CENTER ON
INSTRUCTION

Improving Instruction through the Use of Data: Phase 2

Dr. Russell Gersten and Dr. Francis "Skip" Fennell
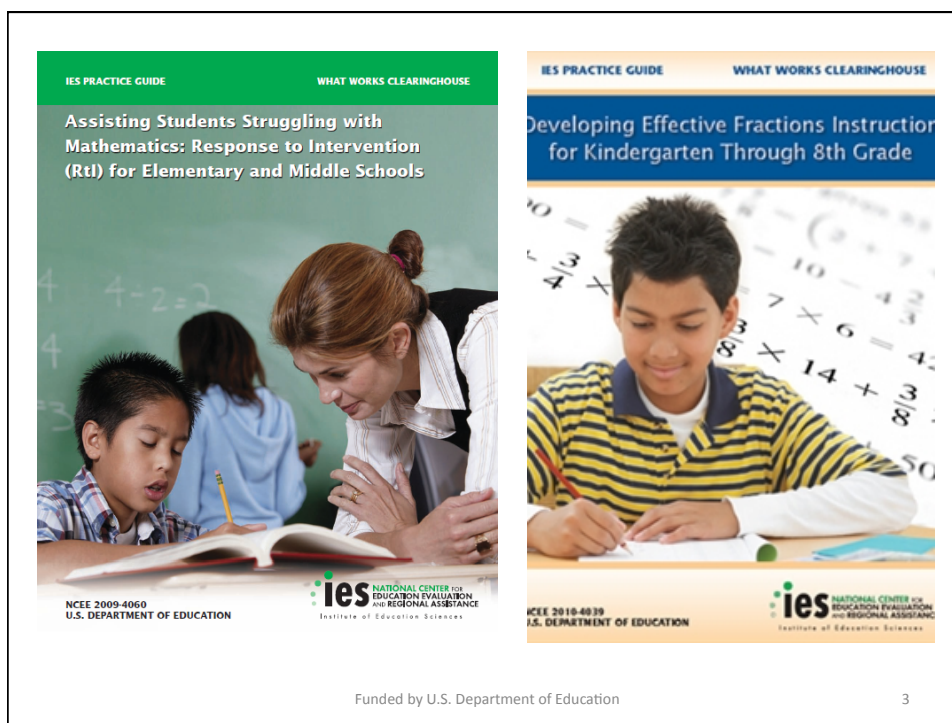October 13, 2012

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Using Data in School Turnaround Efforts: Mathematics-Focus on Algebra Readiness and Importance of Fractions/Rational Number

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Resources

Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools (NCEE 2009-4060). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/practice_guides/rti_math_pg_042109.pdf

Siegler, R., Carpenter, T., Fennell, F., Geary, D., Lewis, J., Okamoto, Y., Thompson, L., & Wray, J. (2010). Developing effective fractions instruction for kindergarten through 8th grade: A practice guide (NCEE #2010-4039). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/practice_guides/fractions_pg_093010.pdf

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Acknowledgement

- Brad Witzel (Winthrop College)

- Sybilla Beckmann (University of Georgia)

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ALGEBRA READINESS

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Why is Mastery of Fractions so Important?

National Mathematics Panel (2008) articulated mathematical reasons why:

➢ "Difficulty with fractions (including decimals and percents) is pervasive and is a major obstacle to further progress in mathematics, including algebra"

➢ Increased level of abstraction

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National Math Panel (2008) Survey of Algebra Teachers

According to the teachers, three major reasons for failure:

➢Lack of knowledge of fractions and decimals
➢Limited ability to solve word problems of any way, shape or form
➢Limited task persistence

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Fractions Research

1. Tom Loveless (Brookings Institution) Analysis of NAEP 8th grade items:
   "Students don't know how to translate fractions into decimals or into percentages and they can't locate fractions on a number line"
   Yet Common Core stresses locating fractions on a number line

2. More recently, Siegler, Duncan et al. (2012) found that 5th graders' facility with fractions predicted high school students' knowledge of algebra and overall math achievement.
   - First empirical finding
   - Demonstrates importance of early intervention in upper elementary grades
   - Supported by decades of NAEP data

Common Core definition implies:

Fractions can be interpreted as parts of one or more "wholes" or unit.

