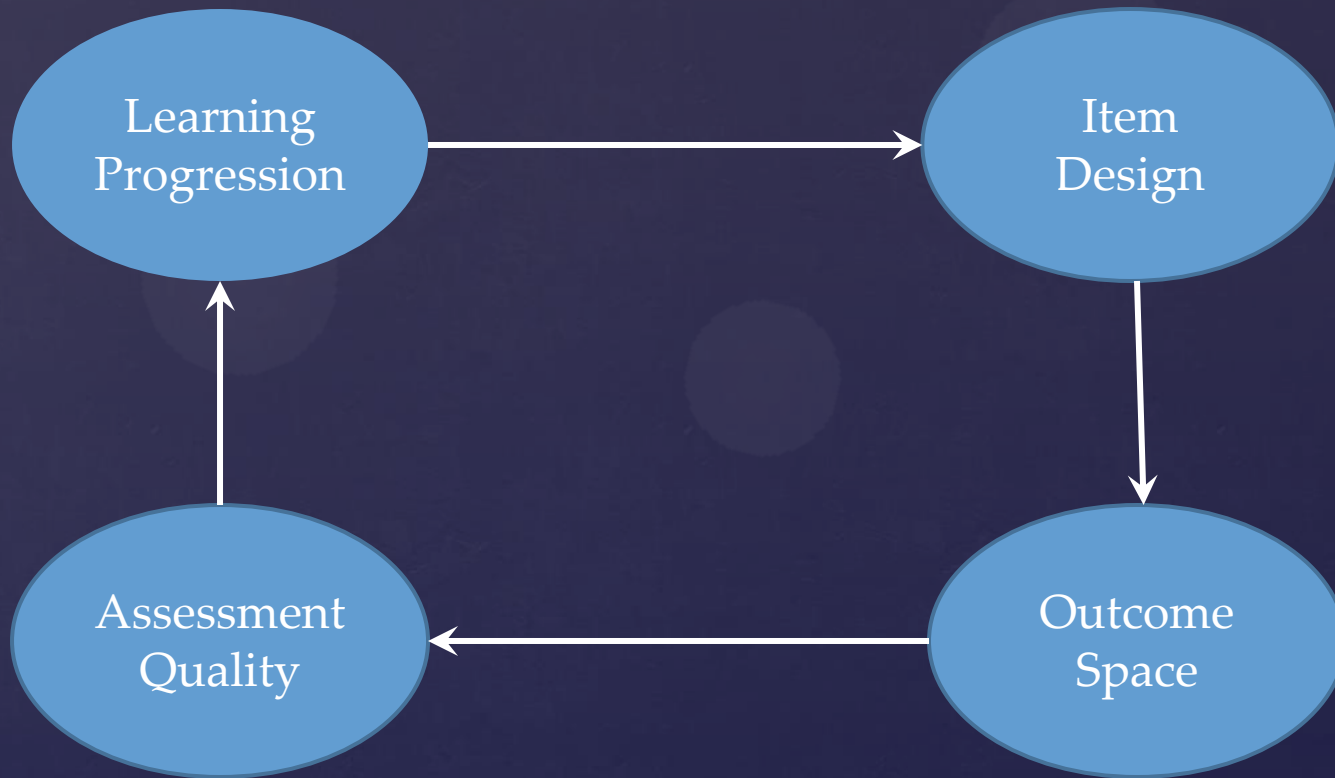
{ From show & tell to productive mathematical discussions

