

Using Podcasts to Examine Elementary Pre-service Teachers' Mathematics Knowledge for Teaching

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FRAYER MODEL

Essential Characteristics: What is it like?

My Definition: What is it?

Word: MKT

Examples

Counterexamples

What is MKT?

Examples

Shulman (1986) – PCK

Ma (1999) – Profound Understanding

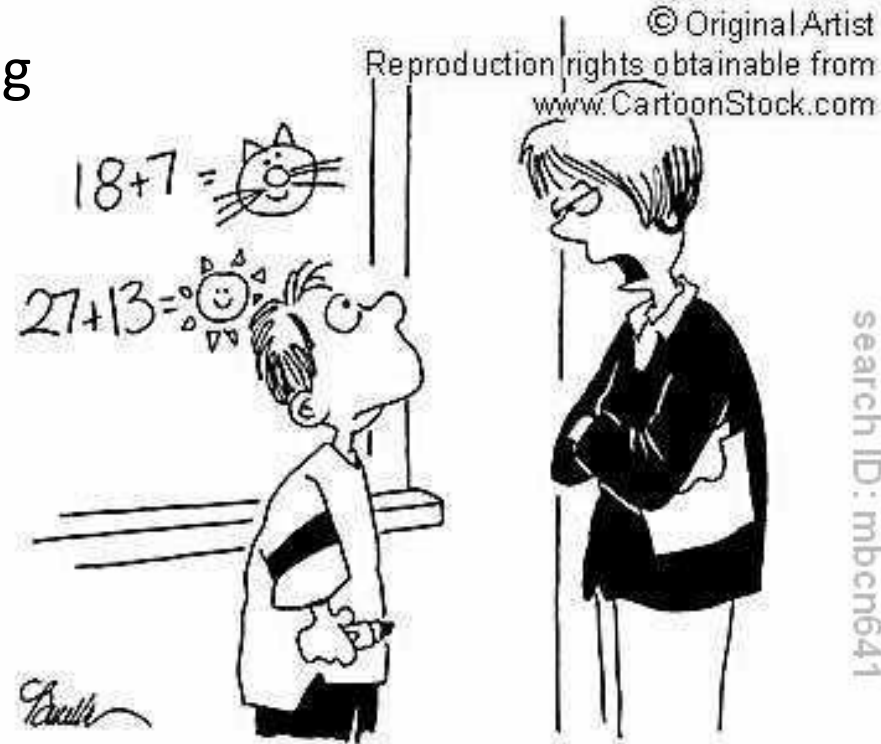
NRC (2001) – Proficient Teaching

Ball (2010) – Usable Knowledge

Teachers with more mathematical knowledge for teaching are more likely to:

- 1. supply mathematical explanations,*
- 2. use concrete models of mathematical processes*
- 3. connect multiple representations*
- 4. translate between students' everyday language and mathematical language.*

Counterexample



"True, we have encouraged you to use your imagination, but not in math."

Research Design

Purpose: This grounded theory study was designed to gather descriptive and qualitative data on the nature of elementary teacher candidates' mathematical content knowledge for teaching at various points in their education.

