

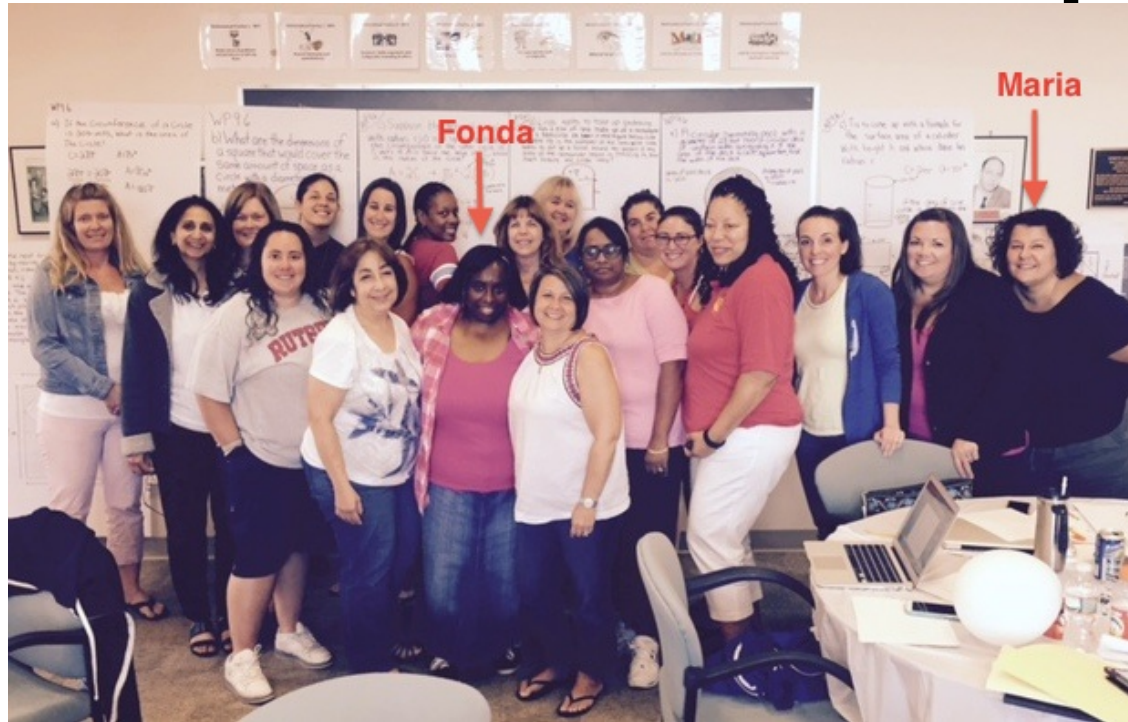
**The Central New Jersey Partnership to
Enhance Mathematics Achievement
CNJ-PEMA**

***What Can Elementary Mathematics
Teachers Learn From Interviewing
Their Students?***



A presentation prepared for the
2015 NCTM Regional Conference -
Nashville, TN
November 18-20, 2015

CNJ-PEMA Partnership



Rutgers University
Partner School Districts
Franklin Township
North Brunswick Township
New Brunswick

Why Focus on Questioning?

“...teachers who press students with *strategic questions* and carefully monitor their answers can move pupils to genuine mathematical *argument* and *reasoning*...”



Why Focus on Questioning?

“...up to **80 percent** of teachers’ interactions with students include **questioning** (Fillippone, 1998). During math discourse, questioning should **challenge students** to be inquisitive and help them **extend** their existing mathematics **knowledge**—for example, “**Why does this work?**” “**Is there a more efficient way of doing that?**” and “**Does this work in every case?**” (Schwols & Dempsey, 2012b).” (Kirsten Miller, ASCD)

Why Focus on Questioning?


Mathematics Teaching Practices

Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.

Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.


Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.

Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.

 **Pose purposeful questions.** Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.

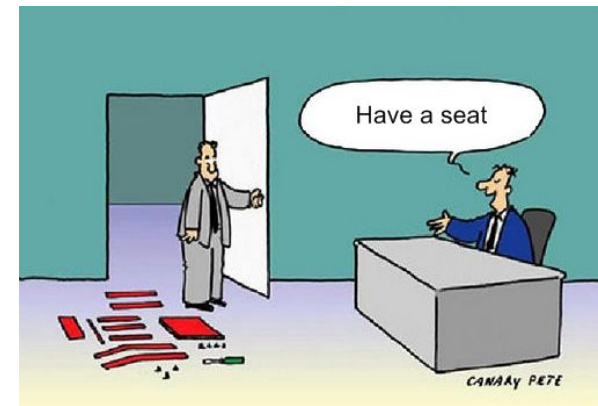
Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.

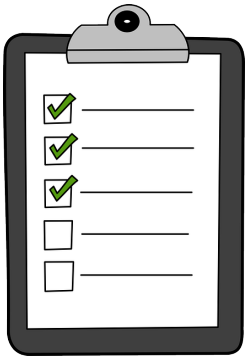
Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.

 **Elicit and use evidence of student thinking.** Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

Clinical Interview: Main Points

- Flexible method for finding out what students think and believe about the world.
- Allows for interpreting student's thinking, strategies, reasoning abilities.
- Can give dramatic insight into how a student's world is different from an adult's world.
- Encourages student's thinking. It makes the adults think, too.



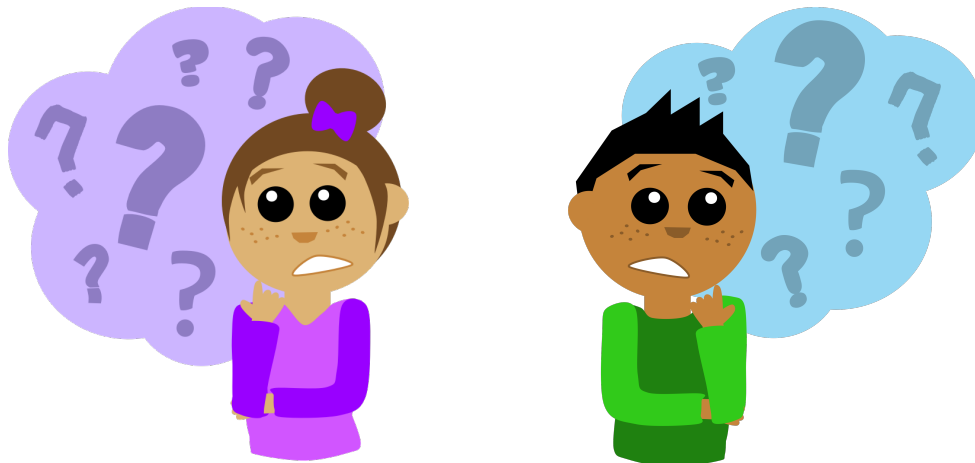


Checklist for the Successful Interviewer

- Prepare a protocol
 - Leave room for flexibility.
 - Choose “appropriate” tasks.
- Put the student in the role of expert.
- Ask for justifications (whether a solution is right/wrong).
- Avoid unnecessary corrections and teaching.

