RECOGNIZING EFFECTIVE IMPLEMENTATION OF STANDARDS

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May 23, 2012

Effective Implementation demands the:

- Inclusion of on-going formative assessments;
- Inclusion of non routine tasks;
- Facilitation of mathematical discourse; and
- Opportunity to build new mathematical knowledge through problem solving.

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Include Essential Components of Formative Assessment

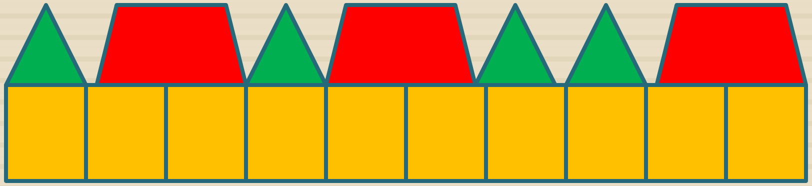
- Assess prior knowledge
- Use observational protocols
- Ask open questions
  - Engaging
  - Clarifying
  - Refocusing
- Collect exit cards/tickets to leave
- Listen twice as much as you talk

Pose Problems That Push Student Reasoning

- Problems that do not require an exact answer.
- Problems that peak a student's interest in the possible solutions.
- Problems that stimulate students to pose their own problems

Village Houses and Roofs

- In a small village houses are built in rows and either have a triangular roof or share a trapezoidal roof.



- How many possible roof arrangements are there if 10 houses are joined in a row?

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Look for and make use of structure

- What pattern might you see in this problem?
- How do you know you have not miscounted?
- How do you know you have counted all the different ways in which the houses might look?

Use a conjecture board

- Pose a problem.
- Record student's responses as conjectures.
- Test the conjectures, revise them, test them again…and repeat the process.
- Conjectures remain on the board until a counter example is found or there is a negation.

Consider the following:

On a number line 7 is halfway between 6 and 8

is

1/7 halfway between 1/6 and 1/8?

Construct viable arguments and critique the reasoning of others.

- How might you support your reasoning and "prove" that 1/7 is, or is not, halfway between 1/6 and 1/8.

- Given a list of three consecutive unit fractions will the middle fraction ever be halfway between the first and last? How do you know?

Appropriate Responses to Student Ideas

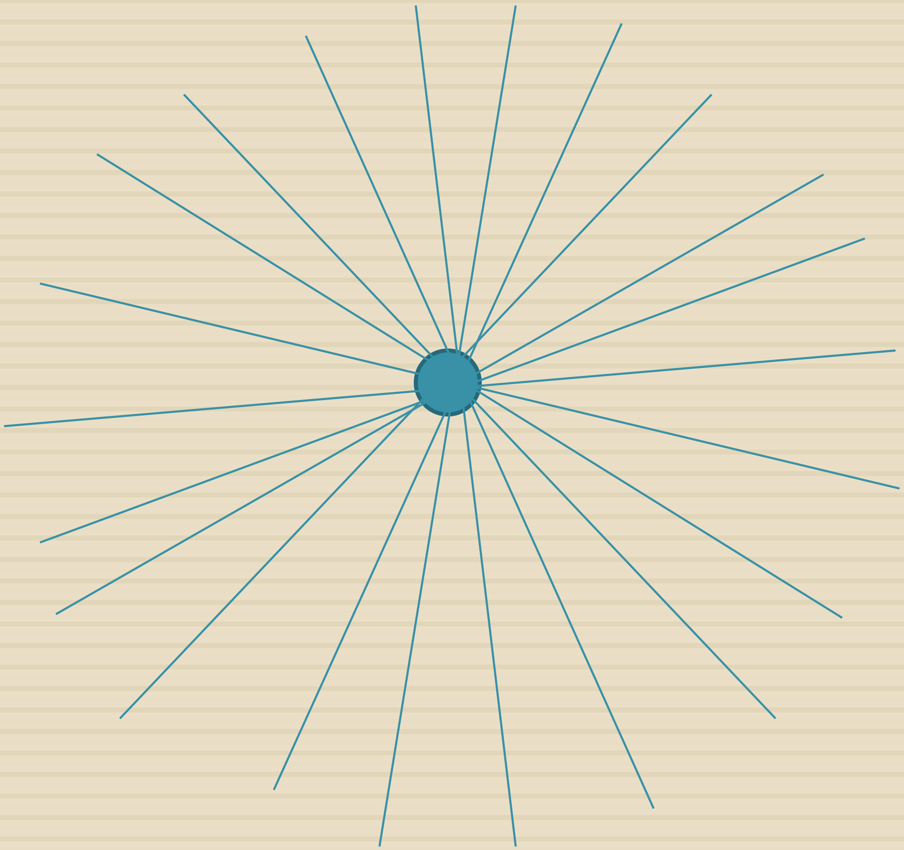
- React neutrally
- Record all responses on a conjecture board
- Listen for misconceptions
- Ask if anyone has a different idea or did it differently

Range Question

- Tell me everything you know about a circle.