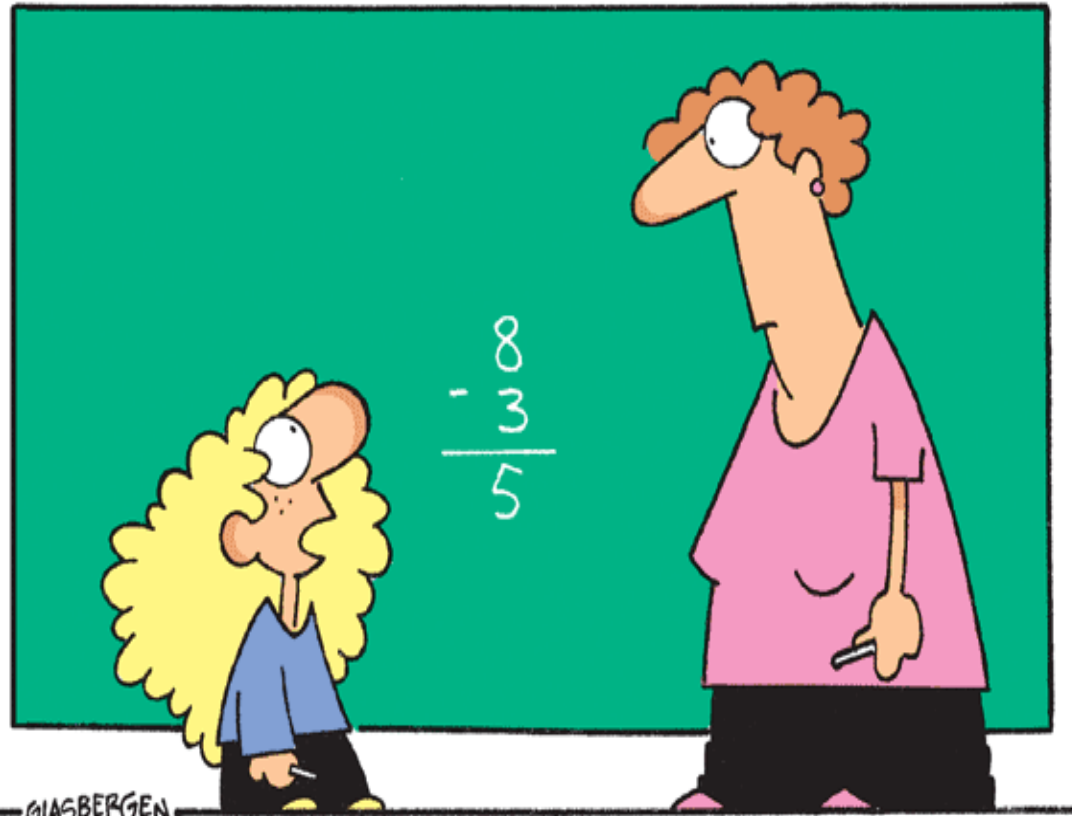
Course	Number of Pre-Service Elementary Teachers	Data Collection
MTH 125 Mathematics for Elementary Teachers I	n = 33	Random selection of section (1 of 3) Pre-podcast (September) Post-podcast (December)
EDS 422 Teaching Elementary Mathematics	n = 50	Three sections Post-podcast (December)

Subtraction with Regrouping

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Present the following problem as though you were explaining it to a student.

$$\begin{array}{r} 452 \\ -286 \\ \hline \end{array}$$



“What gives anyone the right to take 3 away from 8? Why should 8 be diminished to the lesser value of 5 just to satisfy someone’s obsession with math?”

Rubric Development: A Grounded Theory Approach

EDS 422

$$\begin{array}{r} 3 \quad 14 \quad 12 \\ 452 \\ - 286 \\ \hline 166 \end{array}$$

$$\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array} \quad \begin{array}{r} 14 \\ - 8 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 452 \\ - 286 \\ \hline \end{array}$$

$$300 \quad 40 \quad 12$$

$$400 + 50 + 2$$

$$- 200 + 80 + 6$$

$$\hline 166$$

$$\begin{array}{r} 452 \\ - 286 \\ \hline 166 \end{array}$$

$$\begin{array}{r} 345.2 \\ - 286 \\ \hline 166 \end{array}$$

MTH 125
Pre- and
Post-
Podcasts

FRAYER MODEL

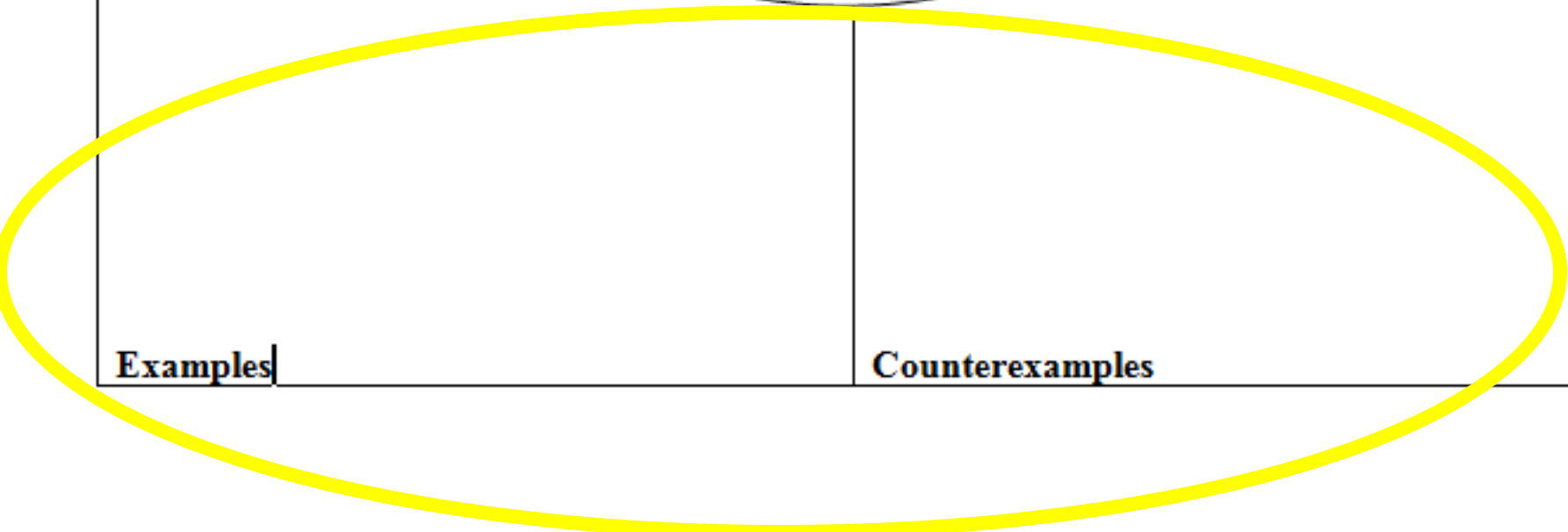
Essential Characteristics: What is it like?