Fundamental Questions

- Tell me how you did that.
- Does that always work? Why or why not?
- What would happen if...?
- How could you explain this to someone who was absent from class? To a younger student?



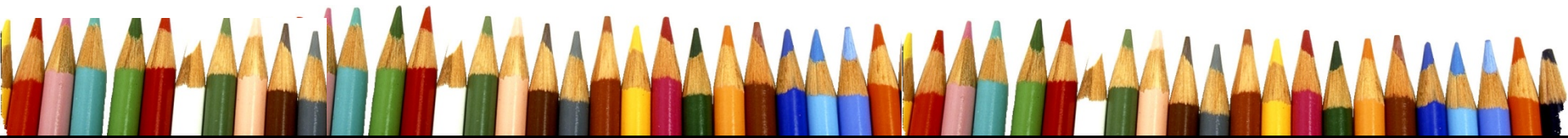
Fonda Dortch-Taylor

Students' understanding of the equal sign

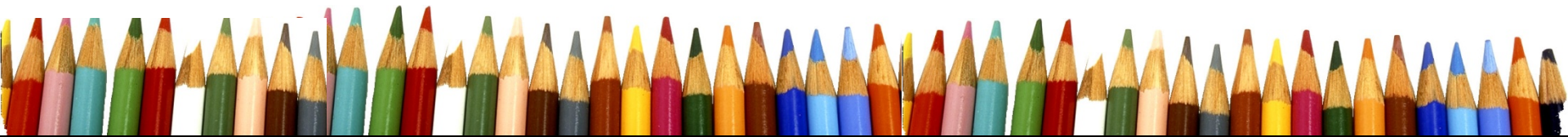


DEFINED

The symbol = Shows that what is on the left of the sign is equal in value or amount to what is on the right of the sign.



HOW DO
STUDENTS VIEW
THE EQUAL SIGN?



First, Third & Fourth Grades

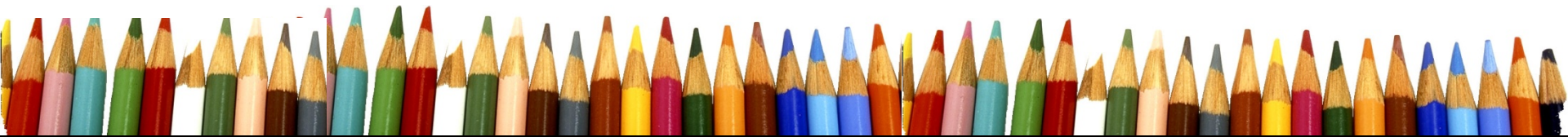


Tenth and Twelfth Grades



MISCONCEPTIONS

- The answer to the problem
- Sum
- Difference
- Total amount
- How much is left
- Adding
- Put two numbers together



MISCONCEPTIONS

Cameron: $7 + 6 = 18 + 5$

Teacher: Cameron, what number did you put in the box?

Cameron: Eighteen

Teacher: How did you decide?

Cameron: 7 and 6 are 13 and 5 more is 18

Teacher: Does 7 plus 6 equal 18 plus 5?

Cameron: 7 + 6 is 13 and 5 more is 18

Luke: $7 + 6 = 13 + 5$

Teacher: Luke, what number did you put in the box?

Luke: Thirteen

Teacher: How did you decide?

Luke: 7 and 6 are 13

Teacher: What about the 5?

Luke: It doesn't matter. The answer to 7 + 6 is 13

Teacher: What is the 5 doing then?

Luke: It's just there.

Chris: $7 + 6 = 8 + 5$

Teacher: Chris, what number did you put in the box?

Chris: Eight

Teacher: How did you decide?

Chris: (Points to the numbers) $7 + 6 = \square + 5$

5 is one less than 6, so you need a number that is one more than 7 to go in the \square so it all balances.

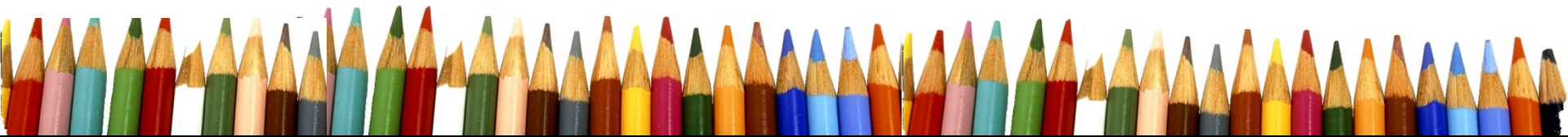


WHERE DO WE GO FROM HERE?

It is imperative that teachers on all levels reconsider how they teach equality.

=

means the same as. It does not mean the answer is on the right side.



LEARNING TARGETS

The following should serve as learning targets when teaching equality:

- ◆ Students will be able to explain that the equal sign means "same as."
- ◆ Students will be able to compare the value of both sides of an equation and determine whether the equation is true or false.
- ◆ Students will know that an equal sign represents the relationship between two equal quantities.
- ◆ Students will know that the quantities on both sides of the equation are equal in value.



