Facing Fractions Building Conceptual Understanding - Thinking vs. Doing

JOHNETTE ROBERTS, LATONYA SNELL, KATHRIN MCGREGOR

LDOE TEACHER LEADER SUMMIT

JUNE 8, 2017

ERNEST MORIAL CONVENTION CENTER

NEW ORLEANS, LA

Welcome!

Each of you received a colored slip to represent your grade level or role .

Please place the colored strip on the table so we can have **at least 3 different colors** ***(3 grade levels and a coach/administrator)*** represented at each table.

Thank you!

Please make a name tent using the sheet of yellow card stock provided.

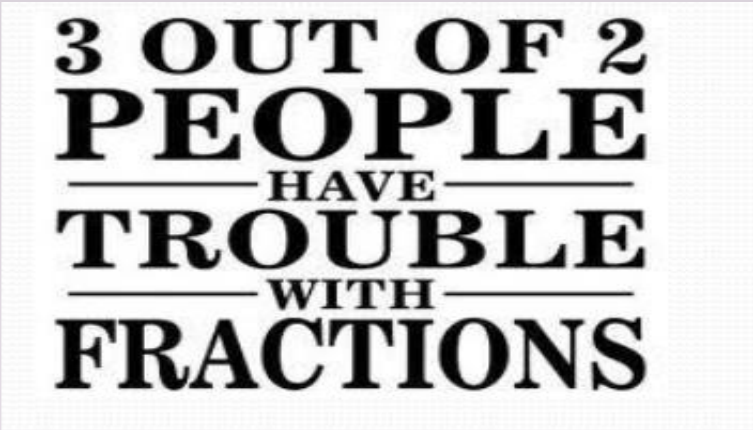
Goals

As a result of engaging in this session, participants will be able to:

- understand the progression of learning for the fractions domain in Grades 3 – 5.
- help learners understand the meaning of fractions using multiple models and representations.
- use the Standards for Mathematical Practice to solve fraction tasks.
- use the resources provided to close learning gaps from prior grades.
- help learners think and reason to develop fraction sense.

We are on a mission to…

increase fraction sense!



eliminate fraction phobia!

We are happy to see you! We are…

Latonya Snell

Louisiana Core Advocates Leadership Team, EBR MSP Grades 3-5 Lead Teacher, Instructional Coach at Claiborne Elementary

Kathrin McGregor

Grade 5 Gifted Teacher at Shenandoah Elementary
National Board Certified Teacher – Middle Childhood Generalist (7 – 12)
Shenandoah Elementary, MSP Participant

Johnette Roberts

National Board Certified Teacher (Early Adolescence Mathematics)
MSP Instructor (4 Projects, Grades 3 – 5) and Math Coach (Grades K – 8)

Participant introductions

Roll call (by show of hands)

3rd

4th

5th

Admin, coaches, etc.

Table introductions – Introduce yourself to 2 people at your table.

Professional Norms for Our Work Today

Be an active participant.