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Examples

Counterexamples



Podcasting MKT

What did we see in the MKT examples

- Calculate correctly
- Provide students with explanations of common concepts and procedures
- Use pictures and diagrams to represent concepts and procedures

Counterexample

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“Class, I’ve got a lot of material to cover, so to save time I won’t be using vowels today. Nw lts bgn, pls trn t pg 122.”

Podcasting 101

Jing <http://www.jingproject.com/>

Digital media by which a user can watch and listen to audio on a computer.

Clarify misconceptions or reinforce key skills

See alternative perspective or methods

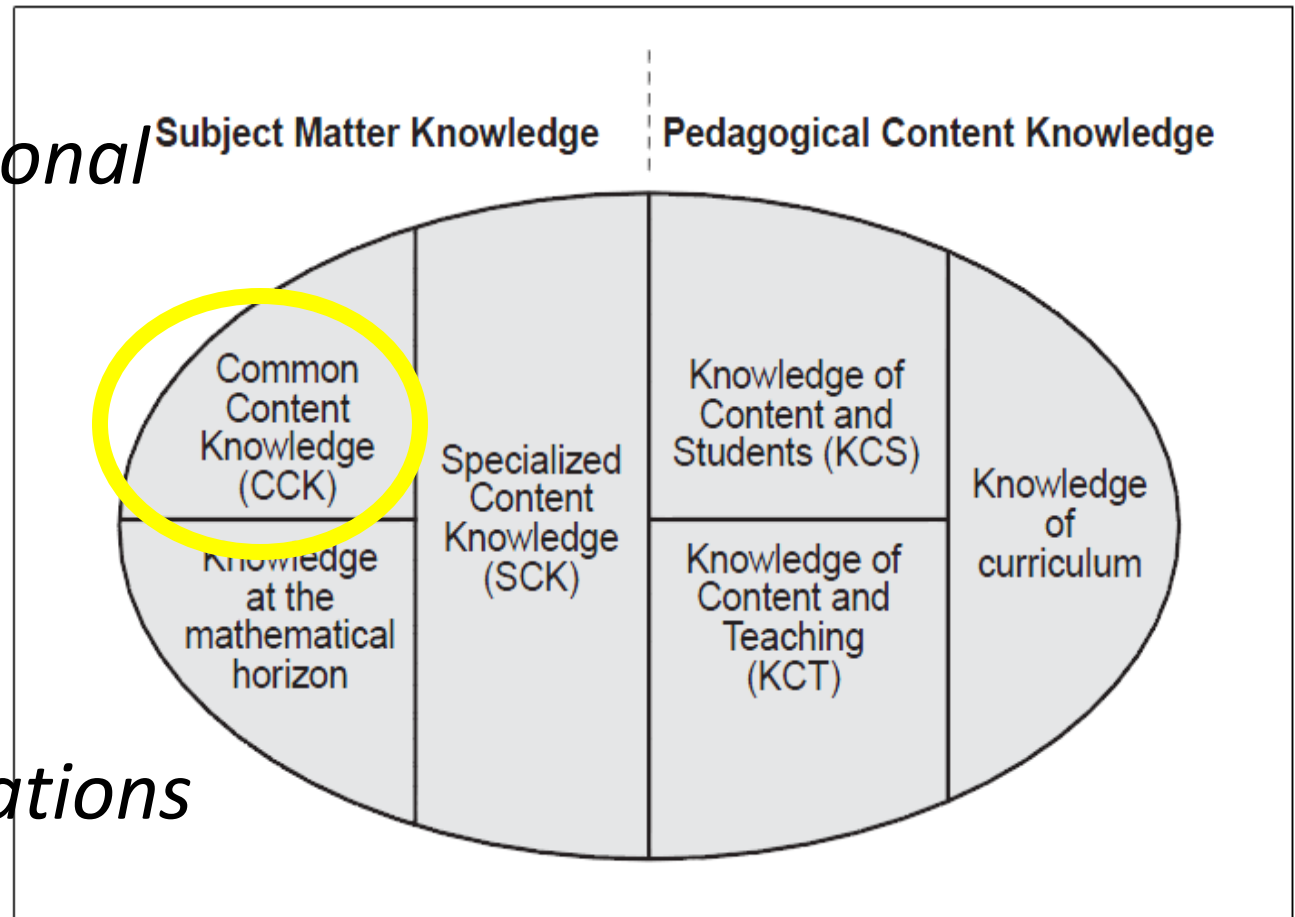
Ascertain PST MKT (our question)



Procedural Facility:

This dimension is concerned with the skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.