Respond With a Clarifying Activity

- Pass out a large post-it note or an index card and instruct students to put a point in the center.
- Next, draw as many line segments as possible through the point BUT be sure there is an equal length on both sides of the center point.



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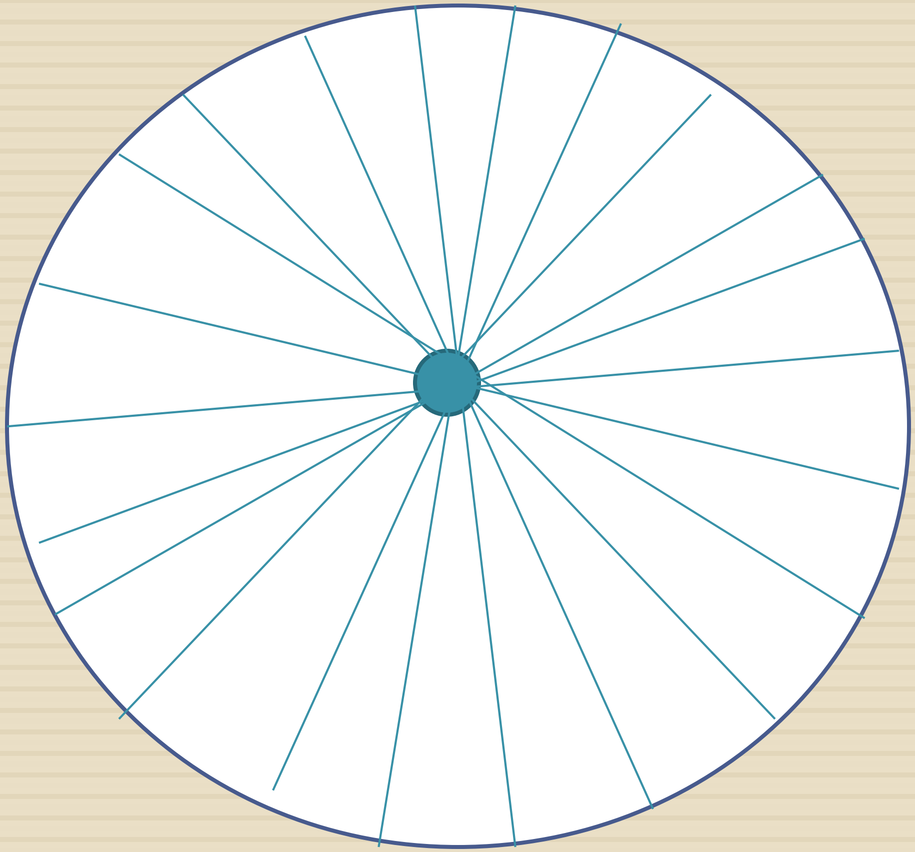

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Role of the teacher

- Select and set up an interesting and rich mathematical task.
- Support students' exploration of the task
- Share work and discuss the task

What are the differences between the following two problems?

- 4/5 is closer to 1 than 5/4. Show why this is true on a number line.

- What is closer to 1?
  a. 5/4
  b. 4/5
  c. ¾
  d. 7/10

Responsive Teaching

- Asks how you thought about the problem.
- Asks if that strategy will always work.
- Invites a student to explain why the strategy works or does not work.

Select and set up a mathematical task

- How does the task build on students' previous knowledge and experiences?
- What definitions, concepts, or ideas do students need to know to begin to work on the task?
- What questions will be asked to help students access their prior knowledge?
- What are all the ways the task can be solved?
- What particular challenges might the task present?

Reasoning and Sense-Making

Seamus ran 30 laps in 15 minutes.

Emma wrote $30 \div 15 = 2$.

What might the 2 represent?

Abby wrote $15 \div 30 = 0.5$.

What might the 0.5 represent?

Effective Teaching

- Puts the student first and foremost when planning lessons
- Asks questions that require more than a 1 sentence response
- Assesses where the student is on each given day
- Supports student learning, student discourse, student reasoning