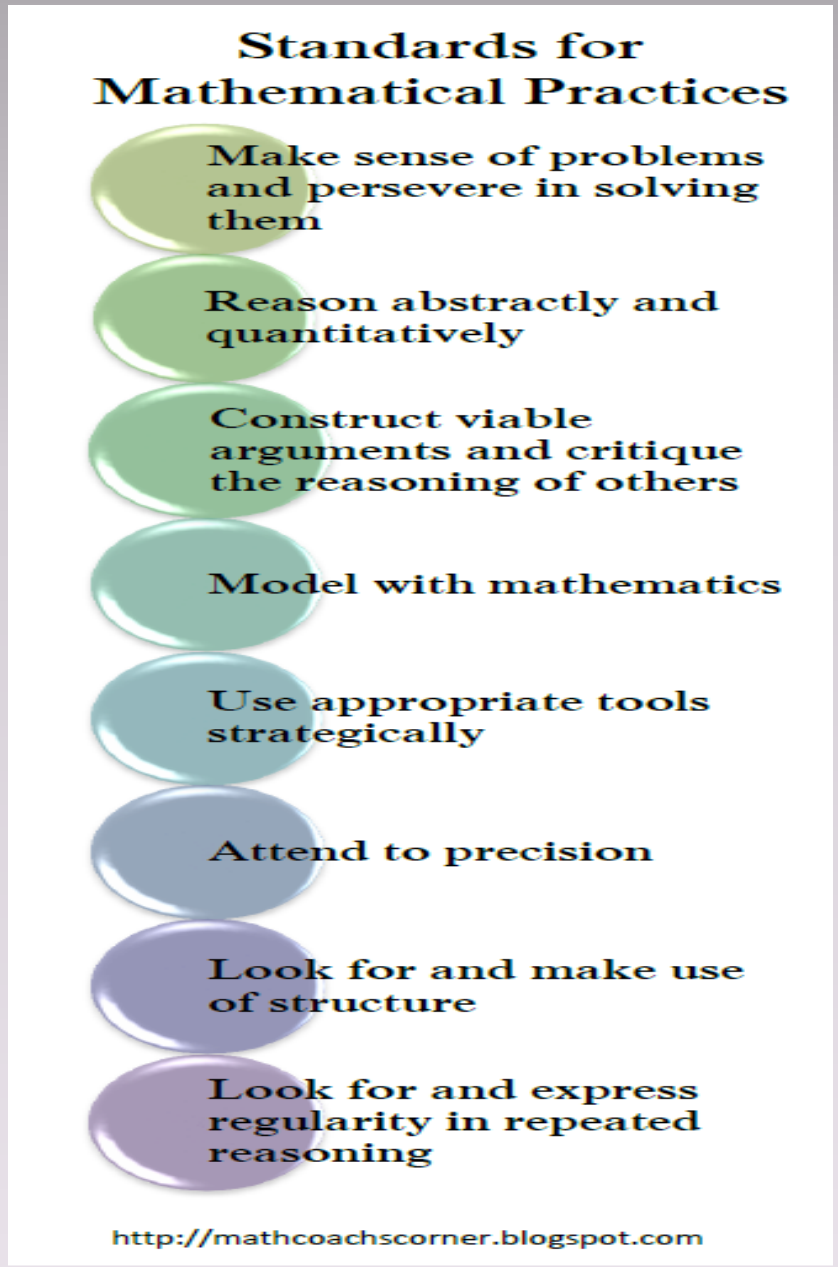
Be respectful of others' thoughts/opinions.

Be open.

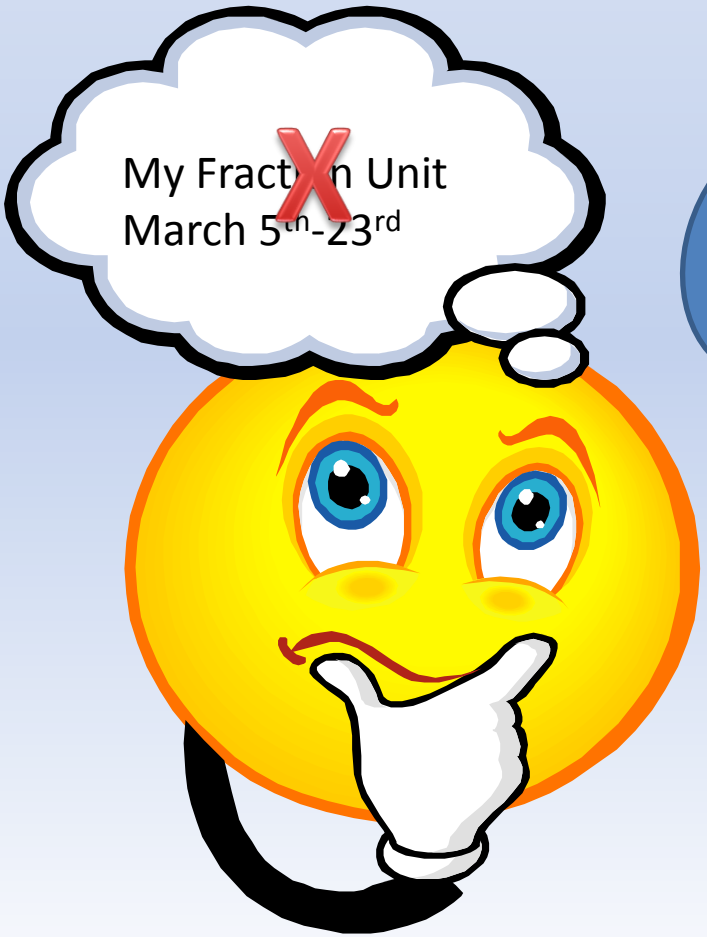
Limit sidebar conversations.