Maria Russo

Assigning fraction names

Standard: CCSS.MATH.CONTENT.5.NF.A.2

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result $2/5 + 1/2 = 3/7$, by observing that $3/7 < 1/2$.*

Figure 1

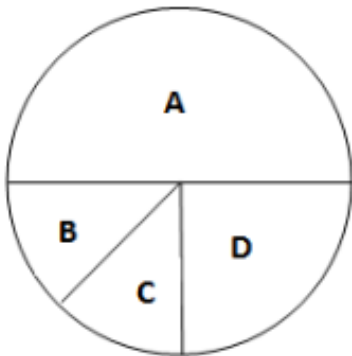


Figure 2

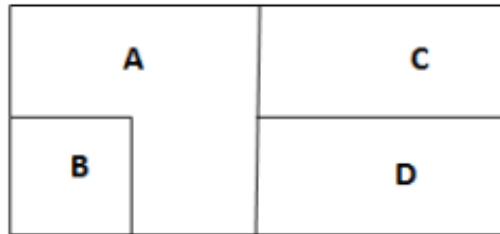
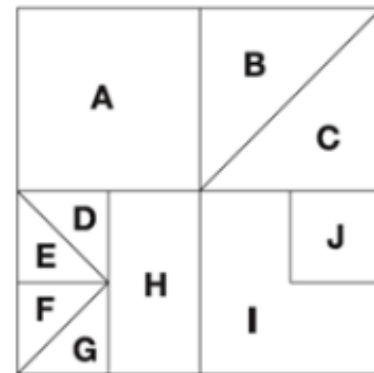


Figure 3



End of Unit Assessment

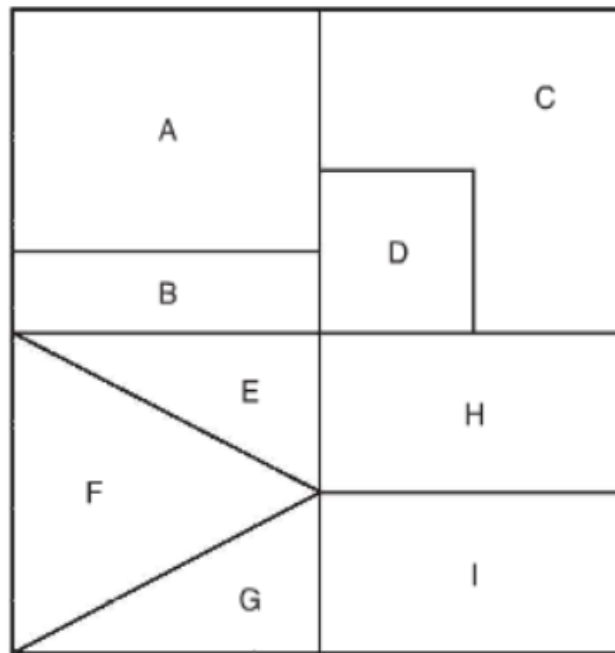


Finding Fractions

The figure below represents One.

Find and write the correct fraction in each of the figure's parts.

Check to be sure that the sum of the fractions is 1.



Explain how you found the fraction for the part labeled F.

What students would need to know about fractions:

- Fractions are numbers that can be added, subtracted, multiplied and divided
- Fractions are divisions of a whole. The more divisions, the smaller the pieces
- Fractional parts need to be equal in size
- Different fractional names can be given to equivalent parts
- The value of any fraction in a model is dependent on the value of the whole. If the whole changes, so does the value of each fractional part.



**KEEP
CALM
AND
ENJOY
FRACTIONS**

The Interview



Figure 1

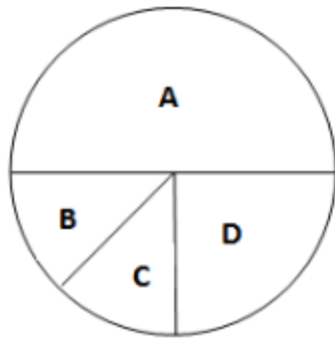


Figure 2

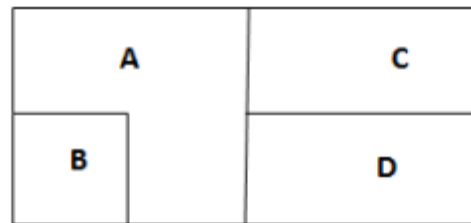
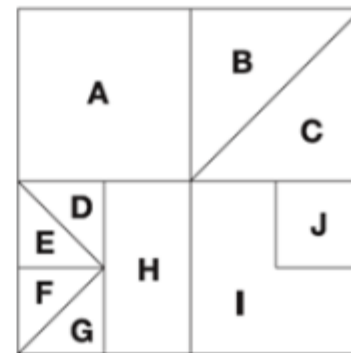
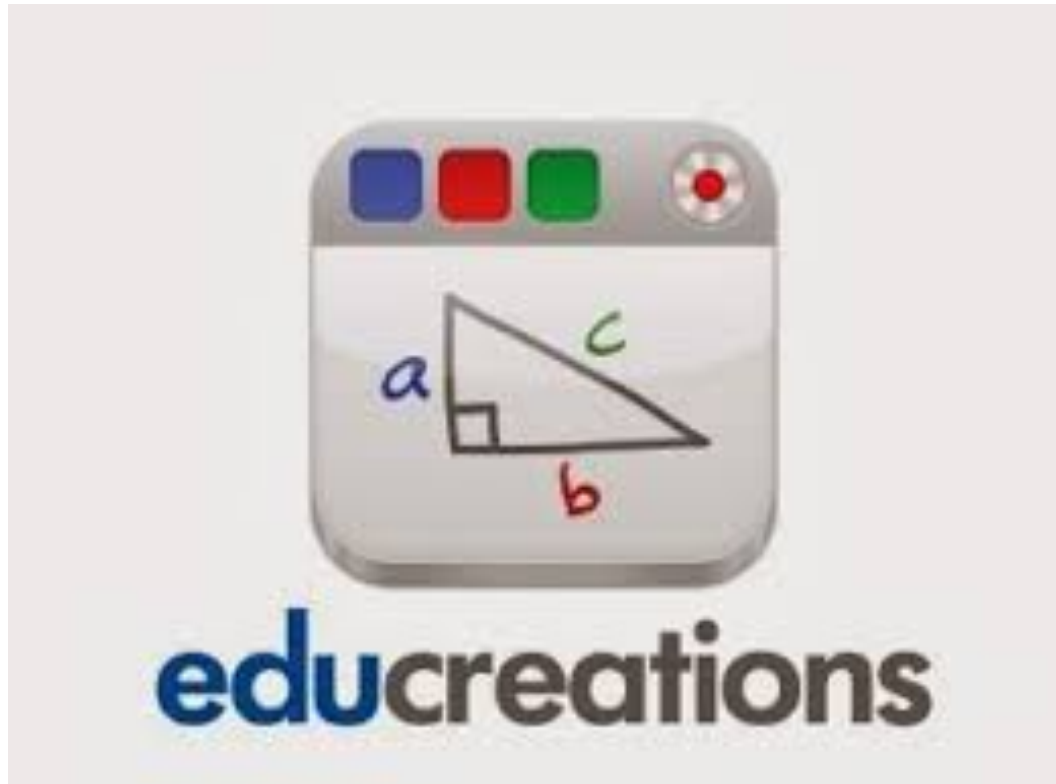


