



Improving Instruction through the Use of Data: Phase 2

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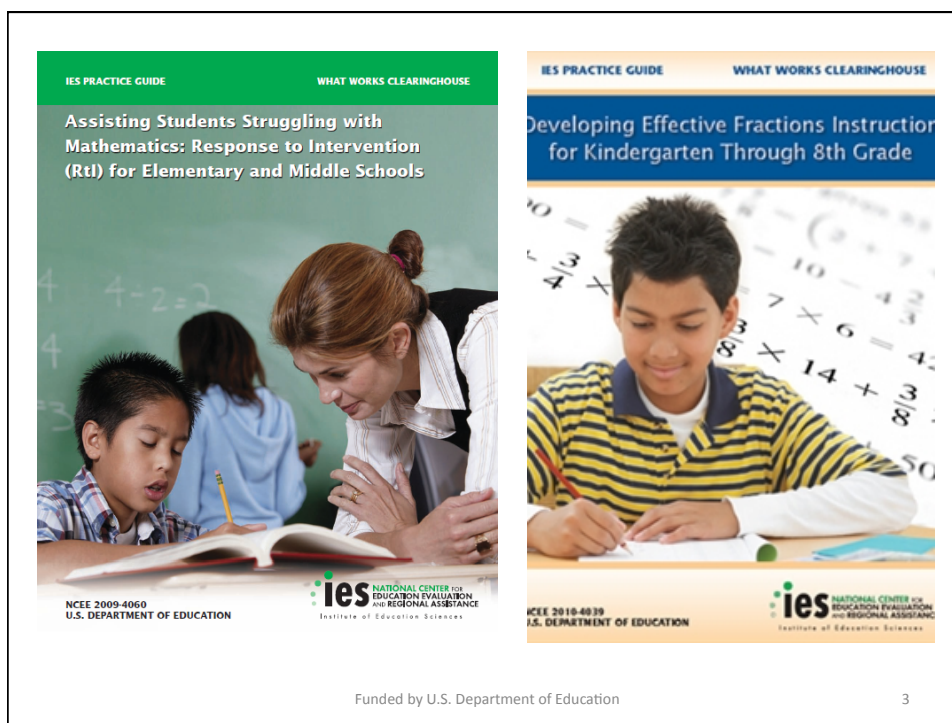


Using Data in School Turnaround Efforts: Mathematics-
Focus on Algebra Readiness and Importance of Fractions/
Rational Number

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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

Carnegie Mellon (http://www.cmu.edu/news/stories/archives/2012/june/june15_mathsuccess.html)

Siegler, R. , Duncan, G. , Davis-Kean, P. , Duckworth, K. , Claessens, A., Engel, M., Susperreguy, M. I., & Chen, M. (2012). Early predictors of high school mathematics achievement. *Psychological Science*, 23(7), 691-697. doi: DOI: 10.1177/0956797612440101

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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

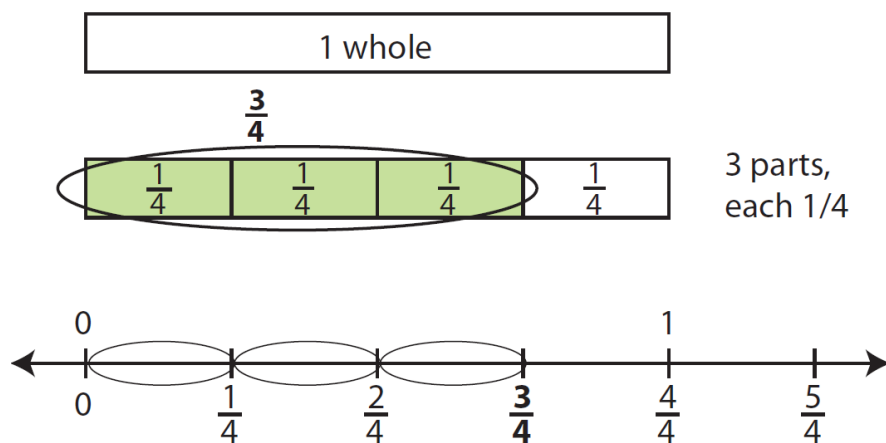
1. Units can be rectangles, circles, octagons, or any shape you can imagine
2. A unit can be one object or a set of objects (e.g. egg carton)
3. A fraction represents a very specific point on a number line.....