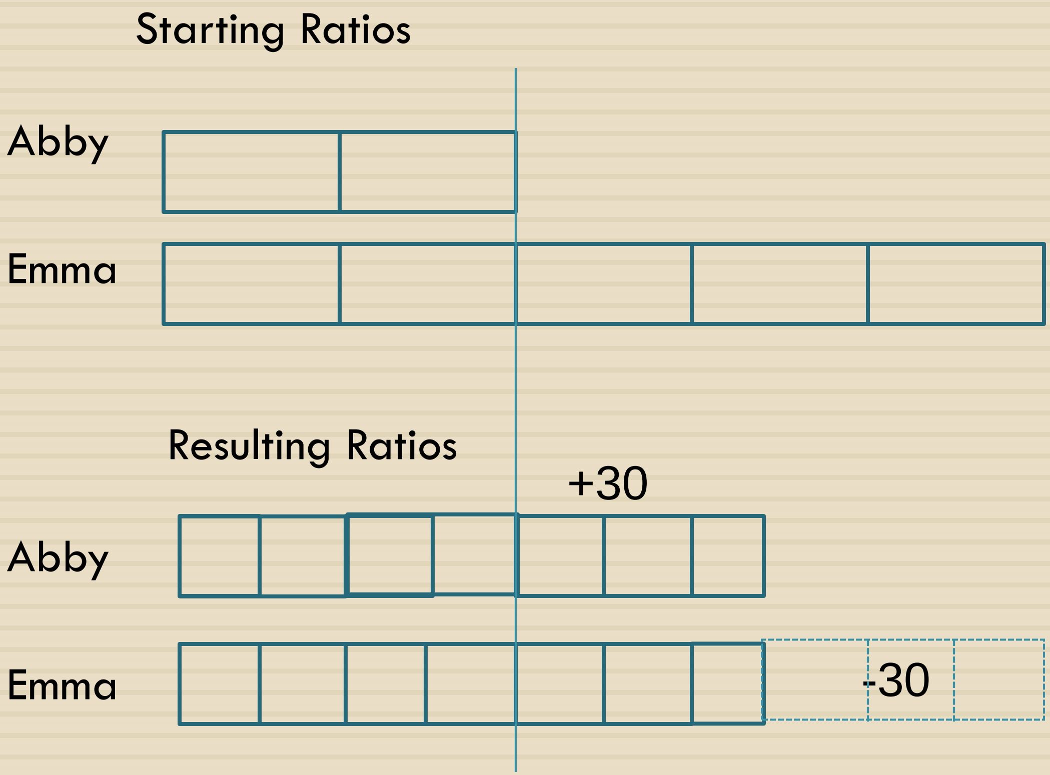
Consider the following

Abby and Emma shared some beads in the ratio of 2 : 5. If Emma gave 30 beads to Abby, they would have the same number of beads. How many beads did Abby have in the beginning?

Without solving the problem…answer the following questions.

- How does the task build on students' previous knowledge and experiences?
- What definitions, concepts, or ideas do students need to know to begin to work on the task?
- What questions will be asked to help students access their prior knowledge?
- What are some the ways the task can be solved?
- What particular challenges might the task present?

What are some problem solving strategies?