Start and end on time.

Silence cell phones.


Standards for Mathematical Practices
Make sense of problems and persevere in solving them
Reason abstractly and quantitatively
Construct viable arguments and critique the reasoning of others
Model with mathematics
Use appropriate tools strategically
Attend to precision
Look for and make use of structure
Look for and express regularity in repeated reasoning
http://mathcoachscorner.blogspot.com

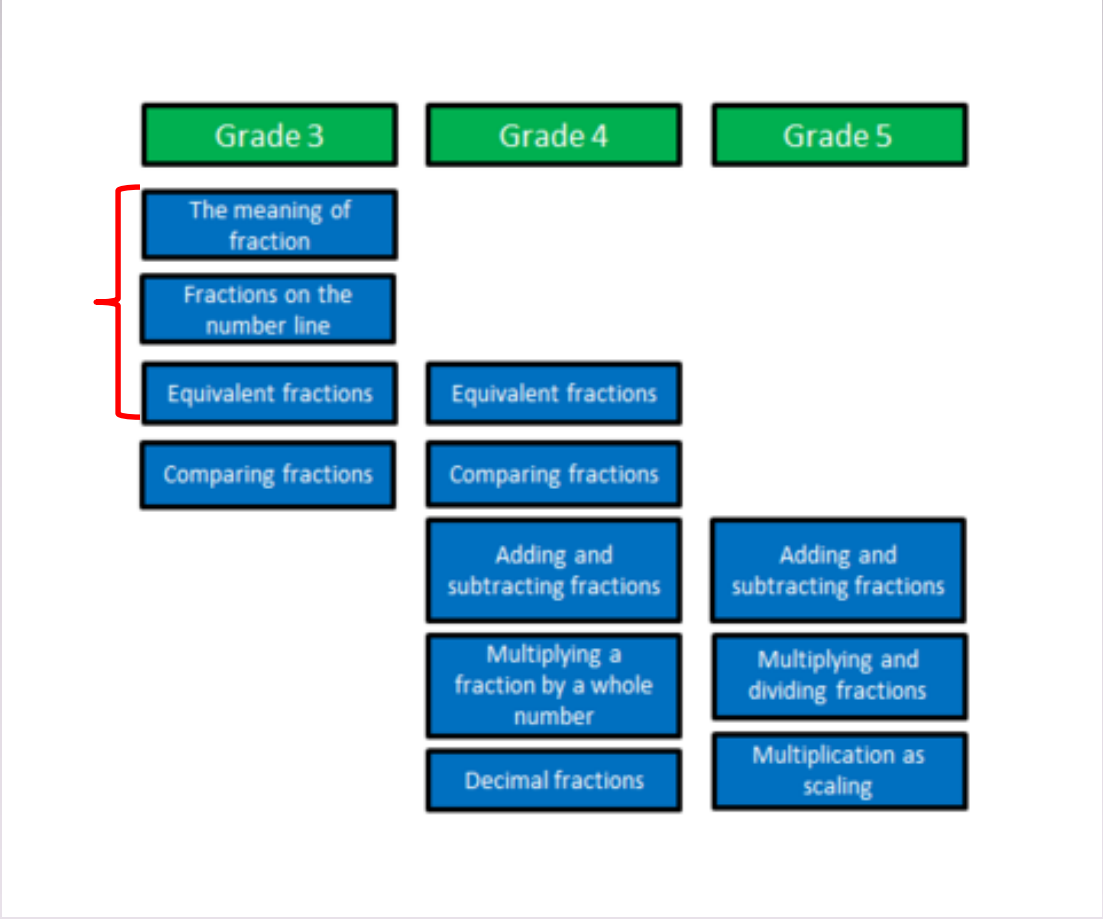
Big Idea: Develop understanding of fractions as numbers



My fraction teaching takes place all year long, with a deep focus at intervals throughout the year. I can use the language of fractions to help me teach measurement, geometry, and operations and I can use the language from the other domains to help me teach fractions.