OFFICE OF LEARNING  
INSTRUCTION · STANDARDS ·  
ASSESSMENT & ACCOUNTABILITY  
& UNIT

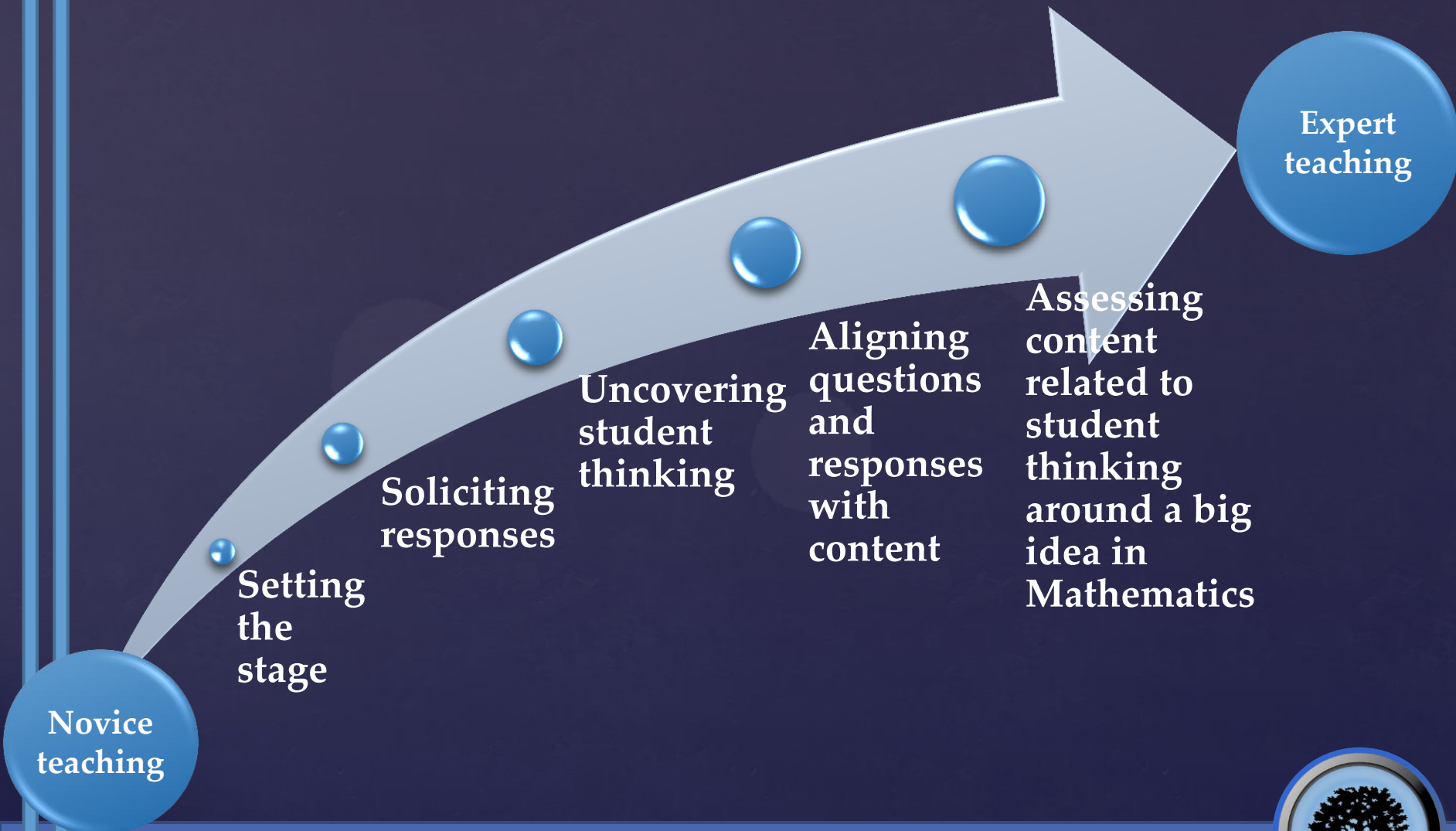




# 4 Building Blocks

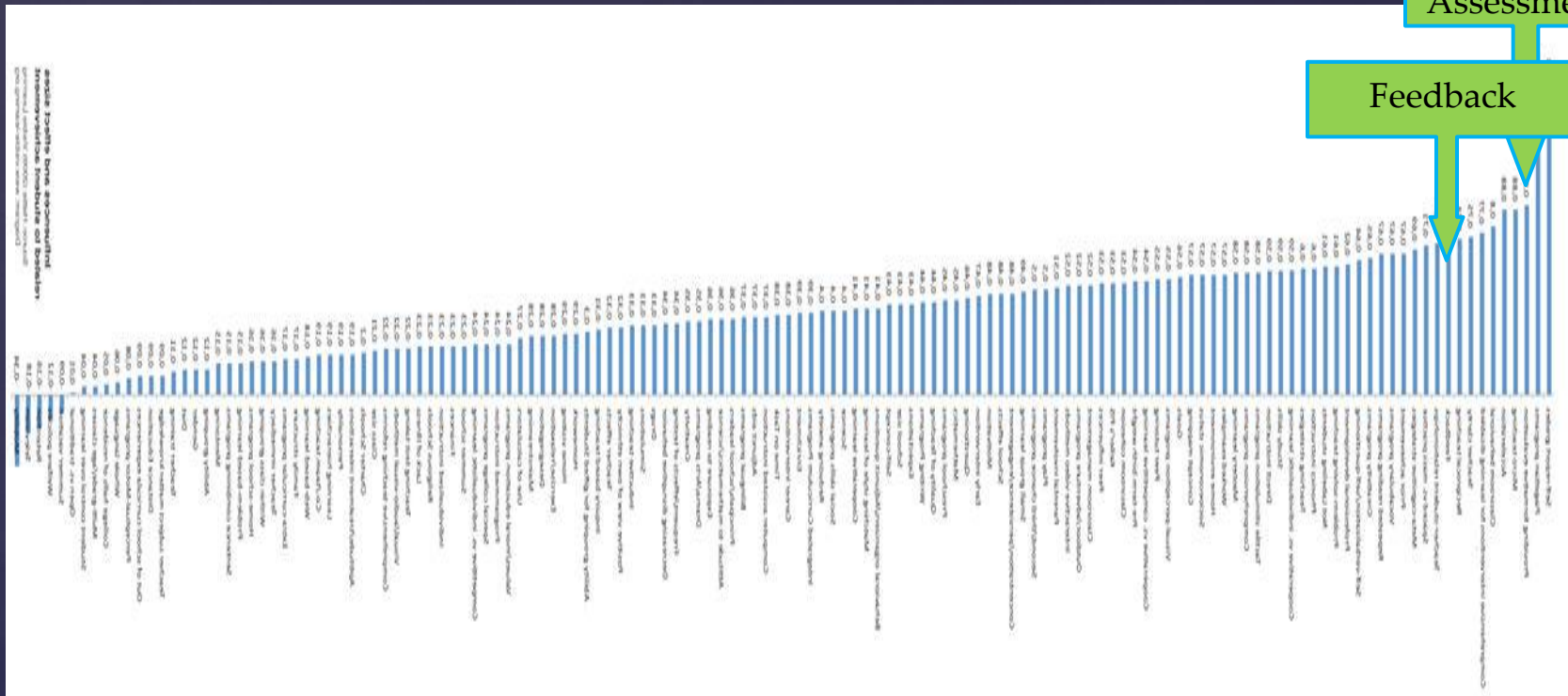


# Learning Progression





# Influences on Achievement

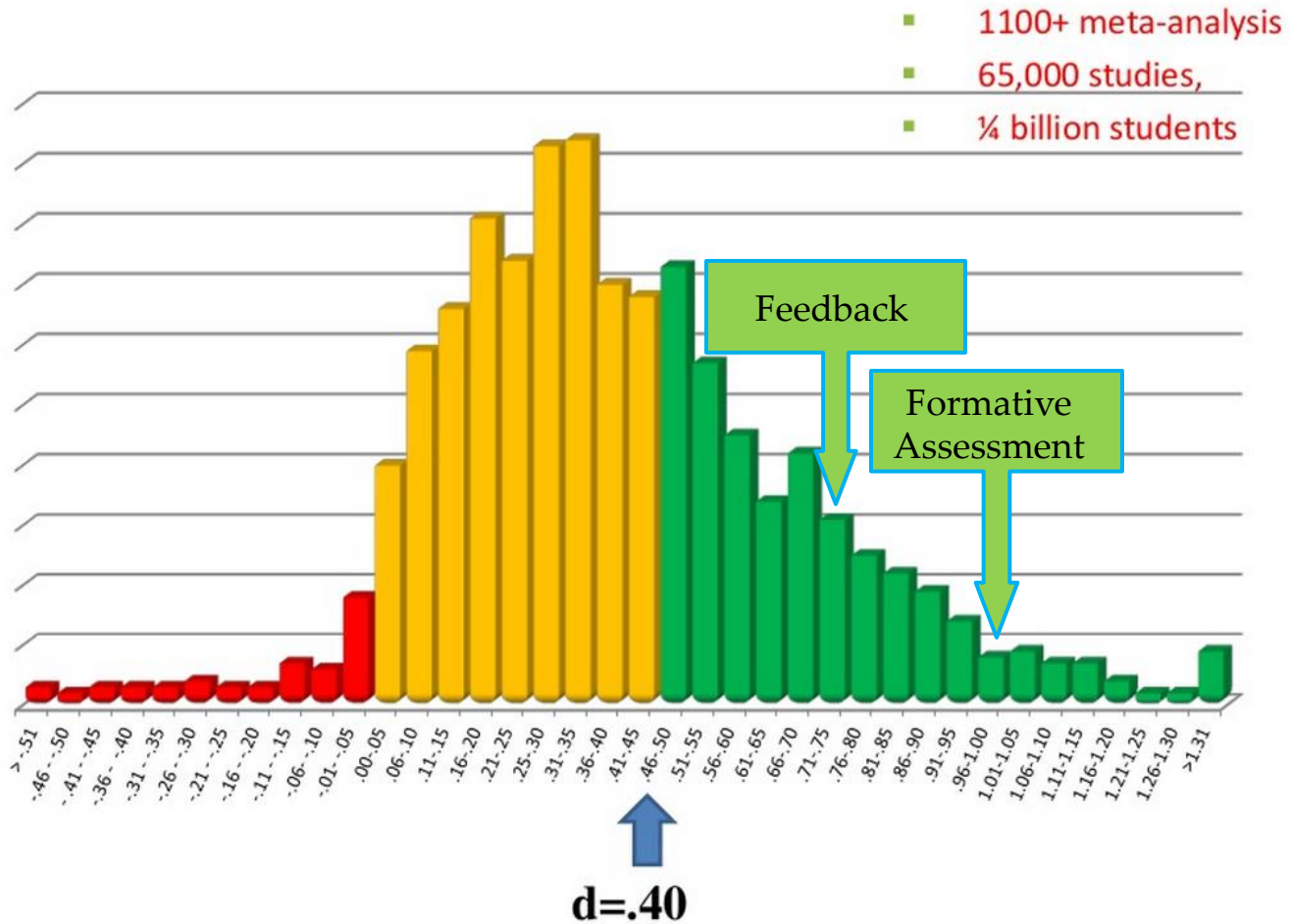


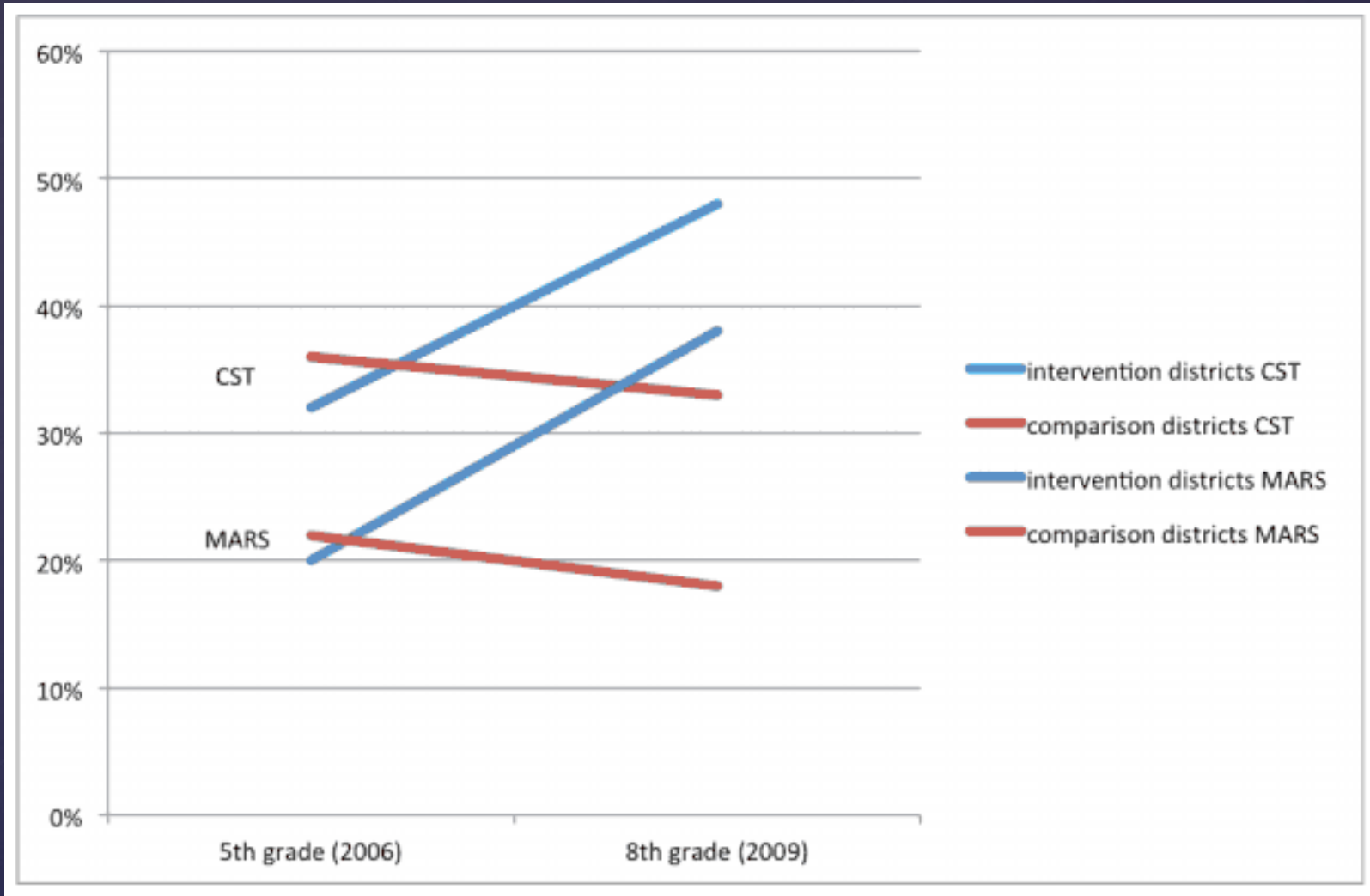
Formative Assessment

Feedback



No. of effects





(Boaler & Foster, 2014)





# Formative Assessment Strategies

- **Priming** Preparing the groundwork
- **Posing** Using an effective range of questions
- **Pausing** Giving students adequate time to think and respond
- **Probing** Asking follow-up questions that deepen student understanding
- **Bouncing** Sampling on a variety of responses
- **Tagging** Representing variation in student thinking
- **Binning** Seeing patterns and taking “Next Steps”



# Instructional Moves

## 5 Practices

- **Anticipating** Student responses to challenging mathematical tasks
- **Monitoring** Students' work on and engagement with the task
- **Selecting** Particular students to present their mathematical work
- **Sequencing** The responses that will be displayed in a specific order
- **Connecting** Different students' responses and connecting the responses to key mathematical ideas