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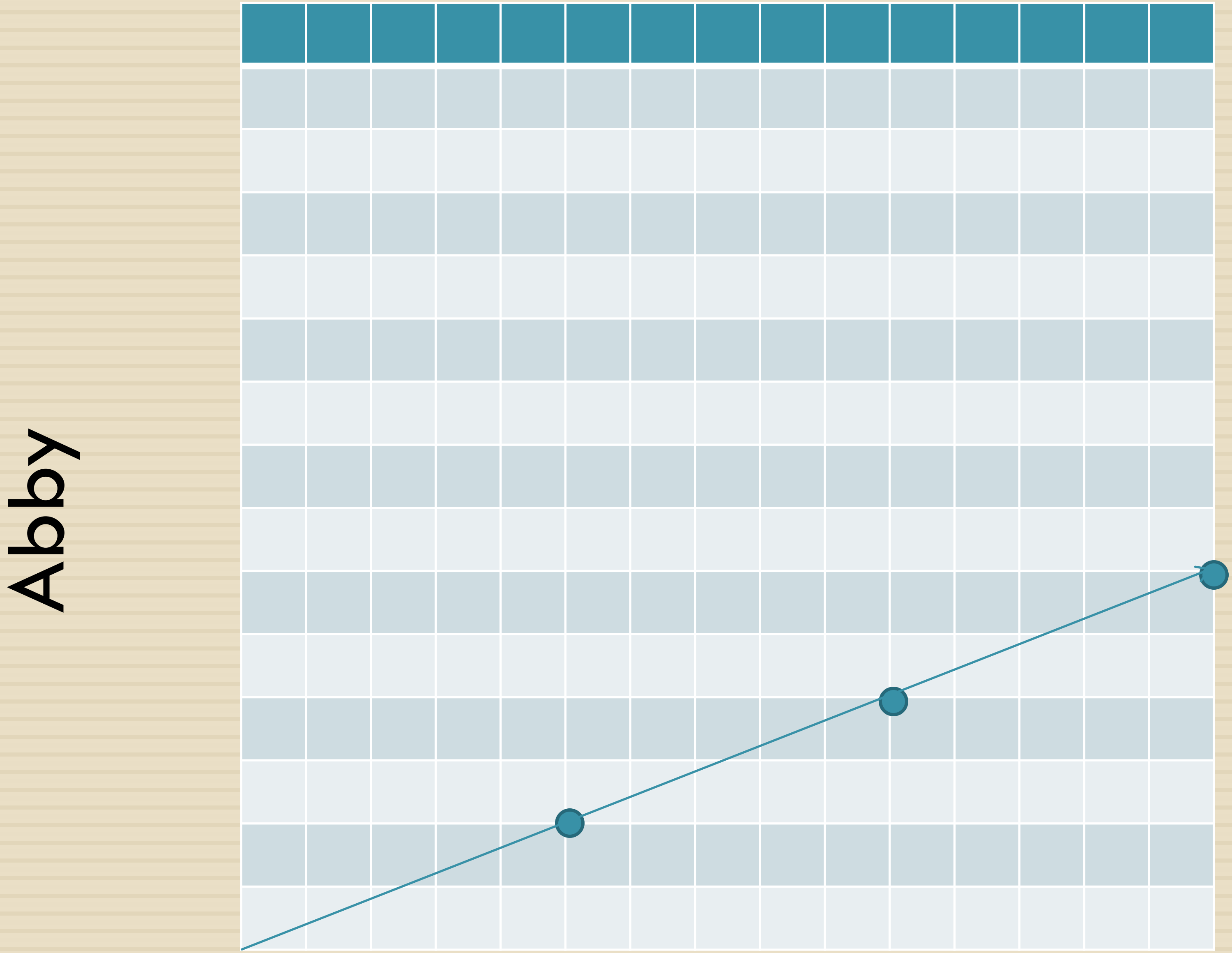
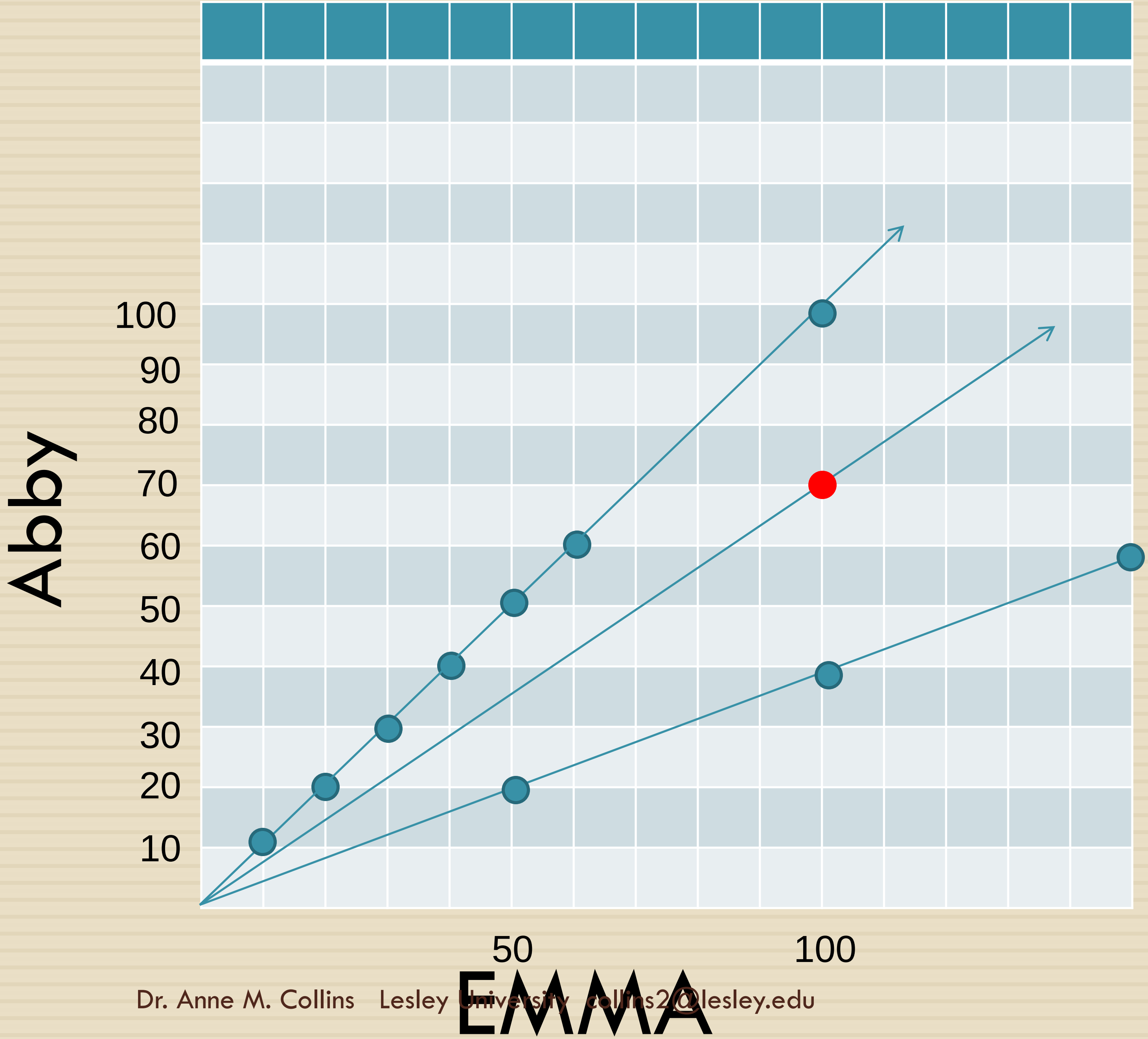
Algebraic Solution