Fractions are a major area of study in upper elementary school mathematics. It is time to shift the emphasis and redefine the goal of fraction instruction from **learning computation rules** to **developing fraction operation sense** (Huinker, 2002).

Fractions Progressions



Louisiana STUDENT STANDARDS MATHEMATICS

This focus document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the Louisiana Student Standards for Mathematics.

MATH MATHEMATICS | 5 GRADE | F FOCUS

5.NF.A	Use equivalent fractions as a strategy to add and subtract fractions.
5.NF.B	Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

MATH MATHEMATICS | 4 GRADE | F FOCUS

4.NF.A	Extend understanding of fraction equivalence and ordering.
4.NF.B	Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
4.NF.C	Understand decimal notation for fractions, and compare decimal fractions.

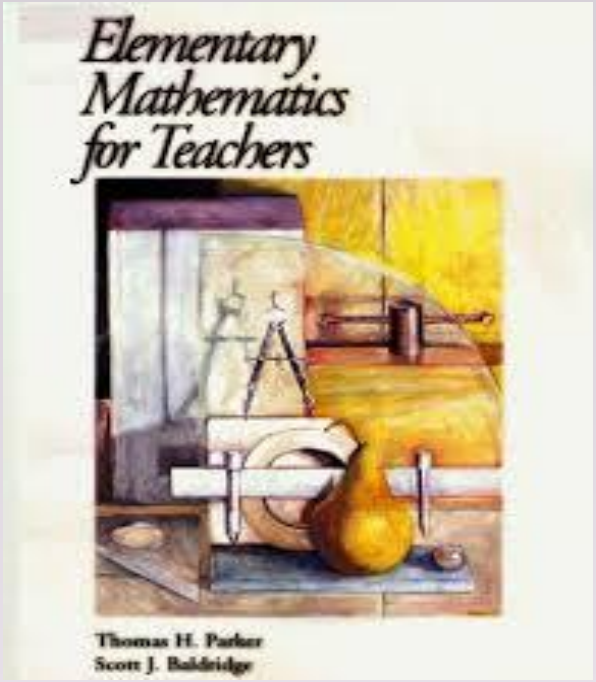
MATH MATHEMATICS | 3 GRADE | F FOCUS

3.NF.A	Develop understanding of fractions as numbers.

Resource

Elementary Mathematics for Teachers

by Dr. Thomas Parker and Dr. Scott Baldridge



A Proper Teaching Sequence for Fractions

Teaching Sequence for Fractions
Source: *Elementary Mathematics for Teachers* by Parker and Baldridge.

Stage 1: **Introducing Fractions** – area or regional model
Linear Measurement Model – fractional markings on rulers, clocks and scales
Set Model – fractions as a count of a subset

Stage 2: **Ordering and Counting** – counting by fractional units
Counting and Ordering – same denominator or same numerator

Stage 3: **Renaming Fractions** – fraction strips
*(Professor B Model for families of equivalent fractions – www.profb.com)

Stage 4: **Addition and Subtraction with Same Denominator**

Stage 5: **Word Problems**

Stage 6: **Mixed Numbers and Improper Fractions** – area and measurement models

Stage 7: **Fractions as an Expression of Division** – partitive (sharing) division

Stage 8: **Addition and Subtraction with Different Denominators**

Stage 9: **Teaching Sequence for Multiplication of Fractions**
Step 1 – Whole number times a fraction
Step 2 – Fraction times a whole umber
Step 3 – Fraction times a fraction

Stage 10: **Teaching Sequence for Division of Fractions**

Step 1: Dividing a Whole Number by a Whole Number
Step 2: Dividing a Fraction by a Whole Number
Step 3: Whole Number Divided by a Fraction
Step 4: Fraction Divided by a Fraction

Take a minute to review the teaching sequence.

Based on the grade level you teach, where are your students struggling most?

Graham Fletcher's Fraction Progressions Video

https://gfletchy.com/2016/12/08/the-progression-of-fractions/

Big Ideas

- **Grade 3:**
  - Develop an understanding of fractions as numbers.
    - Specifying the whole
    - Explaining what is meant by “equal parts”
- **Grade 4:**
  - Extend understanding of fraction equivalence and ordering.
  - Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
  - Understand decimal notation for fractions, and compare decimal fractions.
- **Grade 5:**
  - Use equivalent fractions as a strategy to add and subtract fractions.
  - Apply and extend previous understanding of multiplication and division to multiply and divide fractions

Reflection

What is your biggest “Aha” as it relates to the progression of learning for fractions?