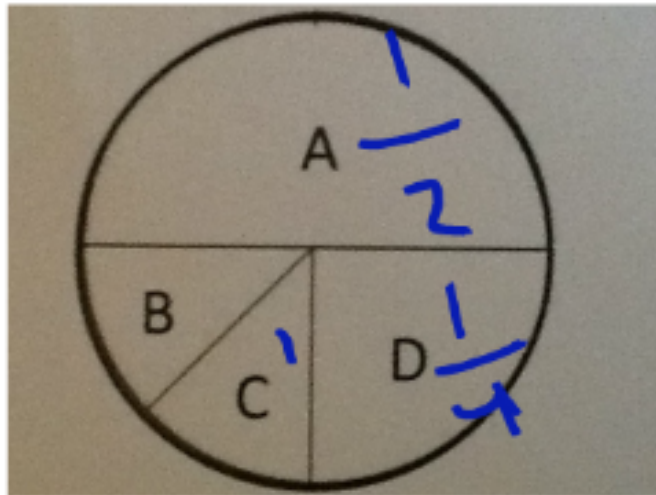
Figure 3



Educreations Application for iPad



What I learned:



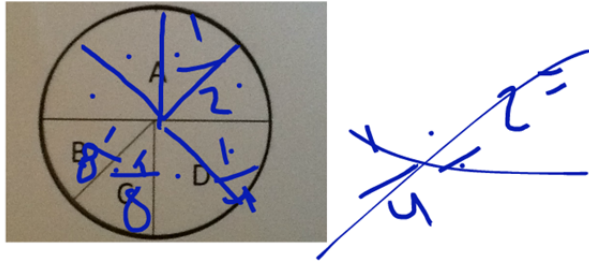
$$\frac{1}{2} \div \frac{1}{4} = 2$$

"I know I need to break $\frac{1}{4}$ into 2 pieces"

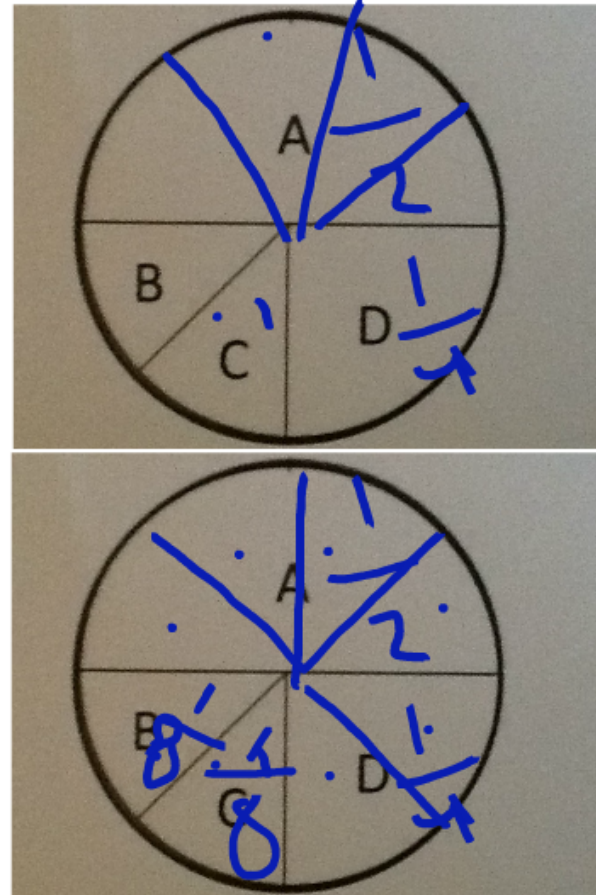
"I don't know what this part would be (C) if I took this part (B and C) and split it into 2 pieces"

$\frac{2}{8}$ A	$\frac{2}{4}$
$\frac{1}{8}$ B	$\frac{2}{4}$ D

" Can you erase?"

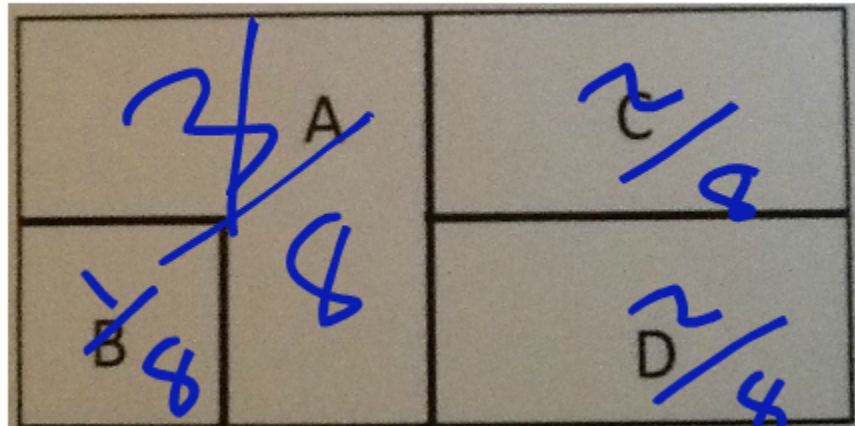
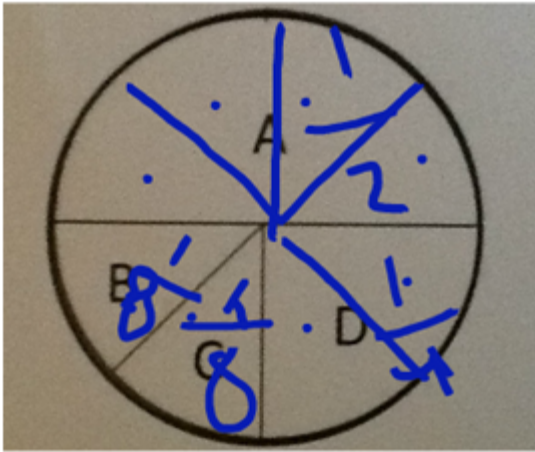


"That (B) would be $1/8$ because the circle could be split up into 8 little triangles of the same size as B and C. And they're (B and C) each one triangle so it would be $1/8$ because there's 8 of them when you split them up in the circle."

