Math Specialists & Instructional Leaders!

Addressing School and District-Based Issues and Needs

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Specialists and Teacher Leaders Project

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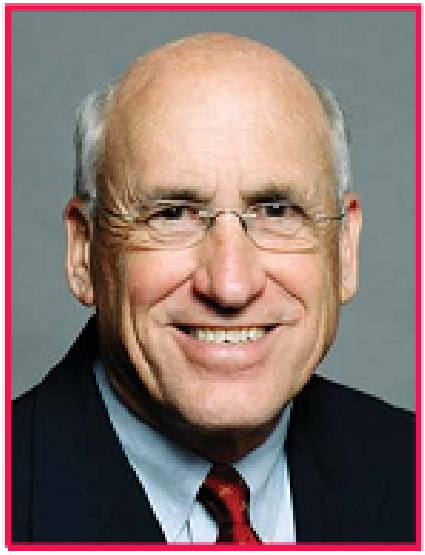
President's Message

We Need Elementary School Mathematics Specialists NOW

Francis (Skip) Fennell



In 1984, an article appeared in the *Arithmetic Teacher* that asked an important question—"Elementary School Mathematics Specialists: Where Are They?" This was written by John Dossey, who later served as NCTM president. Now it is 2006, and I am again asking, where are the mathematics specialists? We need you NOW in elementary schools and at every other level in prekindergarten through grade 12 mathematics education.

Many school systems are exploring ways to ensure that their students receive mathematics instruction from teachers who have a deep understanding of mathematics content and pedagogy; however, some still see this problem as being less important at the elementary school level. Major reports—including *Principles and Standards for School Mathematics (NCTM 2000)*, *Adding It Up* (National Research Council 2001), and the *Mathe-*

They facilitate teachers' use of instructional strategies, including differentiated instruction for diverse learners, and they work with families and community leaders to foster school-based partnerships focused on learning mathematics. In addition, they provide schoolwide and, to a lesser extent, districtwide professional development for teachers. Variations of this model may include intervention with small groups of children. Some lead teacher/specialist/coach models emanate from the school district office, where the teacher specialist is responsible for more than one site. The specialized teacher model gives one teacher the primary responsibility for teaching mathematics. The specialized teacher typically has responsibility for a single grade—often at the upper grade levels (e.g., grades 4 or 5).

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Elementary Mathematics Specialists and Teacher Leaders Project

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Elementary Mathematics Specialists & Teacher Leaders Project

The Brookhill FOUNDATION

News and Updates

NEW **AMTE EMS State Certification Conference - Louisville, KY, July 7-9, 2011 (Brookhill Foundation)**
Teams from 8 states (Alaska, Colorado, Idaho, Illinois, Missouri, New Jersey, Oregon, Wisconsin) met to explore efforts related to the establishment of elementary mathematics specialist state certification/endorsement. Click **here** to view Skip Fennell's EMS programs of study slides.

NCSM Summer Leadership Academy in Atlanta, GA - June 21-23, 2011:

http://www.mathspecialists.org/index.html

ems&tl

YOU are the transition “agent.”