Building CONCEPTUAL UNDERSTANDING

Our goal is to help learners understand the **meaning** of fractions using multiple models and representations.

Let's take a look at what students are learning in Grades 1 and 2 to prepare them for fractional thinking.

Preparing for Fractions in Grades 1 and 2

1.G.A.3

- **Partition** circles and rectangles into two and four **equal shares**,
- describe the shares using the **words halves, fourths, and quarters**, and
- use the phrases **half of, fourth of, and quarter of.**

- **Describe the whole** as two of, or four of the shares.
- Understand for these examples that **<u>decomposing into more equal shares creates smaller shares.</u>**

2.G.A.2

2.MD.A.1

2.MD.A.3

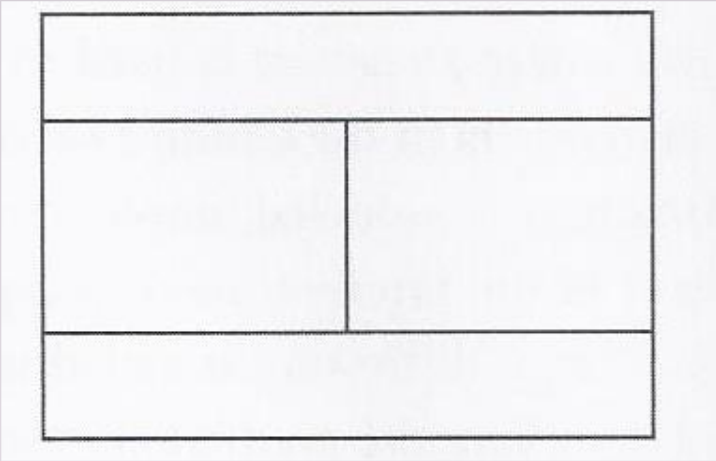
2.MD.B.5

2.MD.B.6

2.MD.B.9

Refer to the Laying the Foundation for Fractions in Grades 1 and 2 handout.

How would you expect a 2nd grader to create an argument explaining why the image shows fourths?



Source: Uncomplicating Fractions to Meet the Common Core Standards in Math, K - 7

Models for Building Conceptual Understanding

- Professor B Equivalent Fractions in Context of Cutting Cake
- Number Line
- Area Model
- Tape Diagram
- Fraction Kit and Other Concrete Tools (Pattern Blocks, Cuisenaire Rods, project image of others from van de Walle's book)

Families of Equivalent Fractions

Two-Thirds Family of Equivalent Fractions

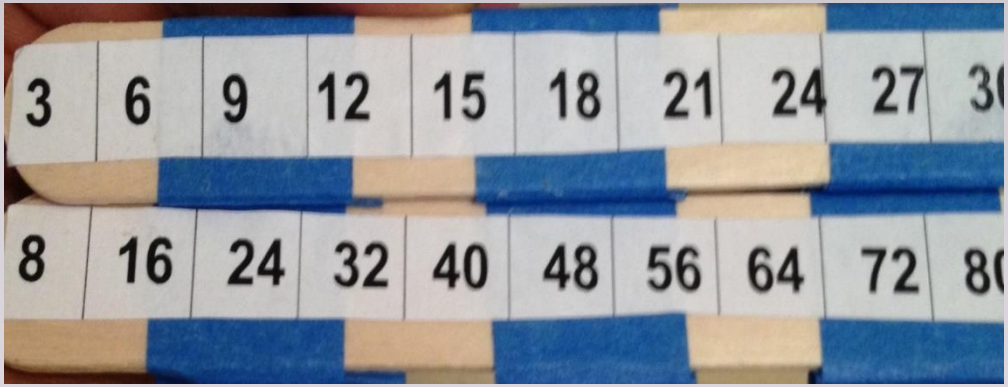
$\frac{2}{3}$ = _____ = _____ = _____ = _____ = _____ = _____ = _____, ...

Source: Professor B Math

Multiples Chart

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180
13	26	39	52	65	78	91	104	117	130	143	156	169	172	195

Equivalent Fractions “Multiples Ladder”



Reflection

How does this model help students understand fraction equivalence?