- *Computational Accuracy*
- *Algorithm Choice*
- *Representations*

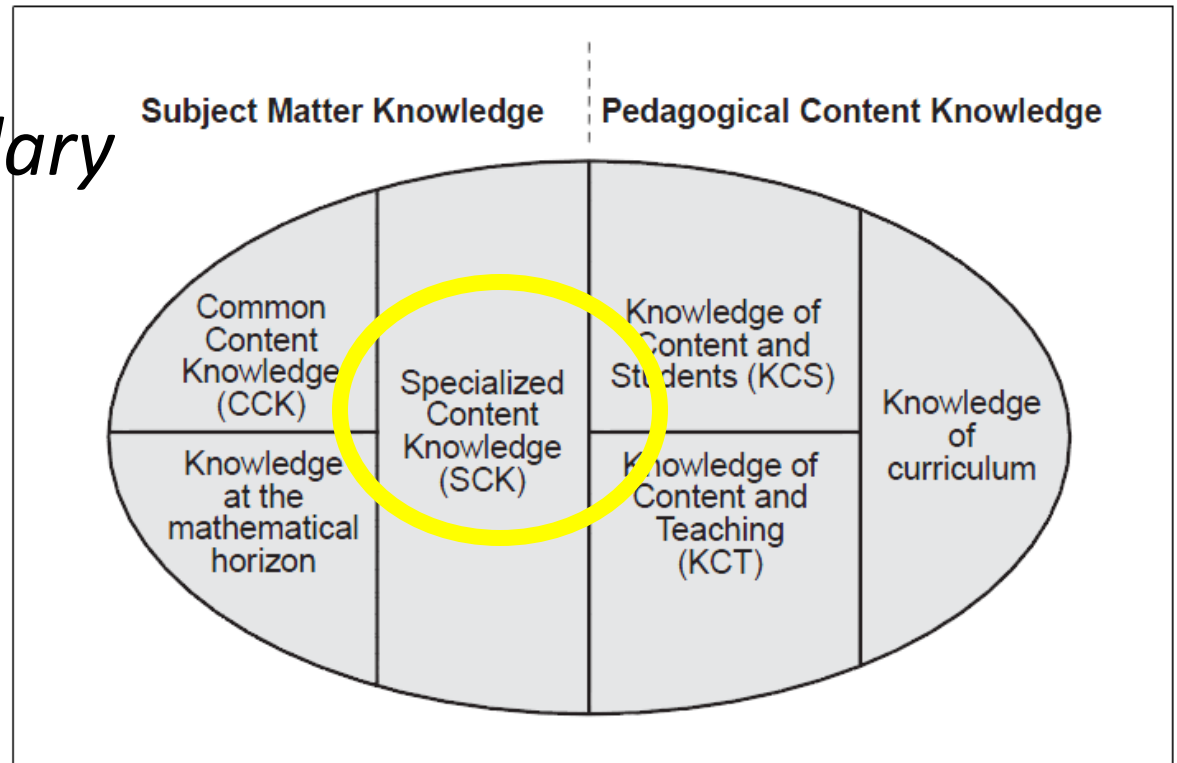


Hill, C.H., Ball, D.L, Schilling, S.G. (2008).

~~Conceptual Understanding:~~ Specialized Content Knowledge

This dimension is concerned with the comprehension of mathematical concepts, operations, and relations.

- *Use of Vocabulary*
- *Depth of Explanation*
- *Others*



Draft Rubric

Vocabulary

0 – Lack of consistent use of mathematical vocabulary or evidence of incorrect

1 – Minor lapses in usage of mathematical vocabulary that does not distract from understanding

2 – Mathematical vocabulary used appropriately and consistently

_____ Frequently Uses the Word “Borrow” (Subtraction Problem)

Depth of Explanation

0 – Inappropriate explanation that distracts from understanding

1 – Coherent explanation but does not give mathematical meaning to the procedure.

2 – Coherent explanation that provides mathematical meaning to the procedure.