- $2x + 30 = 5x - 30$
- $60 = 3x$
- $X = 20$

Emma had 100 beads to begin with. Abby had 40.


Abby
EMMA



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Effective Teaching: Values Incorrect Answers

Wrong answers:

- Need to be part of the teaching/learning process
- Give information about what the student is thinking
- Might be an error of haste or an on-going misconception

Answer Getting Versus Learning Math

- United States
  - How can I teach my students to get the answer to the problem or computation?
- Japanese
  - How can I use this problem to teach the mathematics of this unit?

On a bulletin board in a high school

AREA

- $A = lw$
- $A = s^2$
- $A = 2\pi r^2$

Model With Mathematics

- Think about the mathematics content that is usually presented in an abstract manner.
- Think about square roots. What do they look like? How might they be represented?
- What models can you use to make those abstract concepts approachable for all students?

Two Possible Models

- Find a close approximation for the square root of 43 (without using a calculator)

Geometric Model

- On graph *paper* outline a 6 x 6 square.

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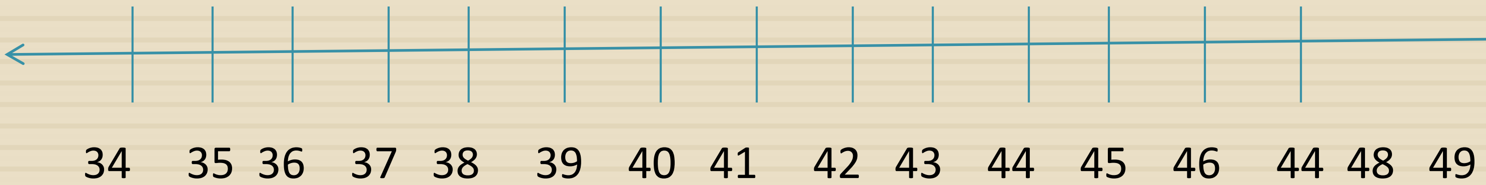
Number Line Model



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Use Multiple Representations

- A picture is worth a thousand words
- Which of the two models gives a visual image of what a square root looks like?
- Students learn best when they move from the concrete-pictorial-abstract.
- We jump too quickly to the abstract!

Fraction as Ratio

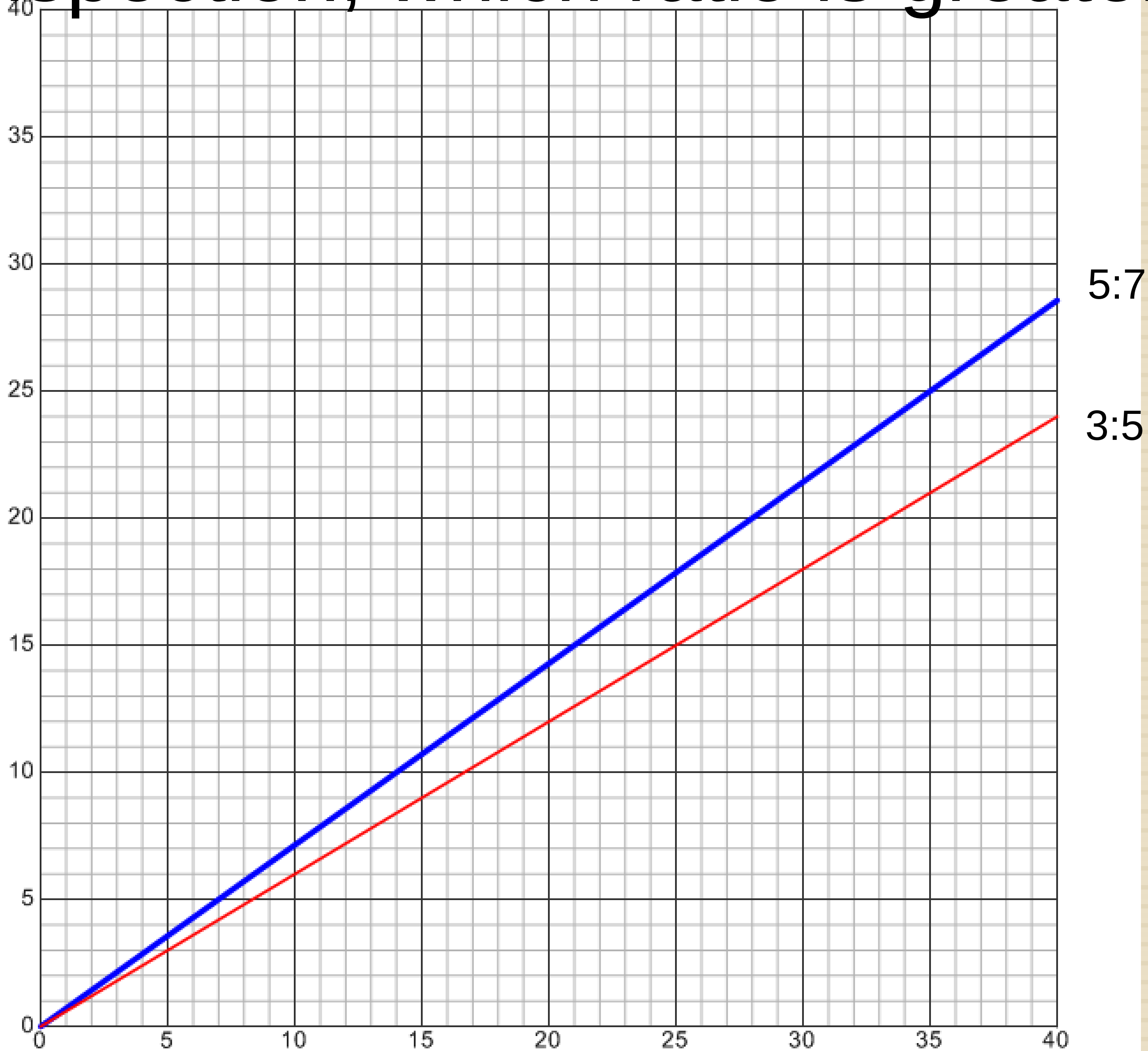
- Discrete
- Relationship between the numerator and the denominator
- Either a part to part or part to whole comparison
- Represent a Rate