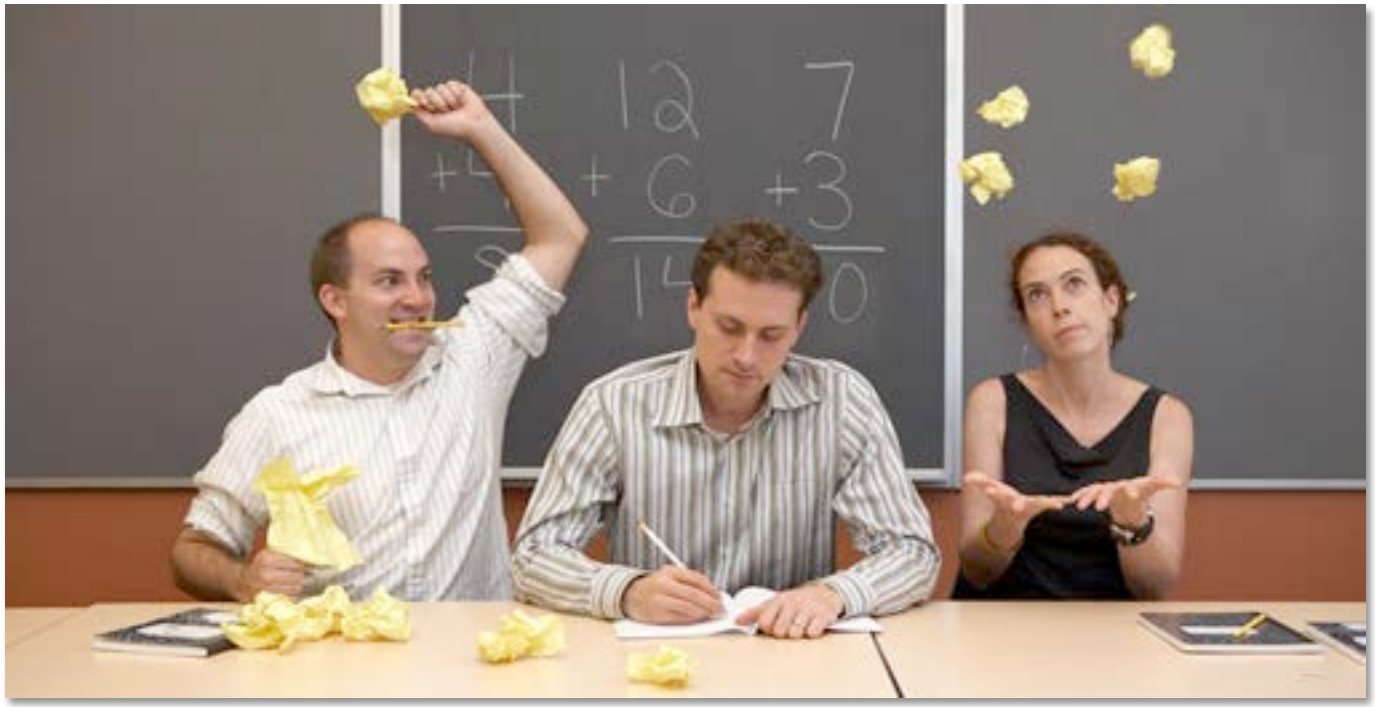
aka – it’s your fault!

Coaching and Adult Learning Issues

- How will you help teachers make the shift?
- How will you deal with teachers (and/or students') content knowledge gaps?

Relationships Issues

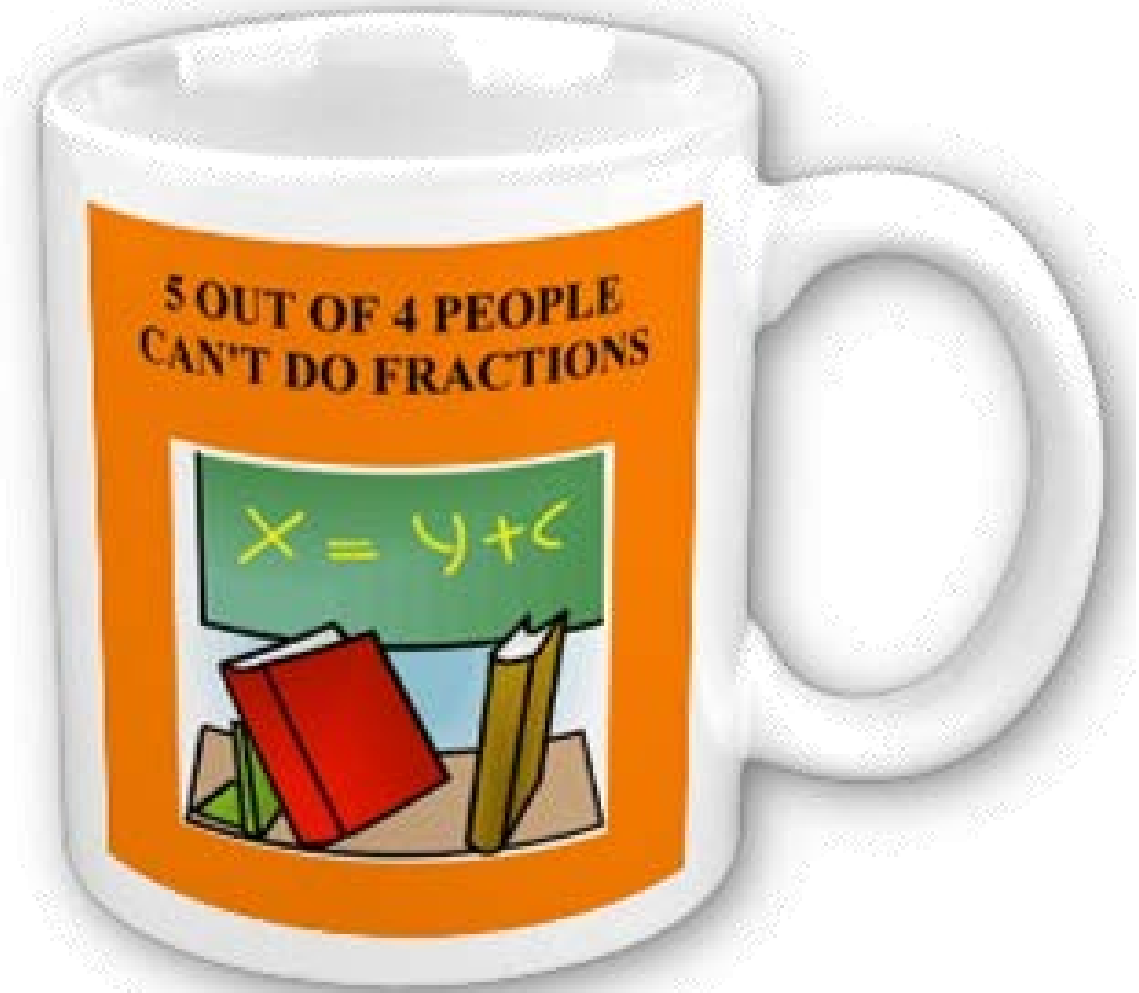
What will you do with the following comment: *“Who created these and why do we have to do them?”*