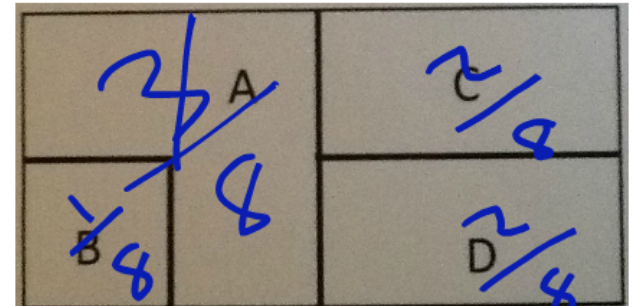
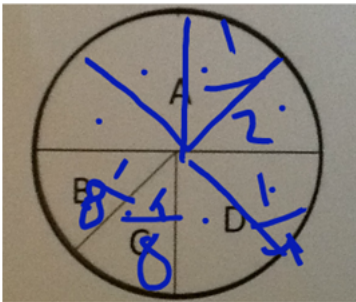


1:20-3:45

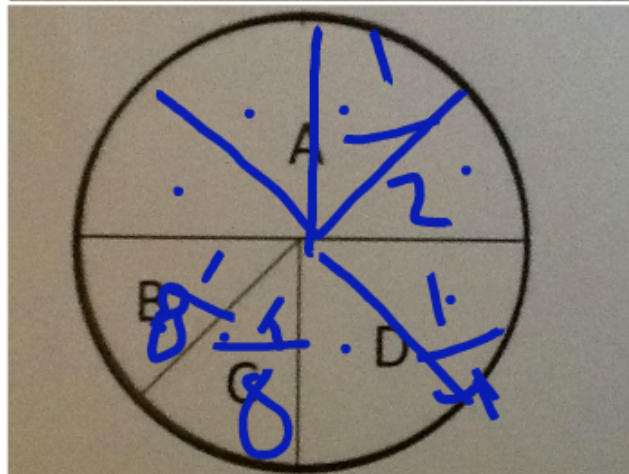
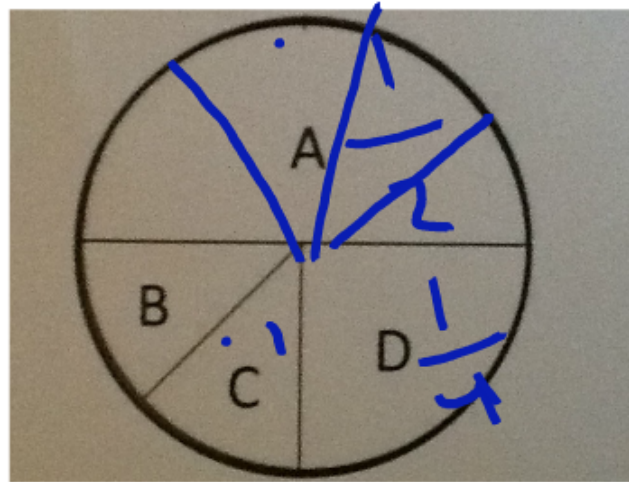
The Unit Fraction



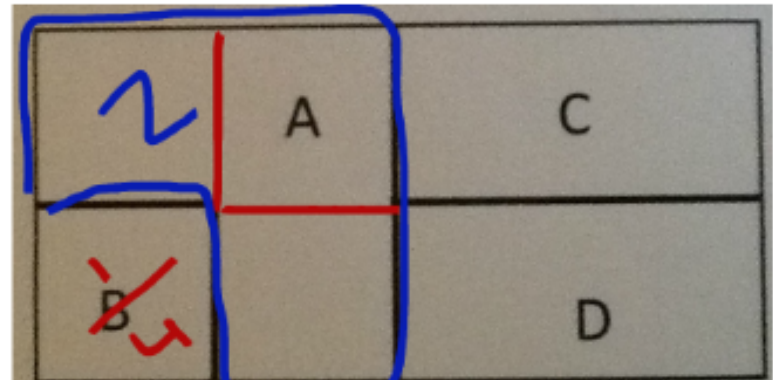
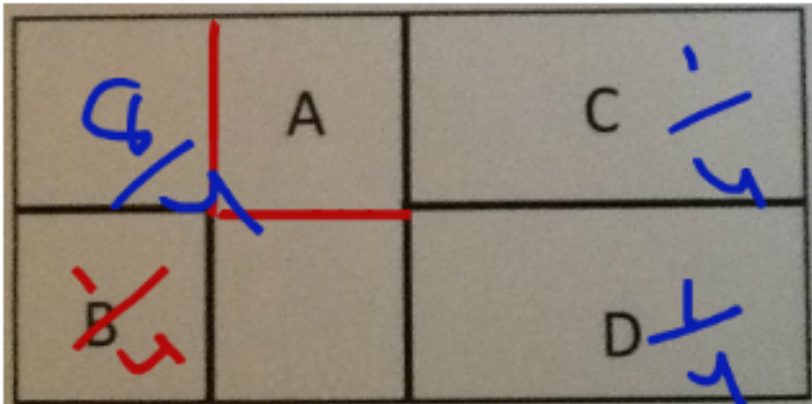
Wrong to Assume



Understanding the “Whole”