Let's do some mathematics

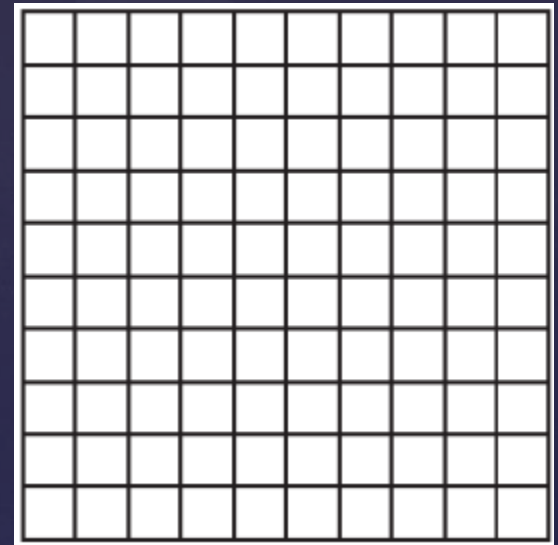


# What is this?

- Shade a “hundredths grid” to show each of the given fractions.

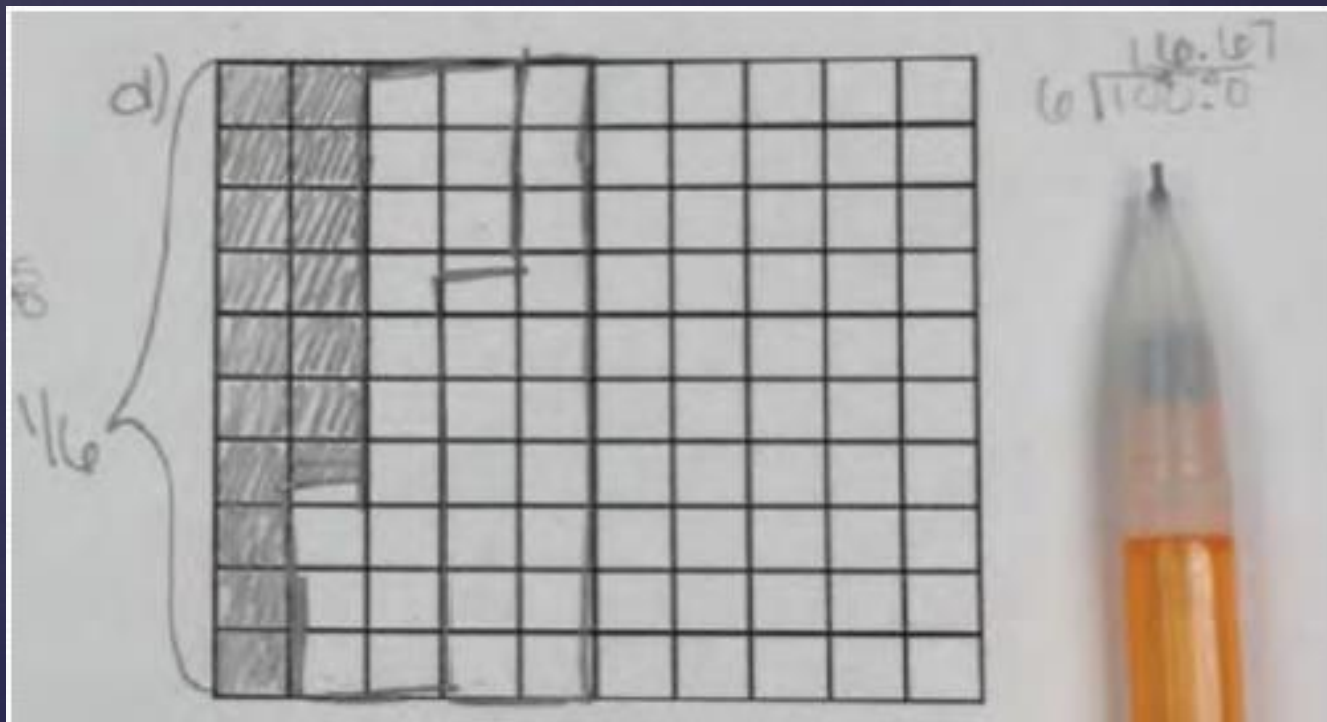
a)  $\frac{3}{20}$    b)  $\frac{1}{8}$    c)  $\frac{1}{6}$    d)  $\frac{7}{12}$

- Then *use your shading to determine a decimal equivalent* for each fraction.