Building Learning Communities

What is my school doing to support parents and family in the transition to the Common Core?

Starting Point: Why are fractions so difficult?



"[**Proficient** fourth graders] should have a conceptual understanding of fractions and decimals…"

(NCES, 2009, p. 18).

Recommendation 1

Build on students' informal understanding of sharing and proportionality to develop initial fraction concepts.

- Use equal-sharing activities to introduce the concept of fractions. Use sharing activities that involve dividing sets of objects as well as single whole objects.
- Extend equal-sharing activities to develop students' understanding of ordering and equivalence of fractions.
- Build on students' informal understanding to develop more advanced understanding of proportional reasoning concepts. Begin with activities that involve similar proportions, and progress to activities that involve ordering different proportions.

CCSS – Grades 1, 2, 3

- 1.G.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…Understand for these examples that decomposing into more equal shares creates smaller shares.
- 2.G.3: Partition..into two, three, or four…Recognize that equal shares of identical wholes need not have the same shape.
- 3.G.2: Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole (e.g. ¼ of the area of the shape).

Recommendation 2

Help students recognize that fractions are numbers and that they expand the number system beyond whole numbers. Use number lines as a central representational tool in teaching this and other fraction concepts from the early grades onward.

- Use measurement activities and number lines to help students understand that fractions are numbers, with all the properties that numbers share.
- Provide opportunities for students to locate and compare fractions on number lines.
- Use number lines to improve students' understanding of fraction equivalence, fraction density (the concept that there are an infinite number of fractions between any two fractions), and negative fractions.
- Help students understand that fractions can be represented as common fractions, decimals, and percentages, and develop students' ability to translate among these forms.

CCSS – Grades 3, 4, 5

- 3.NF:
  1. Understand a fraction 1/b as the quantity formed by 1 part where a whole is partitioned into b parts; understand a fraction a/b as the quantity formed by a parts of the size 1/b.
  2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.
  3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

CCSS – Grades 3, 4, 5

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CCSS – Grades 3, 4, 5

- 4.NF
  1. Extend understanding of fraction equivalence and ordering.
  2. Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
  3. Understand decimal notation for fractions and compare decimal fractions.

CCSS – Grades 3, 4, 5

- 5.NF

  Use equivalent fractions as a strategy to add and subtract fractions.

Recommendation 3

Help students understand why procedures for computations with fractions makes sense.