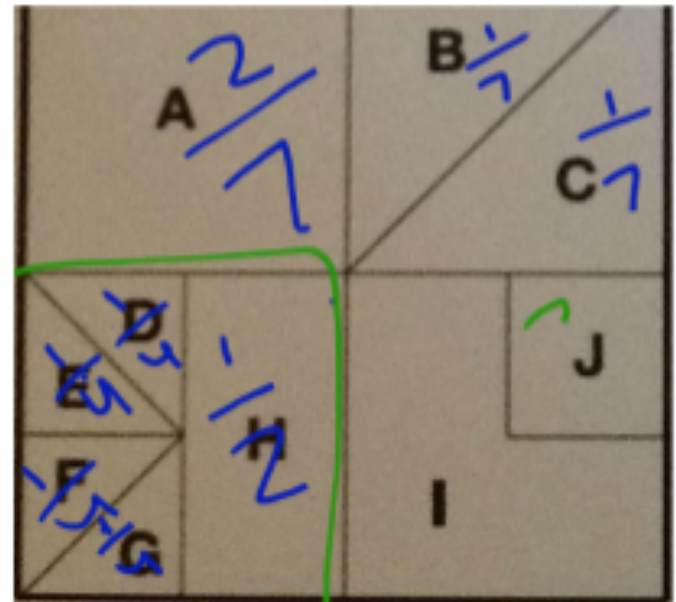
Losing the Whole



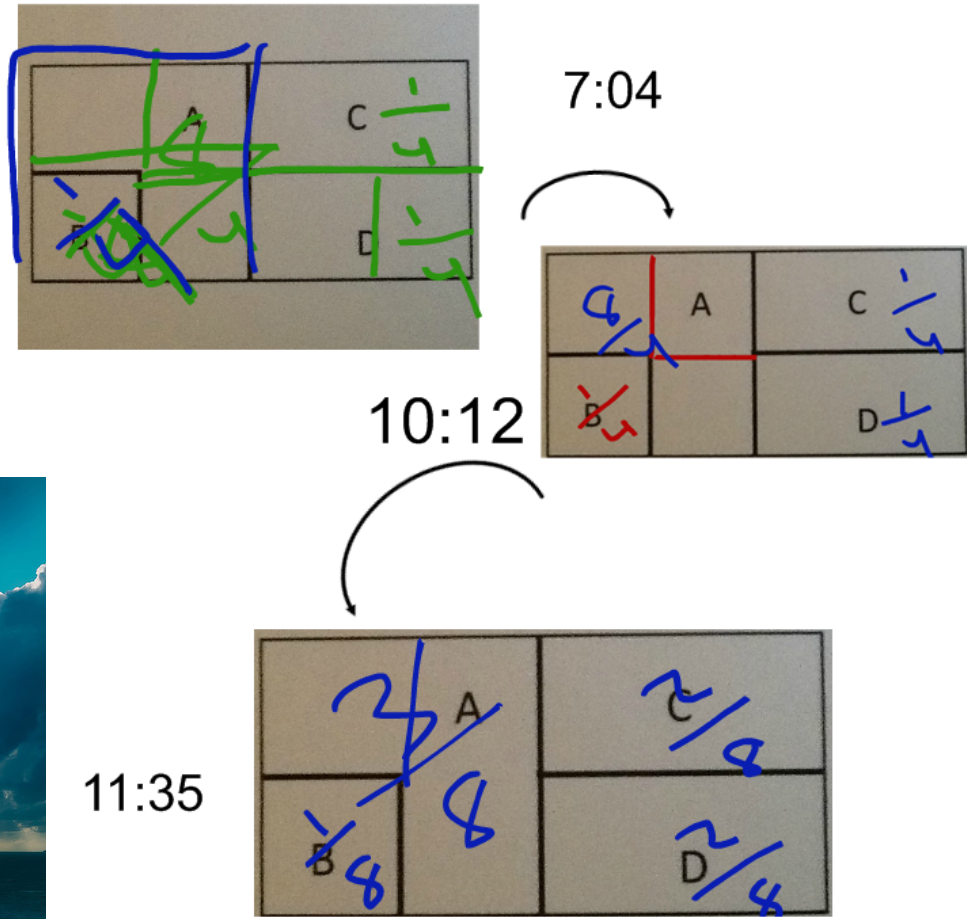
Losing the Whole

“D, E, F, and G are each $\frac{1}{4}$ because there are 4 of them.”

“H is $\frac{1}{2}$ because it is half of this box (outlined in green)”



Wait Time and the urge to “Jump In”



Computation Situation



Computation Situation

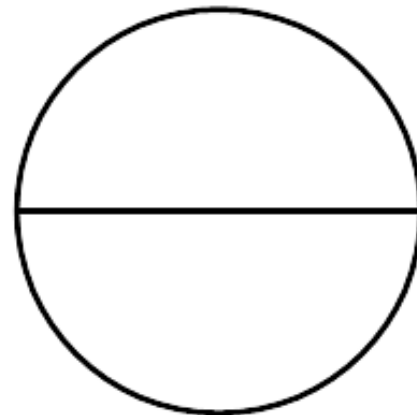
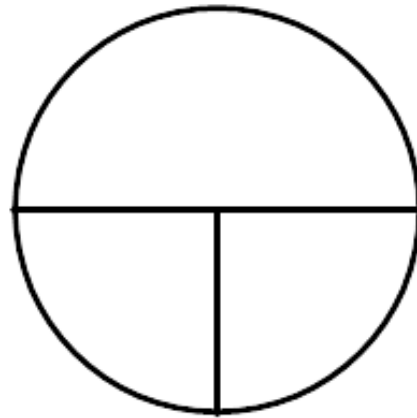
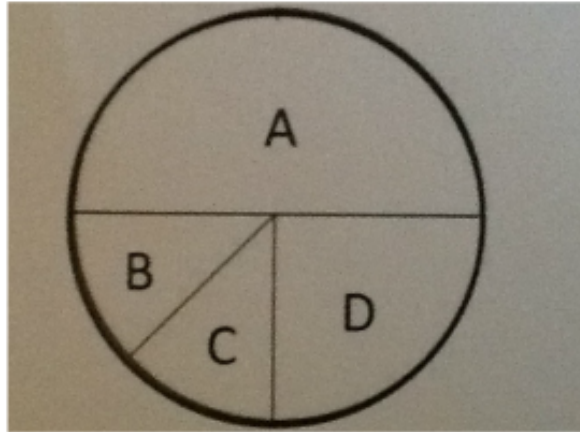
$$\frac{1}{2} + \frac{1}{5} = \frac{2}{4} + \frac{4}{4} = \frac{6}{4}$$