Rubric Development: A Grounded Theory Approach

$$\begin{array}{r} 3 \quad 14 \quad 12 \\ 452 \\ - 286 \\ \hline 166 \end{array}$$

$$\begin{array}{r} 12 \\ - 6 \\ \hline 6 \end{array} \quad \begin{array}{r} 14 \\ - 8 \\ \hline 6 \end{array}$$

EDS 422

$$\begin{array}{r} 452 \\ - 286 \\ \hline \end{array}$$

$$300 \quad 40 \quad 12$$

$$400 + 50 + 2^{+10}$$

$$- 200 + 80 + 6$$

$$\hline 166$$

MTH 125
Pre- and
Post-
Podcasts

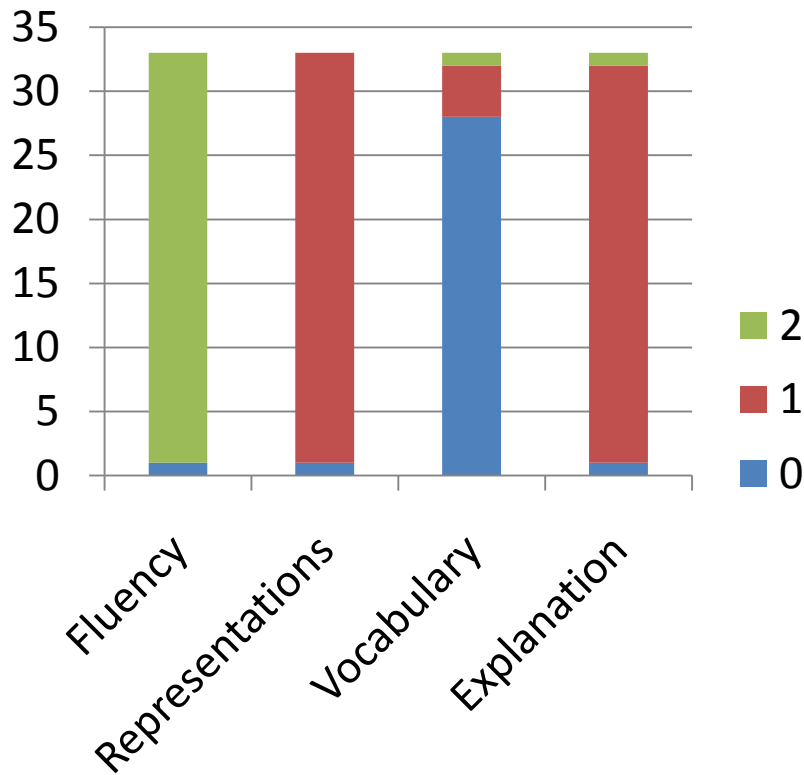
$$\begin{array}{r} 452 \\ - 286 \\ \hline 166 \end{array}$$

$$\begin{array}{r} 345.2 \\ - 286 \\ \hline \end{array}$$

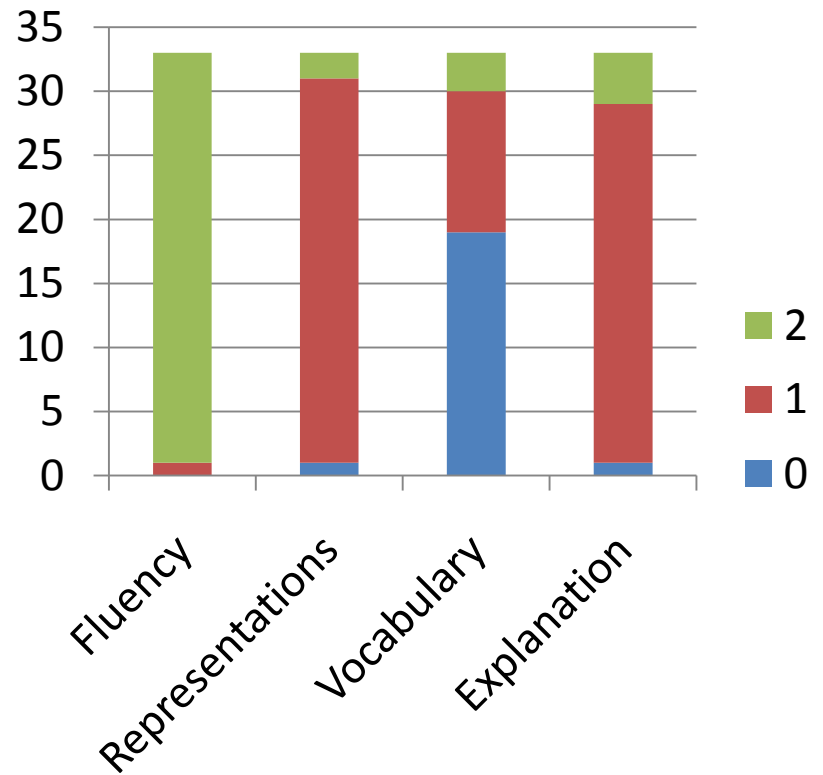
Subtraction Results

MTH 125

PRE-PODCASTS (SEPT)