- Use area models, number lines, and other visual representations to improve students' understanding of formal computational procedures.
- *Provide opportunities for students to use estimation to predict or judge the reasonableness of answers to problems involving computation with fractions.*
- *Address common misconceptions regarding computational procedures with fractions.*
- Present real-world contexts with plausible numbers for problems that involve computing with fractions.

CCSS Grades 4, 5, 6

- 4.NF: Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers
  - 3. Understand a fraction a/b with a > 1 as a sum of fractions 1/b.
  - 4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

CCSS Grades 4, 5, 6

- 5.NBT: Perform operations with multi-digit whole numbers and with decimals to hundredths.
  - 7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value…relate the strategy to a written method and explain the reasoning used.

CCSS Grades 4, 5, 6

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

CCSS Grades 4, 5, 6

- 6.NS:
  - Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
  - Apply and extend previous understandings of numbers to the system of rational numbers.

Recommendation 4

Develop students' understanding of strategies for solving ratio, rate, and proportion problems before exposing them to cross-multiplication as a procedure to use to solve such problems.

- Develop students' understanding of proportional relations before teaching computational procedures that are conceptually difficult to understand (e.g., cross-multiplication). Build on students' developing strategies for solving ratio, rate, and proportion problems.
- Encourage students to use visual representations to solve ratio, rate, and proportion problems.
- Provide opportunities for students to use and discuss alternative strategies for solving ratio, rate, and proportion problems.

CCSS – Grades 6, 7

- 6.RP: Understand ratio concepts and use ratio reasoning to solve problems.

- 7.RP: Analyze proportional relationships and use them to solve real-world and mathematical problems.

Recommendation 5

Professional development programs should place a high priority on improving teachers' understanding of fractions and of how to teach them.

- Build teachers' depth of understanding of fractions and computational procedures involving fractions.
- Prepare teachers to use varied pictorial and concrete representations of fractions and fraction operations.
- Develop teachers' ability to assess students' understandings and misunderstandings of fractions.

Making Real-World Connections

Crystal McCubbin, a fourth-grade math teacher in Baltimore County's Seventh District Elementary School, used DWW resources to work with elementary and Special Ed teachers on fractions. "This was the first time I'd ever planned professional development sessions," she said. "I found that these resources really helped guide the planning of my sessions. They were also a great way to show teachers the progression of fractions instruction across grade levels and the importance of connection to real-world situations."

Fractions as Numbers!

Sorsha T. Mulroe, Math Support Teacher at Bryant Woods Elementary School in Howard County, MD used DWW materials to prepare teachers for full implementation of the Common Core. She found the IES Practice Guide, *Developing Effective Fractions Instruction for Kindergarten Through 8th Grade "a substantial help* for transitioning teachers to better understand the Common Core State Standards for Mathematical Content, particularly the [CCSS domain of] Number and Operations — Fractions." Her data showed "a need to learn how to teach fraction concepts and fractions as numbers more conceptually before tackling operations with fractions." Mulroe also used DWW video clips related to recommended practices on *Initial Fraction Concepts and Fractions as Numbers.* The clips, she says, were "valuable resources in facilitating our discussions on topics from ordering and equivalent relationships to using various visual fraction models, including the importance of using the number line [as a representational tool]."

DWW to the Rescue!

Elementary Math Specialist Angela Waltrup, also part of the ems&tl project, used DWW resources in helping to develop a cadre of math instructional leaders for Frederick County (MD's) 36 public schools. Noting that fractions are a difficult concept for children to learn, she says, "I really liked the games and templates that the website provided. The student interviews and videotaped lessons are great for showing teachers different ways to introduce fractions."

A useful tool…

https://sites.google.com/site/dwwemstl/developing-effective-fractions-instruction-for-k-8

Full Circle…

- **IES Practice Guide….**
- **Common Core State Standards**
- **Consortial Assessments** – PARCC and SMARTER Balanced

PARCC Partnership for Assessment of Readiness for College and Careers

- 24 States – mostly east coast
- 18 governing states
- 6 participating states
  - PA, KY, AL, ND, SC, CO
- Will provide 4 Assessments
  - Diagnostic – optional
  - Mid-Year – optional
  - End of year – third quarter - required
  - End of year – fourth quarter - required

- 27 states – mostly mid-west and west
- 21 governing states
- 6 participating states (see PARCC)