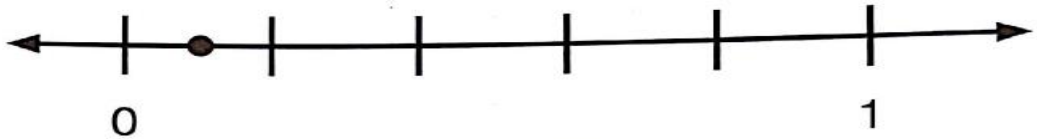
What are the relevant content/practice standards?

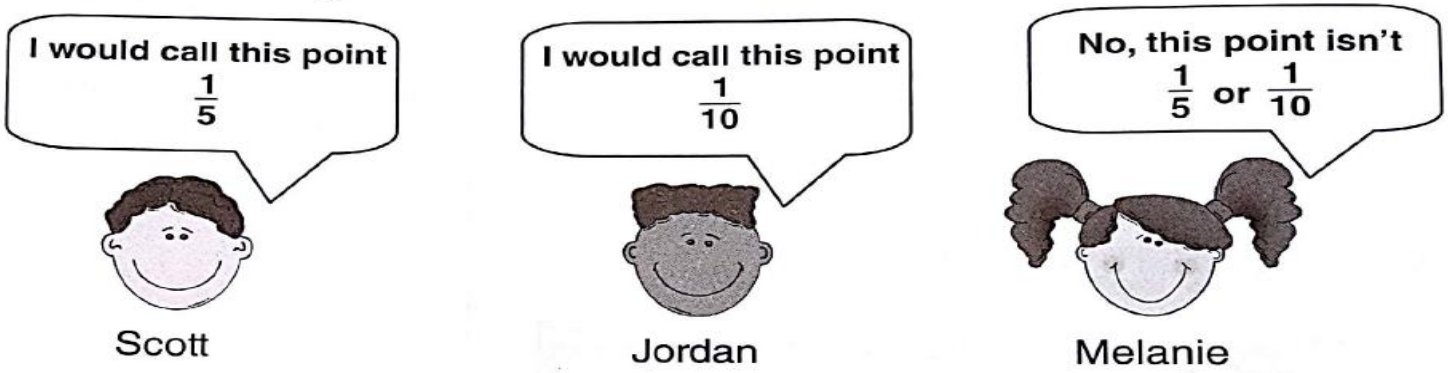
What ideas do you have about implementing this strategy?

Fractions on a Number Line

Locating a Fraction on a Number Line

Three students are working together on a problem. They have different opinions about what to name the point shown on the number line below.





Who do you agree with?

Circle one: **Scott** **Jordan** **Melanie**

Explain your choice:

Source: Uncovering Student Thinking about Mathematics in the Common Core: 25 Formative Assessment Probes by Cheryl Rose Tobey and Emily R. Fagan

Reflection

How does this model help students understand fractions on a number line?

What are the relevant content/practice standards?

What ideas do you have about implementing this strategy?

Jed's Brownies

Jed has $\frac{1}{2}$ of a tray of brownies left over from his birthday party. Jed is hungry and eats $\frac{2}{3}$ of the left over brownie. How much of one tray of brownies did Jed eat?

Source: Rational Number Project: Fraction Operations and Initial Decimal Ideas (2009)

Reflection

How does the area model help students fraction operations?

What are the relevant content/practice standards?

What ideas do you have about implementing this strategy?

Solving Word Problems
Bar Models/Tape Diagrams

In the 6th grade, $\frac{5}{8}$ of the students are girls. If there are 200 girls, how many students are there altogether?

Source: Singapore Math Bar Modeling Course, Ed2Go, Anni Stipek - Instructor

Reflection

How does the bar model/tape diagram help students solve word problems?

What are the relevant content/practice standards?

What ideas do you have about implementing this strategy?

Building

FRACTION KITS

to help students with fraction equivalence

Building the Fraction Kit

Supplies:

- 3” x 18” strips of construction paper, 5 different colors for 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$.
- envelope to store kit
- dark colored marker
- scissors
- paperclips for unit fractions (4 per student)

3 additional colors of strips will be needed to make thirds, sixths and twelfths.