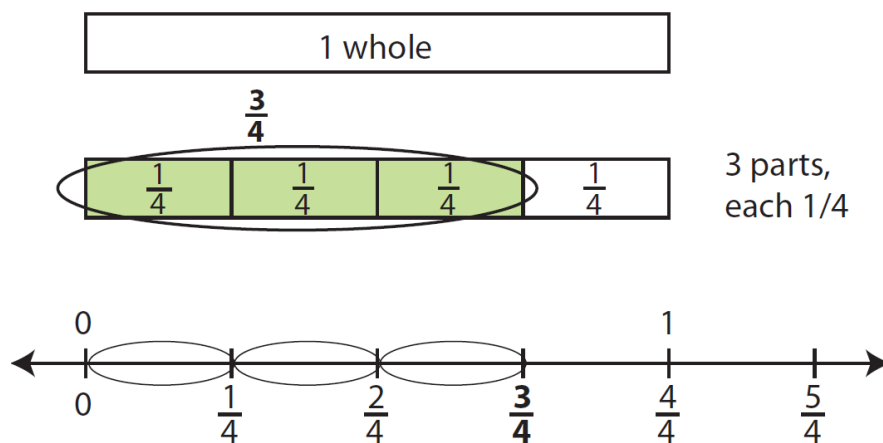So wrong to teach part of a whole

1. Units can be rectangles, circles, octagons, or any shape you can imagine

2. A unit can be one object or a set of objects (e.g. egg carton)

3. A fraction represents a very specific point on a number line…….

Research in the Area of Fractions and Its Application to Classroom Practices

Common Core definition of fraction

1 whole

$\frac{3}{4}$

$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

3 parts,
each 1/4

0   1

0    $\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ $\frac{5}{4}$

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Critical Similarities between Effective Work in Turnaround Schools and RTI models

- Incorporate prevention and early intervention rather than waiting
- True for early intervention in mathematics (K,1, even preK)
  - ➤ But equally true for algebra readiness
    - ➤ In grades 4 and 5
    - ➤ Again, in middle school

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HOW TO USE DATA FROM STATE ASSESSMENT

- Example from one state follows:
  - From Grades 3-5 on Fractions/Decimals (aka Rational Number)

    Mythical state is called Transylvania

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Using State Test Data for Initial Screening

Distribution of scores of Franklin High School 10th grade students on state comprehensive assessment in Mathematics					
MATHEMATICS					
GRADE 10	Total Number of Students	Proficiency Level (%)			
		Advanced	Proficient	Needs Improvement	Failing
All Students	425	2	7	41	50
Regular	259	3	8	43	46
With Disabilities	85	1	6	39	54
English Language Learners	81	1	5	35	59

Source: Boudett, City, and Murnane (2010)   Funded by U.S. Department of Education   14

Potential Problems

1. A high percentage of students require Tier 2 intervention because they score "at risk"
2. Is small group instruction the answer?
3. What are proactive measures?
   ➢ Some sort of double dose to cover key material from previous years
   ➢ Look at state assessment data

Step One:

- Individual item analyses

- Note: These can be done at a school level or district or state
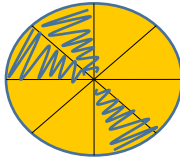 ➢ School level likely to be more informative

  Step 1: Find lowest items or item clusters

Transylvania assessment - 4th grade: Each portion of the figure is equal. Describe the shaded portion. Is the shaded portion closer to 0, ½ or 1?

Interpretive Question

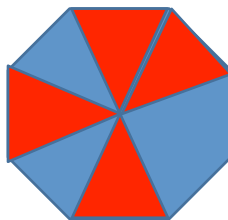- 60% correct (state developed test so average items was about 50% correct)

4th: Which portion is shaded?

A) 4/7 B) 1/2   C) 4/4   D) 4/3

You try it

- A.
- B.
- C.
- D.

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In contrast
4th: Which portion is shaded?
A) 4/7 B) 1/2   C) 4/4   D) 4/3
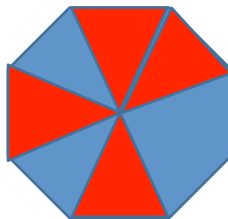
- 38% correct as opposed to 60% for "interpretative item."
- Think about what the misconception is likely to be

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Intervention target

Parts of a fraction must be equal

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4th: (description) Students hypothesize that ¼ cup of a soda evaporate per day. In their experiments, four student groups find different amounts of cups.