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

Common Core definition of fraction



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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

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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

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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

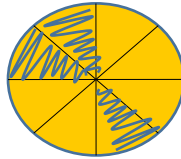
Step 1: Find lowest items or item clusters

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Transylvania assessment - 4th grade: Each portion of the figure is equal. Describe the shaded portion. Is the shaded portion closer to 0, $\frac{1}{2}$ or 1?

Interpretive Question



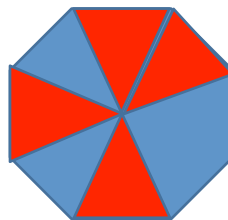
- 60% correct (state developed test so average items was about 50% correct)

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4th: Which portion is shaded?

A) $\frac{4}{7}$ B) $\frac{1}{2}$ C) $\frac{4}{4}$ D) $\frac{4}{3}$



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You try it

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

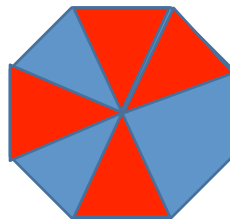
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In contrast

4th: Which portion is shaded?

A) $\frac{4}{7}$ B) $\frac{1}{2}$ C) $\frac{4}{4}$ D) $\frac{4}{3}$



- 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 $\frac{1}{4}$ 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

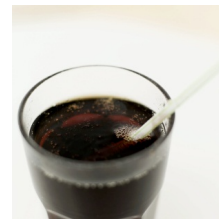
Which is the same as $\frac{1}{4}$?

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?



Answer: A ($\frac{2}{3}$) is twice B ($\frac{1}{3}$)

P = 65%

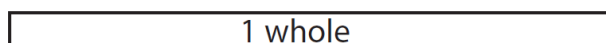
Think about:

- Is this typical for state?
- What is likely to be an intervention focus for kids who need intervention?

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Equivalent Fractions



$\frac{2}{3}$

Describe the next step



$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

Explain the 2×4

Explain the 3×4

Why \times , aren't we dividing?

Explain both = signs

Source: Sybilla Beckmann

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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?

- I have used state assessment data and did not find it helpful.
- I have never used state assessment data for turnaround efforts.
- I have used state assessment data and found it difficult to know how to use in turnaround effort.
- 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

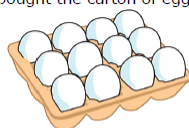
- PARC Consortium
 - Multiple choice, paper/pencil format
- Smarter Balance

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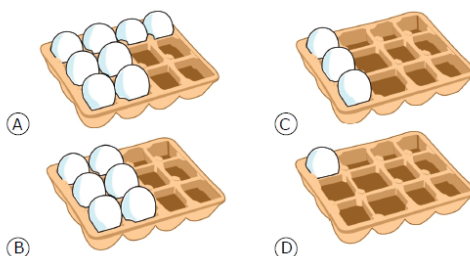
5th grade – SBAC version

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)

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

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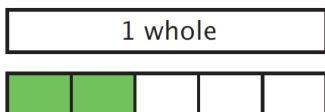
Remediation examples

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Errors in interpreting fractions and intervention: Proactive and Tier 2

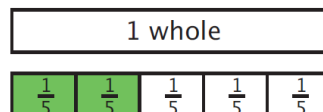
Common errors:



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

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

To help students:



$$\frac{1}{5} + \frac{1}{5} = \frac{2}{5} \quad \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{3}{5}$$

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

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III) $300.62 \div 100$

| 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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