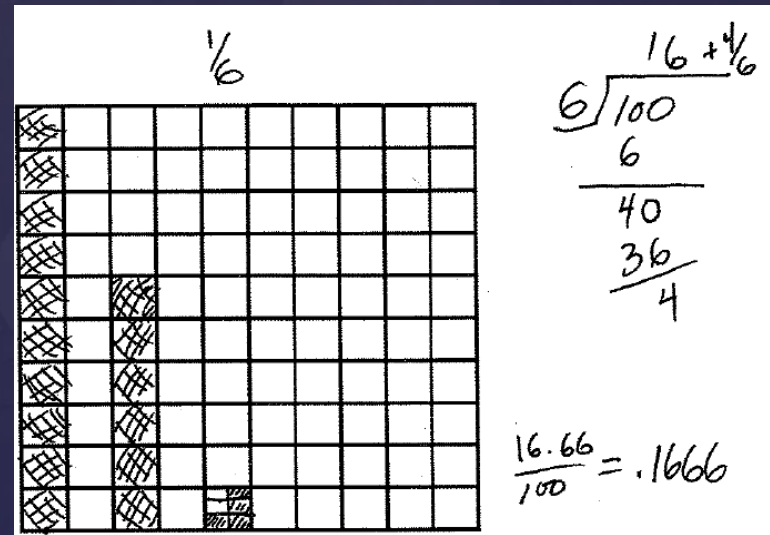
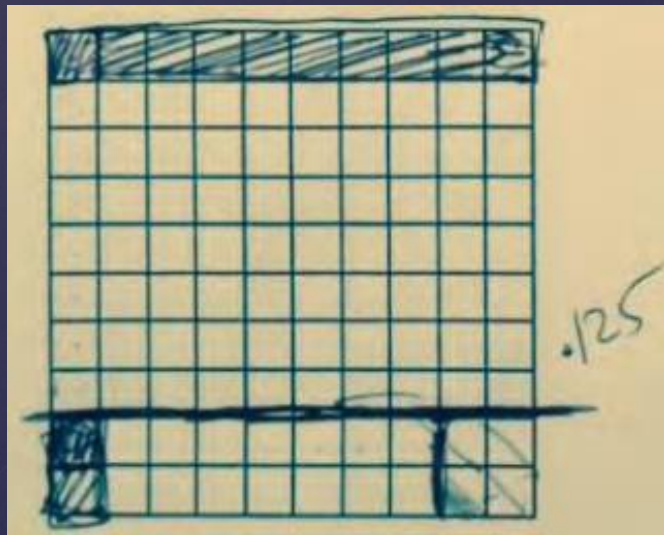
# Numerical Division Strategy

- Divide 100 by the denominator and partition the hundredths grid
- Shade the numerator value of these partitions