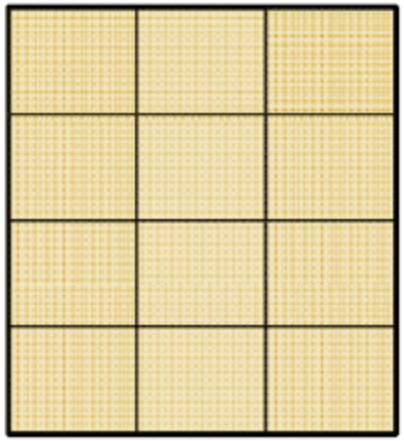
The Field

Prompt 1

A farmer is planting different vegetables in a field. The farmer plants $\frac{5}{12}$ of the field with soybeans.

Drag the soybean picture into the field as many times as needed to show the fraction of the field the farmer plants with soybeans.

Farmer's Field



Soybean

Carrot

The Field

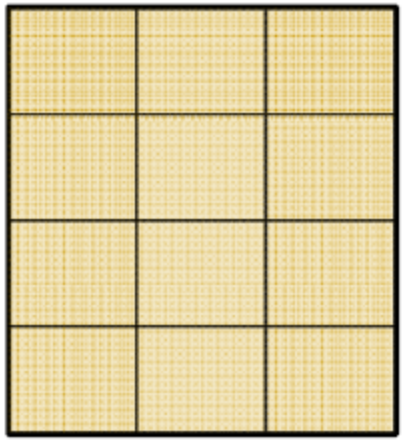
Prompt 2

The farmer also plants enough carrots so that $\frac{3}{4}$ of the field has soybeans or carrots planted.

Drag the carrot picture into the empty spaces of the field as many times as needed to show the fraction of the field the farmer plants with carrots.

Student response from previous screen

Farmer's Field



Prompt 3

What fraction of the field has carrots planted? $\frac{\square}{\square}$

Soybean

Carrot

The Field

Prompt 4

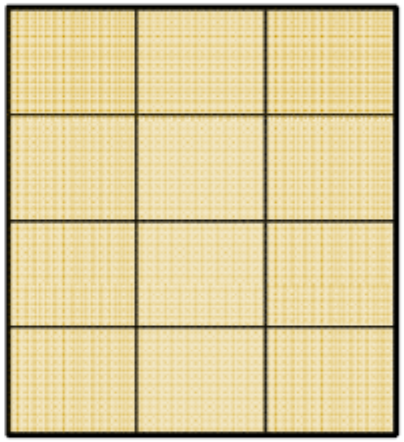
Type a fraction different than $\frac{3}{4}$ in the boxes that also represents the fractional part of the farmer's field that is planted with soybeans and carrots.

$$\frac{\boxed{3}}{\boxed{4}} = \frac{\square}{\square}$$

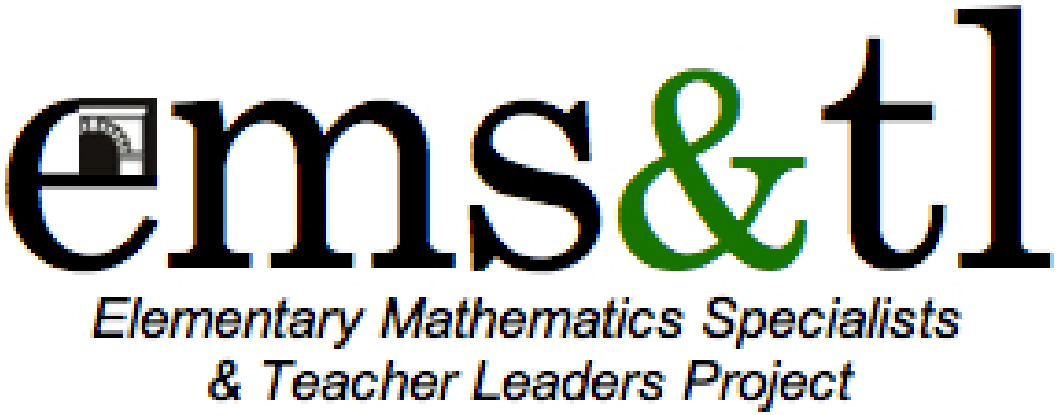
Explain why the two fractions above are equal.

Student response from previous screen

Farmer's Field



Questions?



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