Geometric Representations

- What representations might you use to compare ratios?

- Which is greater 5:7 or 3:5? And why do you think I chose those two ratios?

By Inspection, which ratio is greater?



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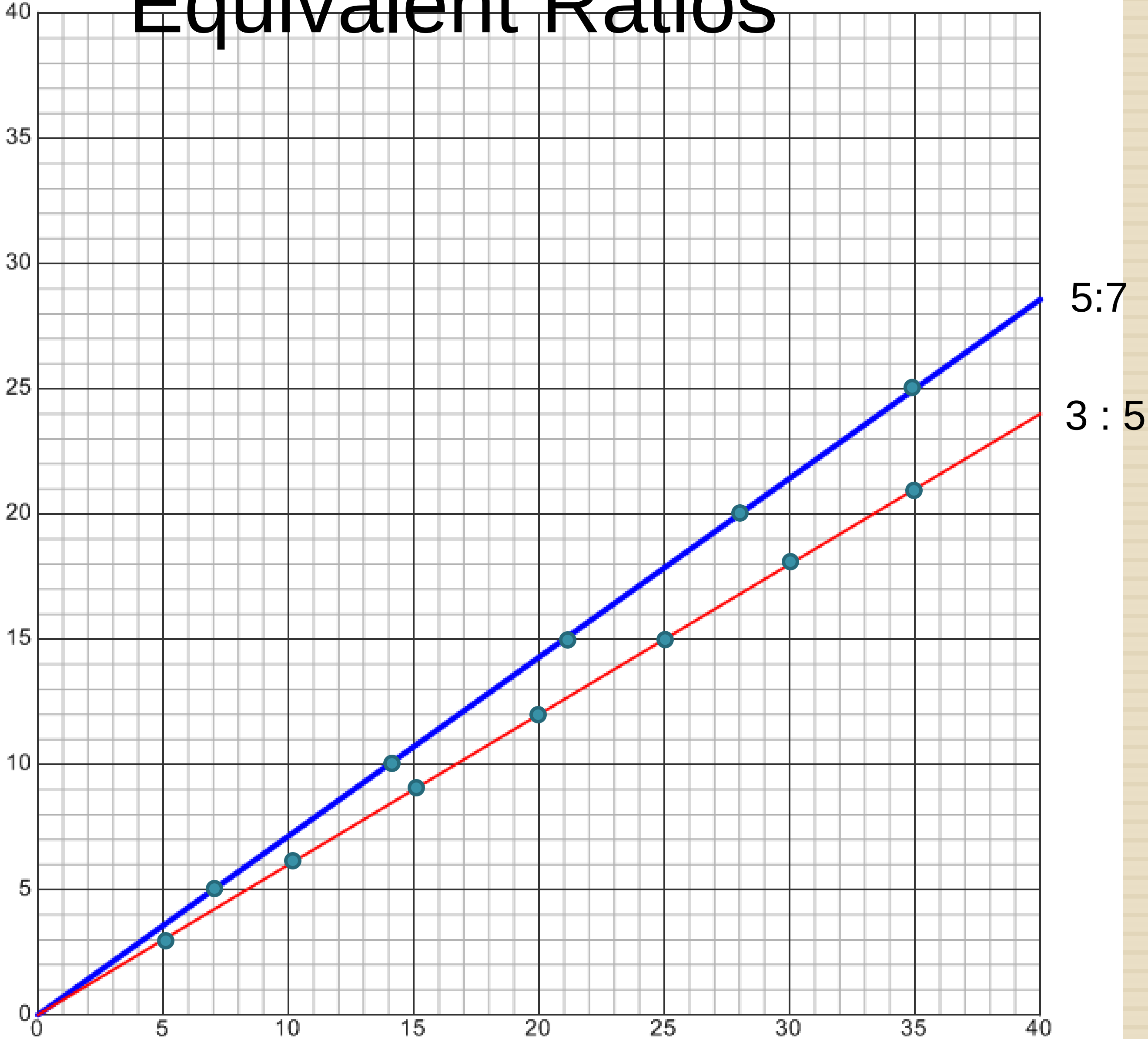
Equivalent Ratios