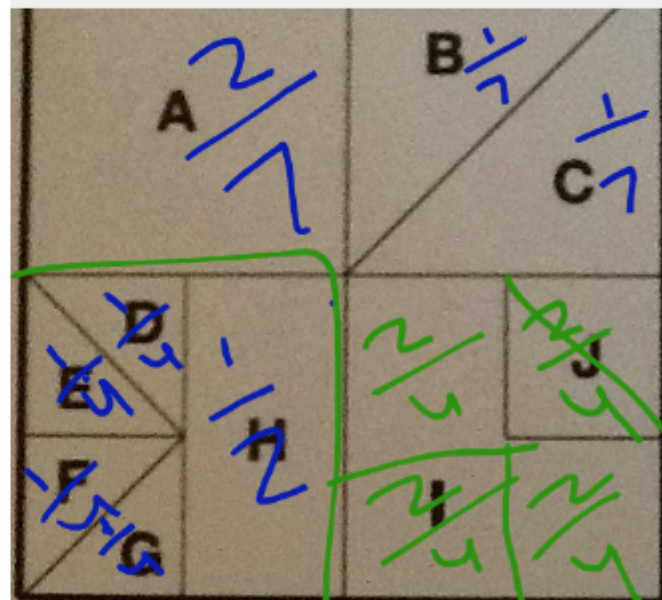
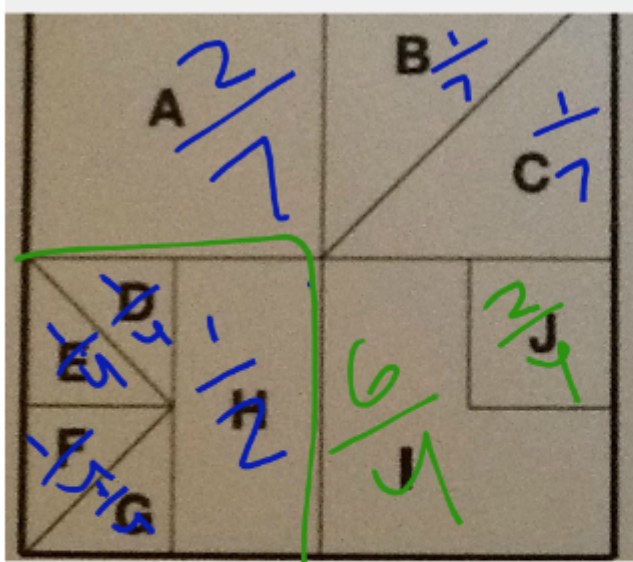
$$\frac{1}{2} + \frac{1}{5} = \frac{2}{4} + \frac{4}{4} = \frac{6}{4}$$



Baby Steps



One thing leads to another...



THE *Hits* JUST KEEP ON COMING

Figure 1

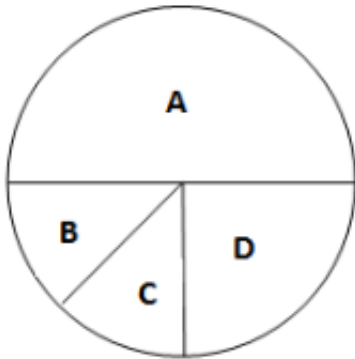


Figure 2

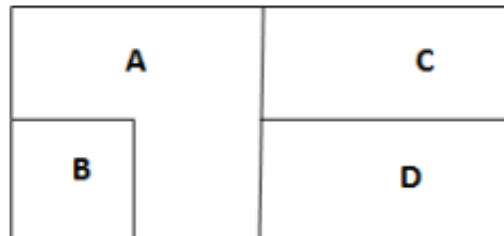
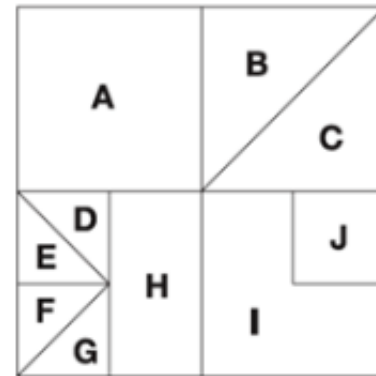


Figure 3



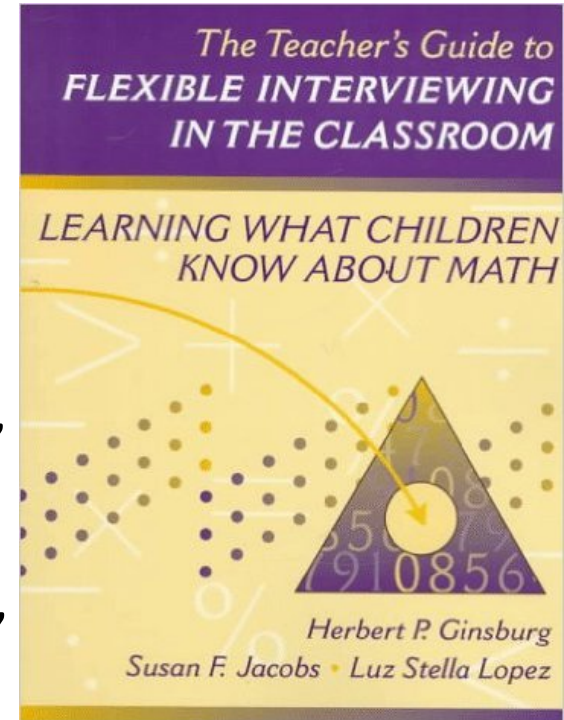
Selecting Rich Mathematical Tasks

Curriculum Materials

- Go Math (New Brunswick), Everyday Math (North Brunswick), Go Math & engageNY (Franklin Twp.)

Teacher's Guide to Flexible Interviewing in the Classroom (Ginsburg, Jacobs, & Lopez, 1998)

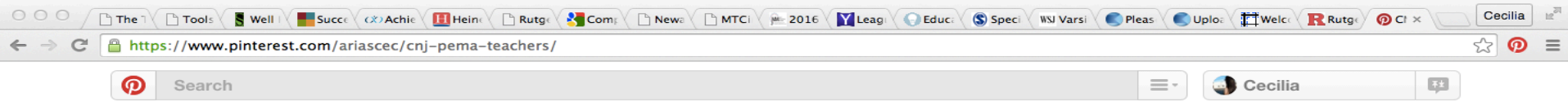
- *“Suppose that your friend said that \$3.00 minus 65 cents is \$2.45. Can you find your friend's error? Why do you think that error was made? How could you help your friend understand how to find the correct amount?”*
- Counting, place value, operations, prime and composite numbers, fractions, ratio, percent, decimals, geometry



Selecting Rich Mathematical Tasks

Pinterest (we pin with our PEMA teachers!)