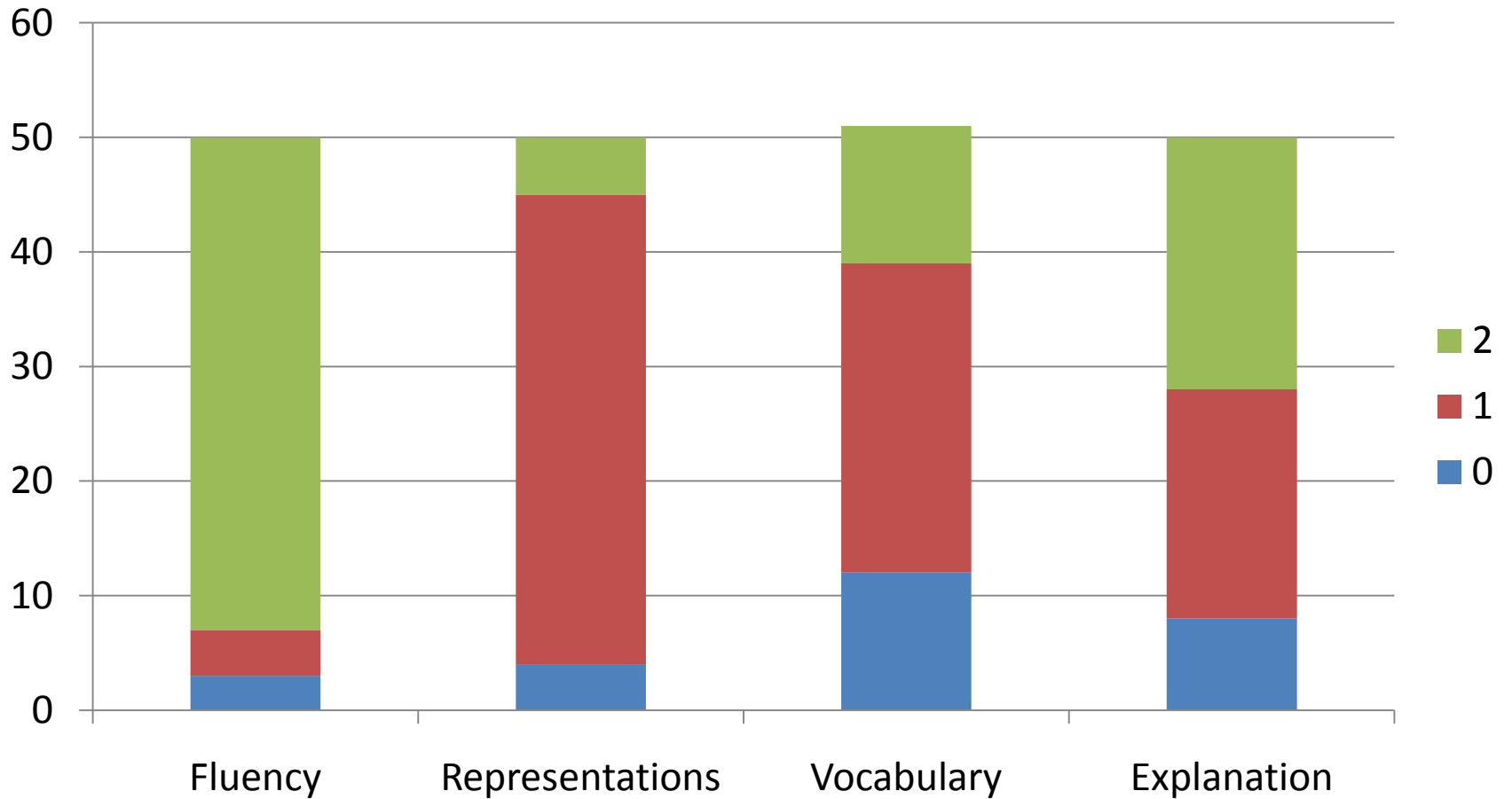


POST-PODCASTS (DEC)



Subtraction Results

EDS 422



Generalized Results

- Use of traditional algorithm
- Tendency to regress back to rote methods
- Place Value language
- Misconceptions “can’t take 6 from 2” or “6 minus 2” can’t be done

$$\begin{array}{r} 300 \quad 140 \quad 12 \\ \rightarrow 452 = 400 + 50 + 2 \\ \begin{array}{r} 286 \\ + \\ \hline 166 \end{array} = 200 + 80 + 6 \\ 24 \end{array}$$