Source: From *Teaching Arithmetic: Lessons for Introducing Fractions* by Marilyn Burns, Math Solutions Publications

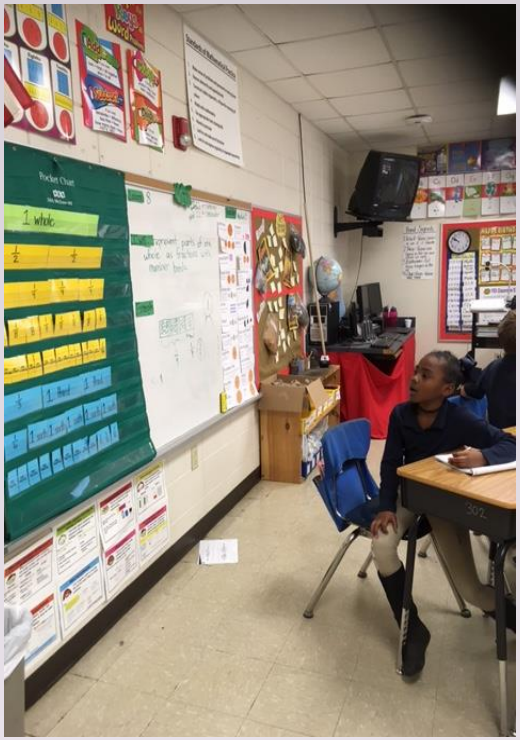
Building Conceptual Understanding with the Fraction Kit

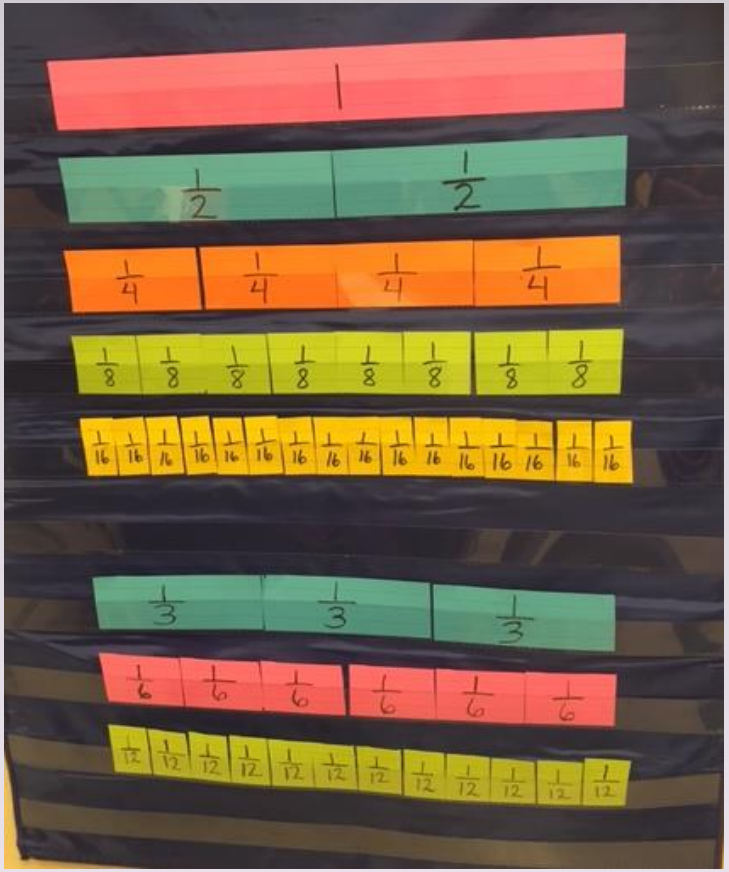
(with Teachers)