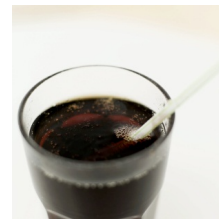A) 0.20cup   B) 0.75cup   C) 0.25cup   D) 0.80cup

Which is the same as ¼?

P = 52%
Think about:
Is this about typical for state?
What is the likely misconception?

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Transylvania- 5th: Compare the size of two figures showing fractions
ex. State the difference between A and B?

A

B

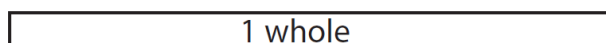Answer: A (2/3) is twice B (1/3)

P = 65%

Think about:
➢ Is this typical for state?
➢ What is likely to be an intervention focus for kids who need intervention?

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Equivalent Fractions

1 whole

$\frac{2}{3}$ Describe the next step

$\frac{2}{3} = \frac{2\times4}{3\times4} = \frac{8}{12}$ Explain the 2×4
Explain the 3×4
Why ×, aren't we dividing?
Explain both = signs

Source: Sybilla Beckmann   Funded by U.S. Department of Education   24

5th: Given a linear model of one whole with, x/y shaded, how long is a piece that is a/b longer than x/y ?

The figure shows 3/8. How large is the figure if 1/4 is added?

- P = 50%

PASS Interpreted Question

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Poll Item: Which Situation Fits You?

A. I have used state assessment data and did not find it helpful.
B. I have never used state assessment data for turnaround efforts.
C. I have used state assessment data and found it difficult to know how to use in turnaround effort.
D. I have used screening data and found it useful, but not state assessment data.

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A look into the Near Future Future

- PARC Consortium
 - Multiple choice, paper/pencil format
- Smarter Balance

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5th grade – SBAC version

On Sunday, Travis bought the carton of eggs pictured below.
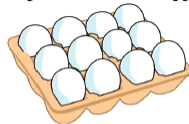
- On Monday, Travis used $\frac{1}{4}$ of the eggs in the carton.
- On Tuesday, Travis used $\frac{2}{3}$ of the eggs that **remained** in the carton after Monday.

Which picture represents the number of eggs remaining in the carton after Travis used eggs on Tuesday?

Ⓐ

Ⓒ

Ⓑ

Ⓓ

SBAC

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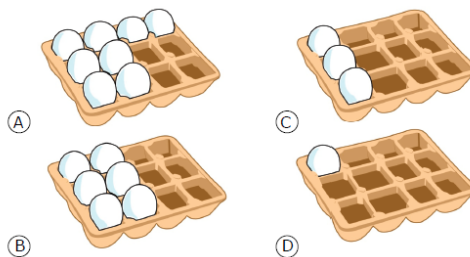
Formative and Diagnostic Assessments
(may be called second tier screening in RtI world)

- <u>Purpose</u>: To provide specific information on skills and strategy needs of individual students.
- <u>When</u>: Following screening or at points during the year when students are not making adequate progress.
- <u>Who</u>: Selected students as indicated by screening or progress monitoring measures or teacher judgment.
- <u>Relation to Instruction</u>: Provided specific information on *target skills*; highly relevant.
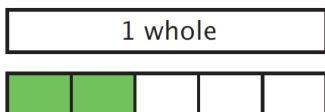
Remediation examples

Errors in interpreting fractions and intervention: Proactive and Tier 2

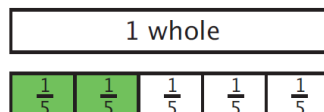Common errors:

1 whole

Error: $\frac{2}{3}$ of the bar is shaded

Error: $\frac{1}{3} + \frac{1}{4} = \frac{2}{7}$

To help students:

1 whole

$\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$

$\left(\frac{1}{5} + \frac{1}{5}\right)$ $\left(\frac{1}{5} + \frac{1}{5} + \frac{1}{5}\right)$

$\frac{2}{5}$ $\frac{3}{5}$

Label each part with its unit fraction
Use unit fractions to find other fractions

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III) 300.62 ÷ 100

Response	Inferred Misconception	Frequency
a) 30062	Move the decimal point 2 places to the right	0%
b) 30.062	Move the decimal point 1 place to the left	6.4%
c) 30.62	Cancel the zero	2.6%
d) 3.0062	CORRECT	68.8%
e) 3.62	Integer-decimal separation or cancel 2 zeros	22.0%
OMITTED		0%

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