- Little connection to inverse operation
- Transition from “borrow a one from neighbor” to borrow a group of ten”
- Little connection between multiple representations.

$$\begin{array}{r} 452 \\ - 286 \\ \hline 6 \end{array}$$

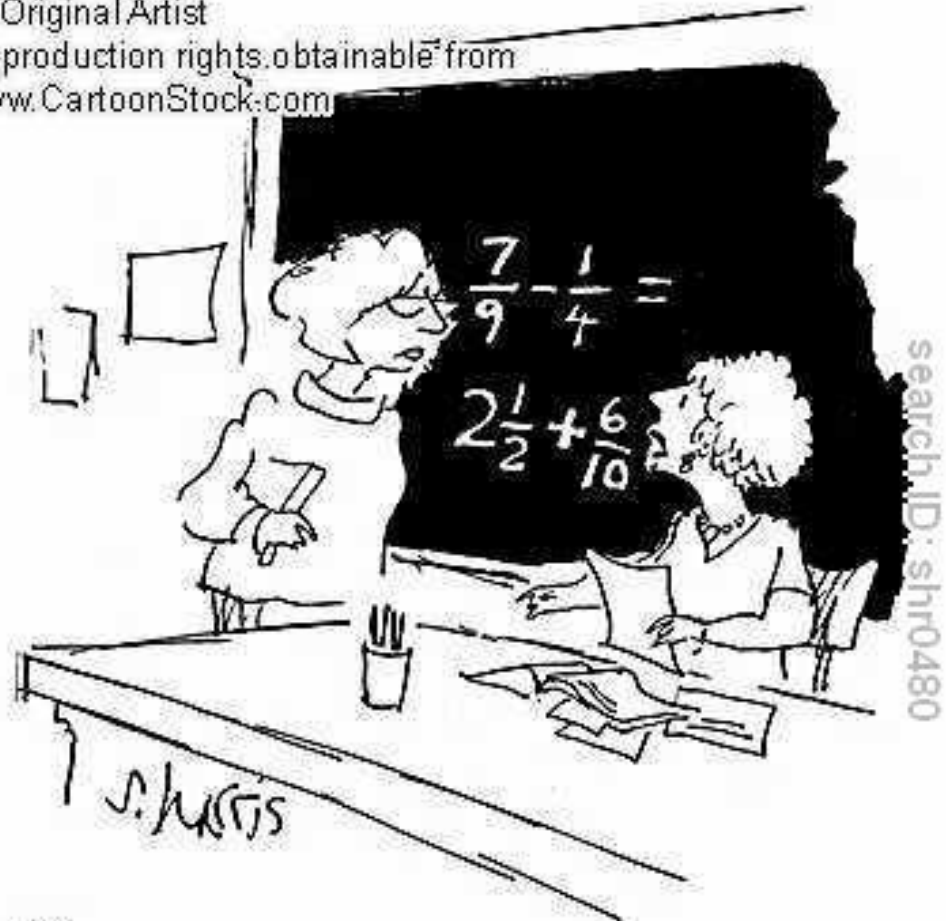
$$\begin{array}{r} 100 \quad 10 \\ \begin{array}{r} 300 \quad 50 \quad 2 \\ - 100 \quad 10 \quad 12 \\ \hline 200 \quad 80 \quad 6 \end{array} \\ \begin{array}{r} 6 \\ 6 \\ 6 \end{array} \end{array}$$

Division of Fractions

Present the following problem as though you were explaining it to a student.

$$1\frac{3}{4} \div \frac{1}{2}$$

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search ID: shr0480

"5/3 OF THE CLASS DON'T UNDERSTAND A WORD I'M SAYING ABOUT FRACTIONS."

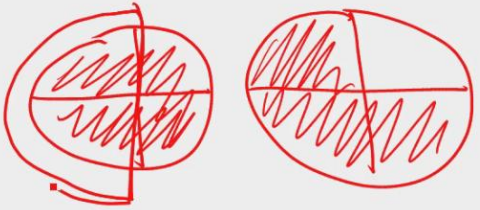
Scoring MKT

EDS 422

$$\begin{array}{l} \frac{3}{4} \div \frac{1}{2} \\ \frac{7}{4} \div \frac{2}{4} \end{array} \quad 3 \frac{1}{4}$$

$$\begin{array}{l} \frac{3}{4} \div \frac{1}{2} \\ \frac{7}{4} \div \frac{1}{2} \end{array} \quad \frac{1}{4} \cdot \frac{2}{2} = \frac{2}{2} = 1$$