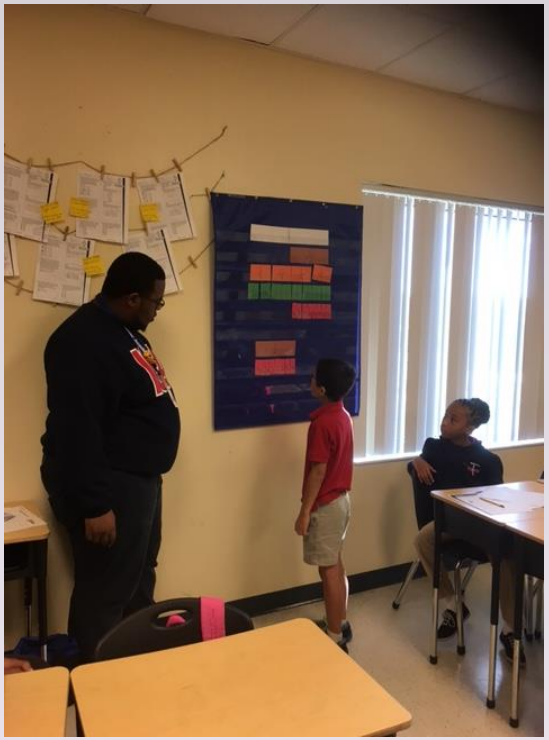
Building Conceptual Understanding with the Fraction Kit

(with Students)

Demonstration Fraction Kit







Student Engagement with Demonstration Fraction Kit

Video clip

Creating and Managing the Fraction Kit

Reflection

How can the fraction kit help students gain better conceptual understanding of fraction concepts?

What are the relevant content/practice standards?

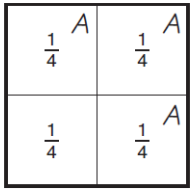
What ideas do you have about implementing this strategy?

Time for Lunch!

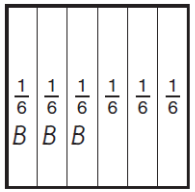
Fraction Capture Game

Example

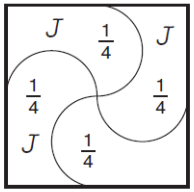
- A player rolls a 4 and a 3 and makes $\frac{3}{4}$. The player claims three $\frac{1}{4}$ sections by initialing them.

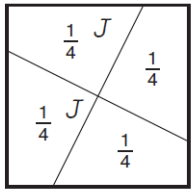


- Equivalent fractions can be claimed. If a player rolls a 1 and a 2 and makes $\frac{1}{2}$, the player can initial one $\frac{1}{2}$ section of a square, or two $\frac{1}{4}$ sections, or three $\frac{1}{6}$ sections.



- The fraction may be split between squares. A player can show $\frac{5}{4}$ by claiming $\frac{3}{4}$ on one square and $\frac{2}{4}$ on another square.





Leapfrog Fractions Task - Grade 4

Source: Noyce Foundation

Leapfrog Fractions Task - Grade 4

What does this task challenge students to do?

Identify two prevalent Math Practice Standards that students will engage in while completing this task.

Source: Noyce Foundation

Fraction Tasks

Grade 3 Tasks – yellow handout

Grade 4 tasks – green handout

Grade 5 tasks – pink handout

Administrator/Coach Group – blue packet

Please get into groups of 4 (grade level or administrator/coach groups).

Instructions:

Take 15 minutes to solve the 3 tasks for your grade level group.

Note: Grade level groups will be combined based on the number of participants.

For each grade level, select a recorder and make an anchor chart for the starred task in your handout.

Coaches and administrators may select a grade level group to join at this point.

Gallery Walk

Make and anchor chart of your problem and post on the wall.

You will have 2 minutes (wait for signal) to look at the other 2 problems from your grade level.

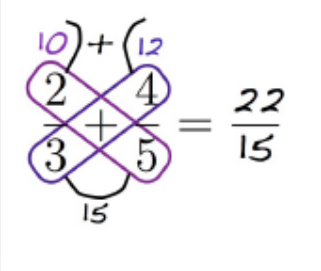
Record any “praises” (yellow Post-it notes) or “pushes” (pink Post-it notes) and place them on the bottom of the chart.

*** You will now have ___ minutes to review the anchor charts for the anchor charts for the 4th and 5th grade tasks.

Gallery Walk Debrief

Teaching by rote is the most effective way of killing math learning.

Butterfly Method, Jesus Fish



"Students have not idea why it works and there is not mathematical reasoning behind the butterfly, no matter how pretty it is."

Source: Nix the Tricks by Tina Cardone and MTBoS

Resources

Action Planning and Sharing

I am going to try _____

When _____

With Whom _____

Because _____

Reflections

Thank you for your participation today!

May you go forth and continue to help build a mathematically literate community.