- <https://www.pinterest.com/ariascec/cnj-pema-teachers/>
- <https://www.pinterest.com/ariascec/classroom-questioning-techniques/>



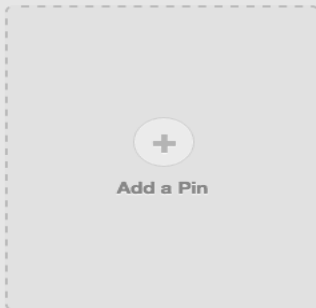
CNJ PEMA Teachers

Resources to share with CNJ PEMA teachers (2014-2016)



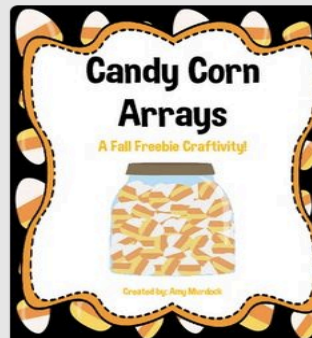
92 Pins
137 Followers

Move Pins Edit board ...

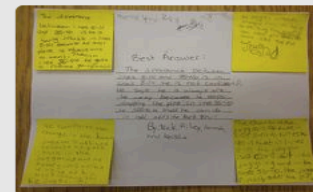


Number portrait, good sub idea

Pinned by Cecilia Arias



Here's a fun fall themed freebie that incorporates some math skills! This craftivity includes templates to have your students create candy corn arrays for multiplication facts or to use to practice fractions. I've included directions on how to assemble the jars for either skill.



from rundesroom.com
Five For Friday - Test Prep and Angry Birds

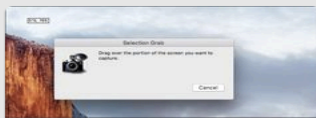
Four corners post-its, one from each student, then they create the best answer in the center.

Pinned by Normita Princezz



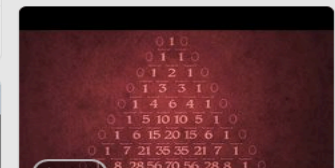
Con Edison STEM Day Out, the first Wednesday of every month during the school year; can sign up for a free field trip – The Museum of Mathematics

Pinned by Cecilia Arias



How to Use the Grab Utility in OS X for Advanced Screenshots

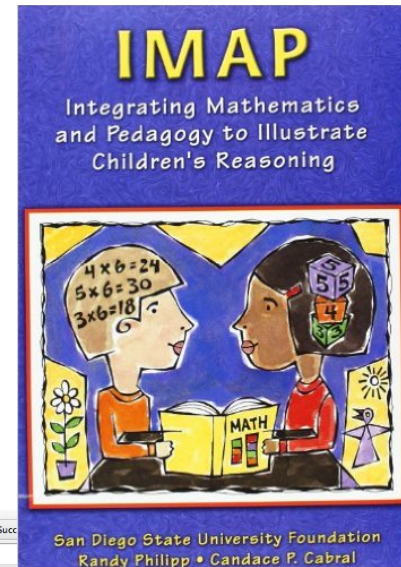
Pinned by



Selecting Rich Mathematical Tasks

Illustrative Mathematics Mathematics Assessment Project

IMAP



The image shows the homepage of the Illustrative Mathematics website. It features a large blue header with the text 'Welcome to Illustrative Mathematics' in white. Below the header, there is a sub-header 'Content Standards' and a description: 'Resources arranged under the Standards for Mathematical Content.' The page also includes a navigation menu on the left with options like 'Content Standards', 'Practice Standards', 'Blueprints', 'Progressions', and 'Professional Learning'. The Illustrative Mathematics logo is in the top left corner.


The image shows the homepage of the Mathematics Assessment Project (MAP) website. The header includes the title 'Mathematics Assessment Project' and 'ASSESSING 21ST CENTURY MATH'. Below the header, there is a navigation menu with options like 'Home', 'About', 'News', 'Lessons', 'Tasks', 'Tests', 'PD Modules', 'TRU Math Suite', and 'Standards'. The main content area features a large image of students working together, followed by a description of the project and several sections: 'Formative Assessment Lessons: Classroom Challenges', 'Summative Assessment Tasks', 'Prototype Tests', 'Professional Development Modules', and 'The TRU Math Tools Suite'. The MARS (Mathematics Assessment Resource Service) logo is in the top right corner.

Selecting Rich Mathematical Tasks

- [101 Questions](#)
- [Would You Rather...?](#)

101questions SEARCH CREATE TOP 10 JOIN SIGN IN

Download More



What's the first question that comes to your mind?

140 Skip It, I'm Bored Submit & See Next

www.wouldyourathermath.com

WOULD YOU RATHER...?

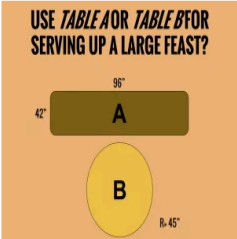
ASKING STUDENTS TO CHOOSE THEIR OWN PATH AND JUSTIFY IT

About Me WYR Sample Sheet

Latest Posts

Would You Rather...

stevens009 November 18, 2015 0



USE TABLE A OR TABLE B FOR SERVING UP A LARGE FEAST?

USE TABLE A OR TABLE B FOR SERVING UP A LARGE FEAST?

Which ever option you choose, justify your reasoning with mathematics. Think about what needs to go on the

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John Stevens @jstevens009 9h To test out this new website, here's a NEW #wymath:

Considerations for Incorporating the Clinical Interview Method

As part of coursework for pre-service teachers

- Focus on questioning
- Focus on listening
- Discuss how thinking of students' may differ from their own thinking

As part of a professional development program for teachers

- Discuss purpose of interview (to gather information, not to teach)
- Focus on questioning
- Discuss what to do with information gathered from interview

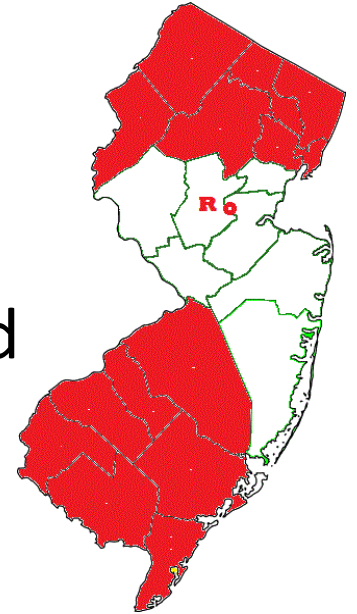


Questions and Comments





Rutgers University
Center for Mathematics, Science, and
Computer Education



CNJ-PEMA

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