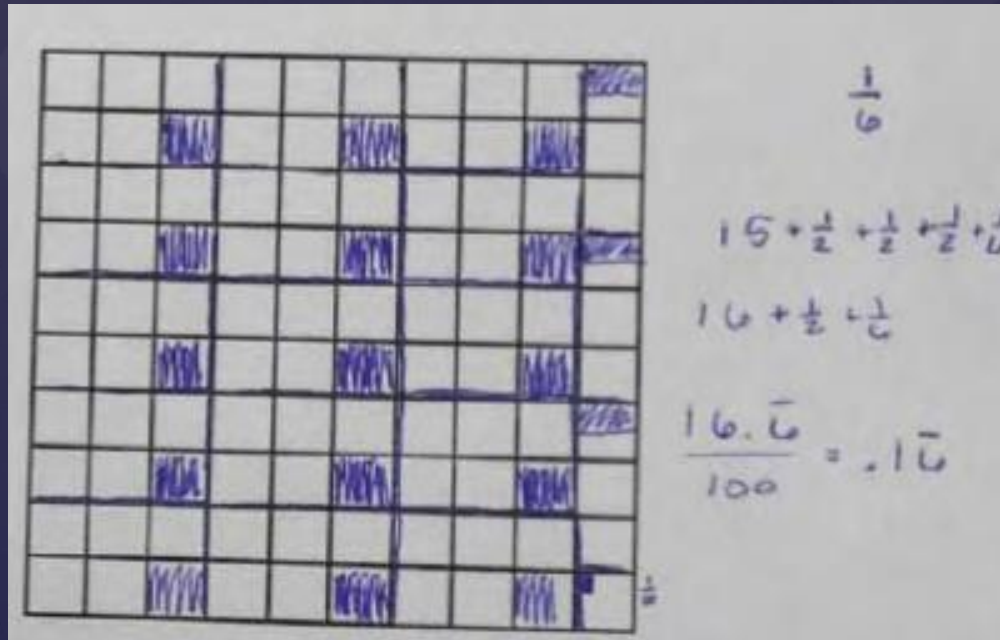
# Pictorial Division Strategy

- Divide the grid by the denominator in chunks, typically driven by place value



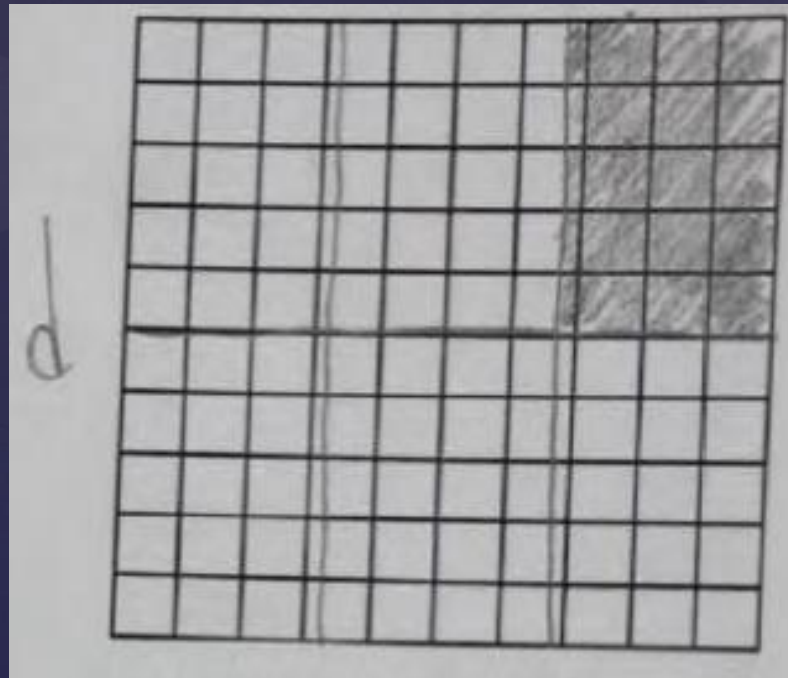
# Ratio Strategy

- Organize the grid into pieces that are the size of the denominator (in hundredths)
- In each piece, shade according to numerator
- Note: Uses division as measurement



# Cutting Strategy

- Cut the whole into pieces of equal size (denominator)
- Shade the required number of pieces (numerator)





# Monitoring Sheet

Note the sequencing  
that is built in

Strategy	Who and What	Order
Numerical Division		
Pictorial Division		
Ratio		
Cutting		
Other		



# Anticipating Questions

- Numerical division: How can you use the picture to show that the fraction is  $\frac{1}{8}$ ?
- Difficulty reasoning with partial hundredths: If you combine these parts, how many hundredths would that be?
- Difficulty getting started: What does  $\frac{1}{8}$  mean?
- Note that these questions are driven by the goal:
  - To use the meaning of fractions and place value understanding to explain the decimal equivalents of fractions



# What Was the Mathematical Goal of This Task?

- **Goal A:** To get the right answers:  
(a)  $3/20 = 0.15$    (b)  $1/8 = 0.125$    (c)  $1/6 = .1666\dots$    (d)  $7/12 = 0.5833\dots$
- **Goal B:** To be able to convert fractions to decimals.
- **Goal C:** To use the meaning of fractions and place value understanding to explain the decimal equivalents of fractions.
  
- Note that Goal C is specific to the task, whereas Goal B is general.
- But neither Goal C nor Goal B are standards in the CCSS.
  - *Does that imply we shouldn't use this task?*



# Targeted Standards

- 5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
- 5.NBT.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and  $\frac{1}{10}$  of what it represents in the place to its left.
- MP.1 Make sense of problems and persevere in solving them.
- MP.3 Construct viable arguments and critique the reasoning of others



# Secondary Standards

- 5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
- 5.NBT.3 Read, write, and compare decimals to thousandths.
  - a. read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g.,  $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$
  - b. Compare two decimals to thousandths based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons.
- 5.NBT. Use place value understanding to round decimals to any place.



# Previous Standards (fractions)

- 3.NF.1 Understand a fraction  $1/b$  as the quantity formed by 1 part when a whole is partitioned into  $b$  equal parts; understand a fraction  $a/b$  as the quantity formed by  $a$  parts of size  $1/b$ .
- 3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
  - b. Recognize and generate simple equivalent fractions, e.g.,  $\frac{1}{2} = \frac{2}{4}$ ,  $\frac{4}{6} = \frac{2}{3}$ . Explain why the fractions are equivalent, e.g., by using a visual fraction model.
- 3.G.2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as  $\frac{1}{4}$  of the area of the shape.*



# Previous Standards (division)

Represent and solve problems involving multiplication and division.

- 3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret  $56 \div 8$  as the number of object in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example describe a context in which a number of shares or a number of groups can be expressed as  $56 \div 8$ .
- 3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

Understand properties of multiplication and the relationship between multiplication and division.

- [Properties of operations (e.g., distributive property)]

Multiply and divide within 100.



# Previous Standards (decimals)

- 4.NF.1 Explain why a fraction  $a/b$  is equivalent to a fraction  $(n \times a)/(n \times b)$  by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
- 4.NF.5 Express a fraction with a denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express  $3/10$  as  $30/100$ , and add  $3/10 + 4/100 = 34/100$ .*
- 4.NF.6 Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite  $0.62$  as  $62/100$ ; describe a length as  $0.62$  meters; locate  $0.62$  on a number line diagram.*