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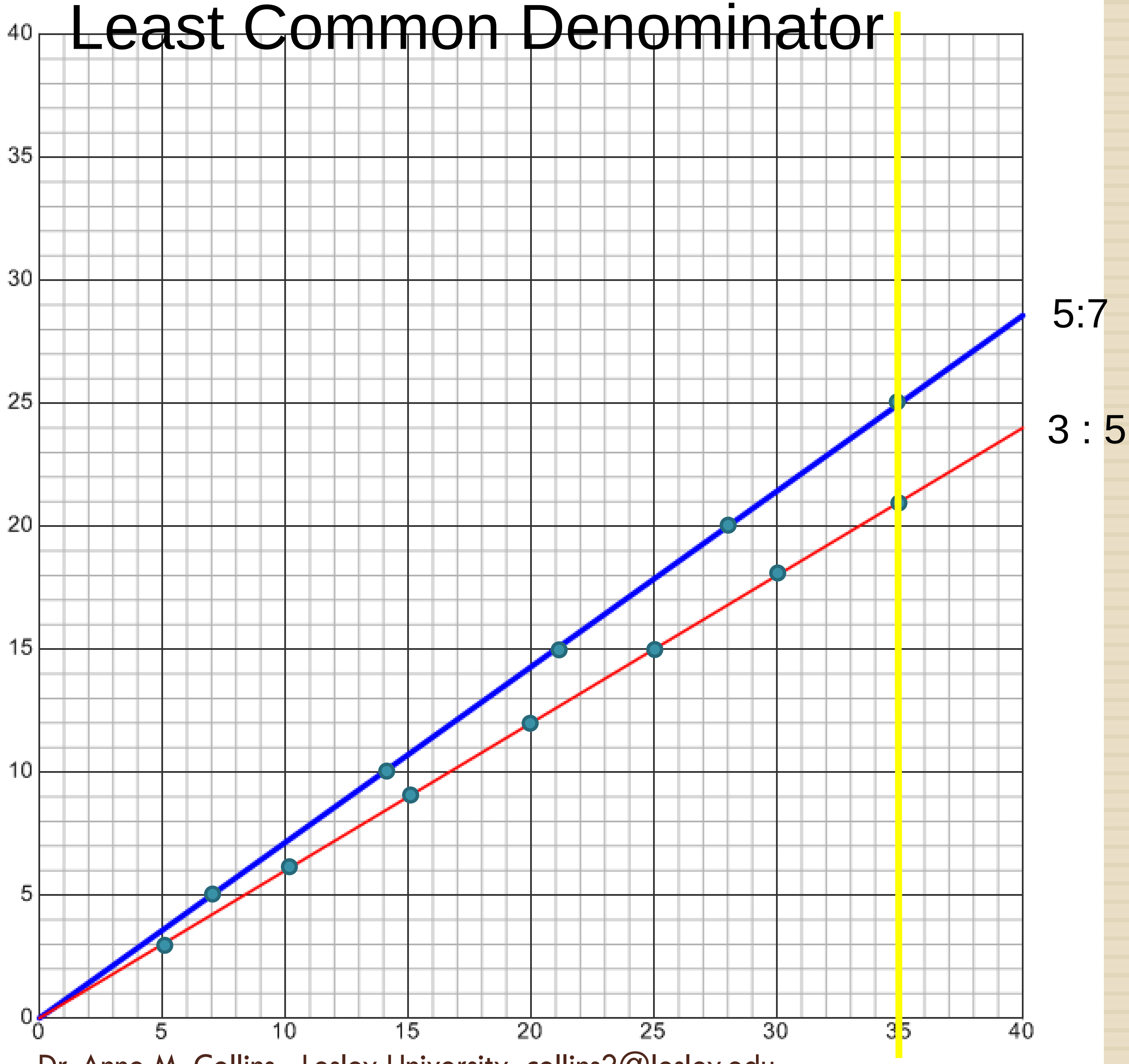
Least Common Denominator



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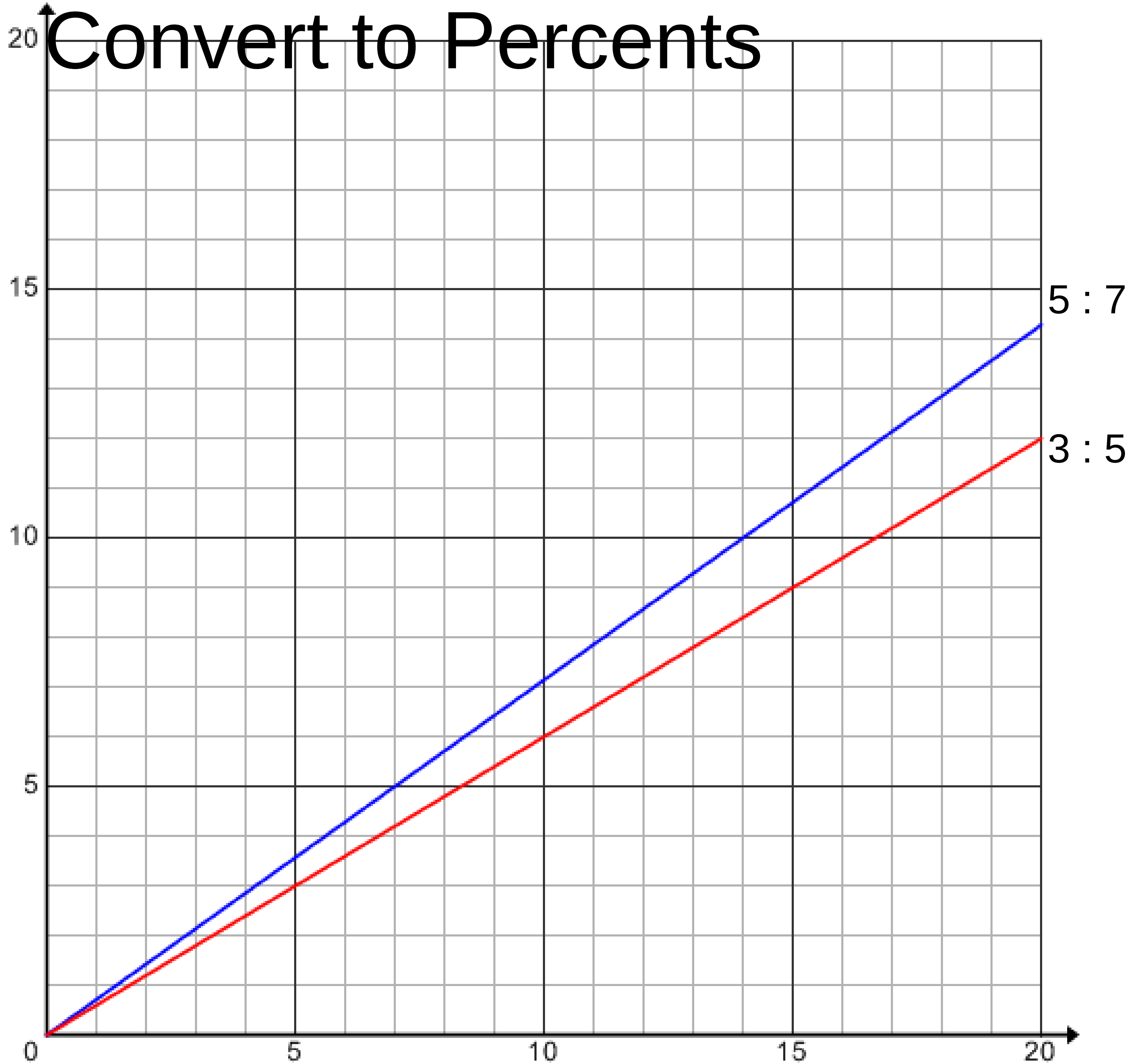
Convert to Percents



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I – We – You Teaching Strategy Is **Ineffective!**

- I- Teacher presents a topic, shows how to do the procedural steps.
- We- Students work through computations with the teacher
- You- Students practice the procedures with worksheets

Underlying Tenet of CCSS-M

- Teachers need to change the way in which they teach.
- If we keep doing what we have always done the results will continue to be the same…and that is not good enough.
- Coaches need to correct mathematical errors…even if it feels awkward.
- Administrators must ensure student ideas, misconceptions, and engagement are at the forefront of every classroom.