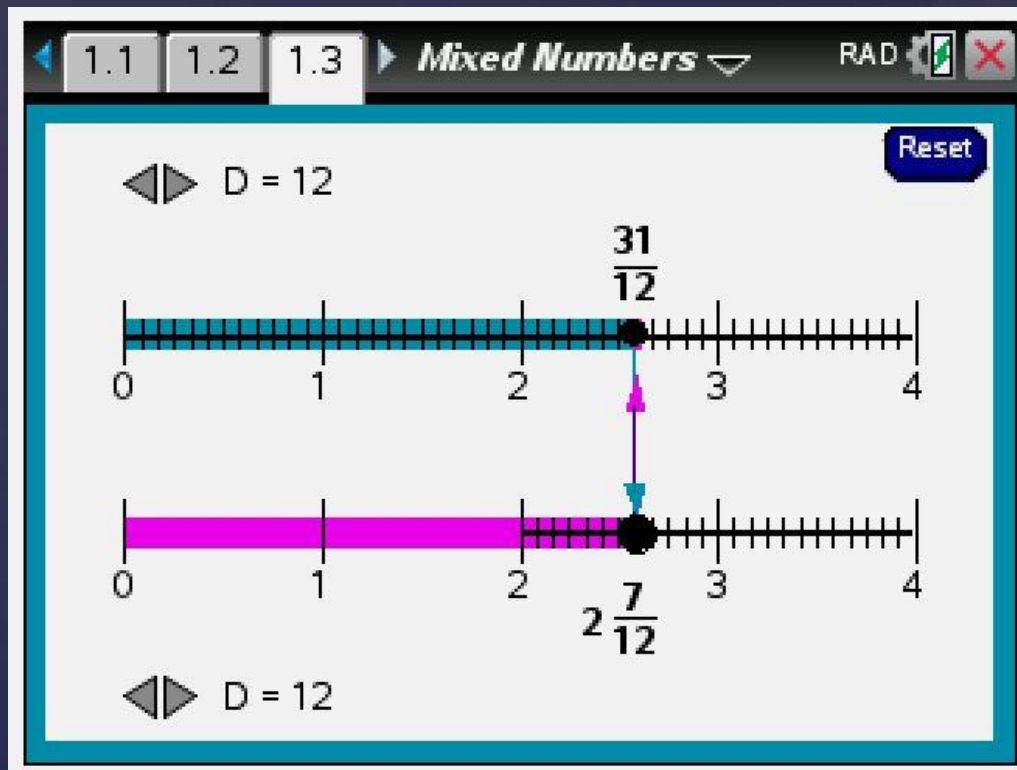


# Later Standards

- 7.NS.2.d. Convert a rational number to a decimal using long division: know that the decimal form of a rational number terminates in 0s or eventually repeats.
- 7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers. (Footnote: Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)
- 8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.



# Let's do some more mathematics



# NIX THE ~~TRICKS~~

## 3.3 Nix: Make Mixed Numbers MAD

Because:

This shortcut allows students to convert a mixed number to an improper fraction without understanding how wholes relate to fractions. This process skips the important conceptual steps that are happening behind the scenes.

$$3\frac{1}{5} \xrightarrow{3 \times 5 + 1} \frac{16}{5}$$

Handwritten diagram showing the conversion of  $3\frac{1}{5}$  to  $\frac{16}{5}$  using the MAD method. The 'M' is under the 3, the 'A' is under the 1, and the 'D' is under the 5. Arrows point from the 3 to the 16, from the 1 to the 16, and from the 5 to the 5 in the denominator.

## 3.4 Nix: Backflip and Cartwheel

Because:

There is no reasoning involved and it is very easy to mix up. Cartwheels and backflips both involve flipping upside down in the middle; if one fraction gets flipped around, why not the other?

$$\frac{16}{5} \xrightarrow{5 \overline{)16}} 3\frac{1}{5}$$

Handwritten diagram showing the conversion of  $\frac{16}{5}$  to  $3\frac{1}{5}$  using the backflip method. The '5' is written above the '16' with a division bar over it. An arrow points from the 16 to the 1 in the numerator of the fraction, and another arrow points from the 5 to the 5 in the denominator.



# Formative Assessment Insights

*Free, online course for K-12 Teachers, Instructional Coaches, and PD Staff*

Visit our *e-brochure* at <http://fa-insights.wested.org>.

Through 2 hours/week of professional learning in teams over the course of six months (September through March) participants will:

- ✓ gain deeper knowledge of college- and career-ready standards across content areas,
- ✓ develop knowledge and skills in implementing formative assessment practices effectively in support of deeper learning.

*Optional: three graduate credits available through COSA/PSU; additional requirements and costs (\$250) apply.*

*Deadline to register is August 21<sup>st</sup>\**.

✎ **Schools and districts** registering in teams: <http://fa-insights.wested.org/or-group-registration/>

✎ **Individual** registration: <http://fa-insights.wested.org/or-registration/>

\*Contact Renee LeDoux at [renee.ledoux@state.or.us](mailto:renee.ledoux@state.or.us) or 503-947-2545 if you have any questions about the course or have concerns about meeting this registration deadline.



Bryan Toller  
503-947-5832  
[bryan.toller@state.or.us](mailto:bryan.toller@state.or.us)