MTH 125
Pre- and
Post-
Podcasts

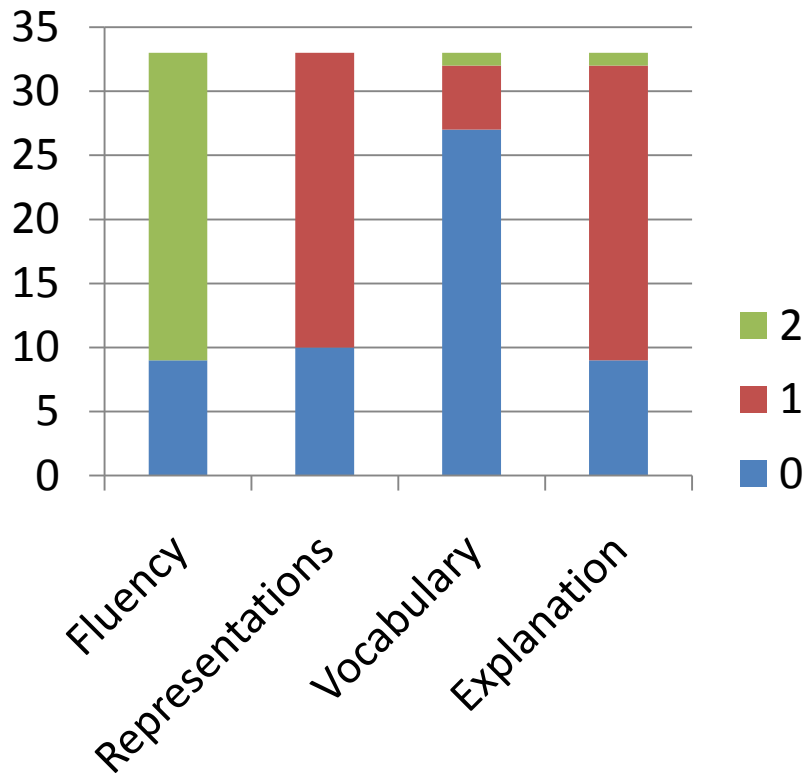
$$\frac{3}{4} \div \frac{1}{2}$$


$$\begin{array}{l} \frac{4}{4} + \frac{3}{4} = \frac{7}{4} \\ \frac{7}{4} \div \frac{1}{2} = \\ \frac{7}{4} \times \frac{2}{1} = \frac{14}{4} \end{array}$$

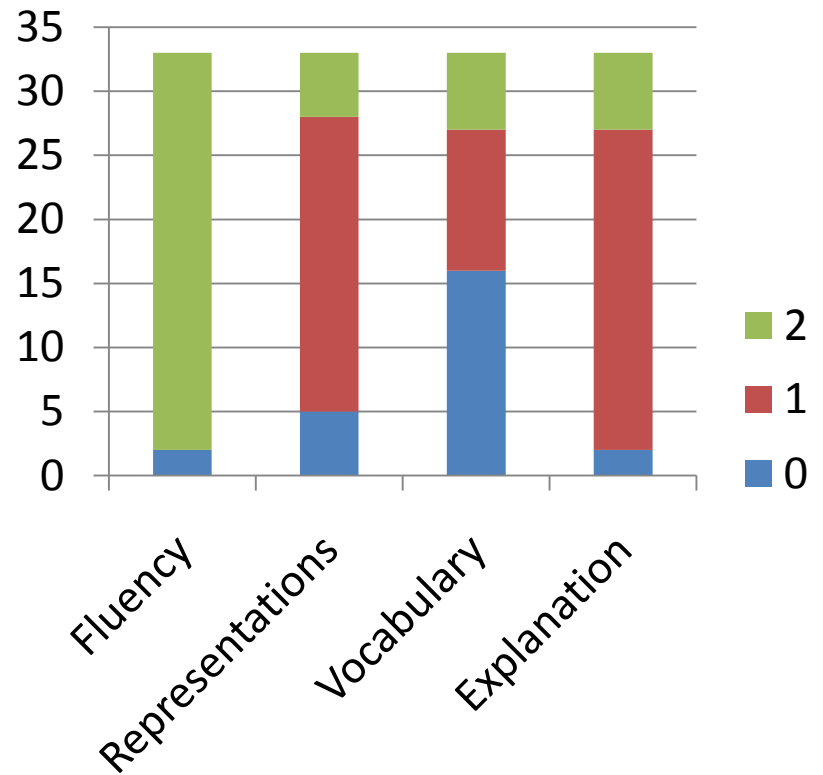
Division Results

MTH 125

PRE-PODCASTS (SEPT)

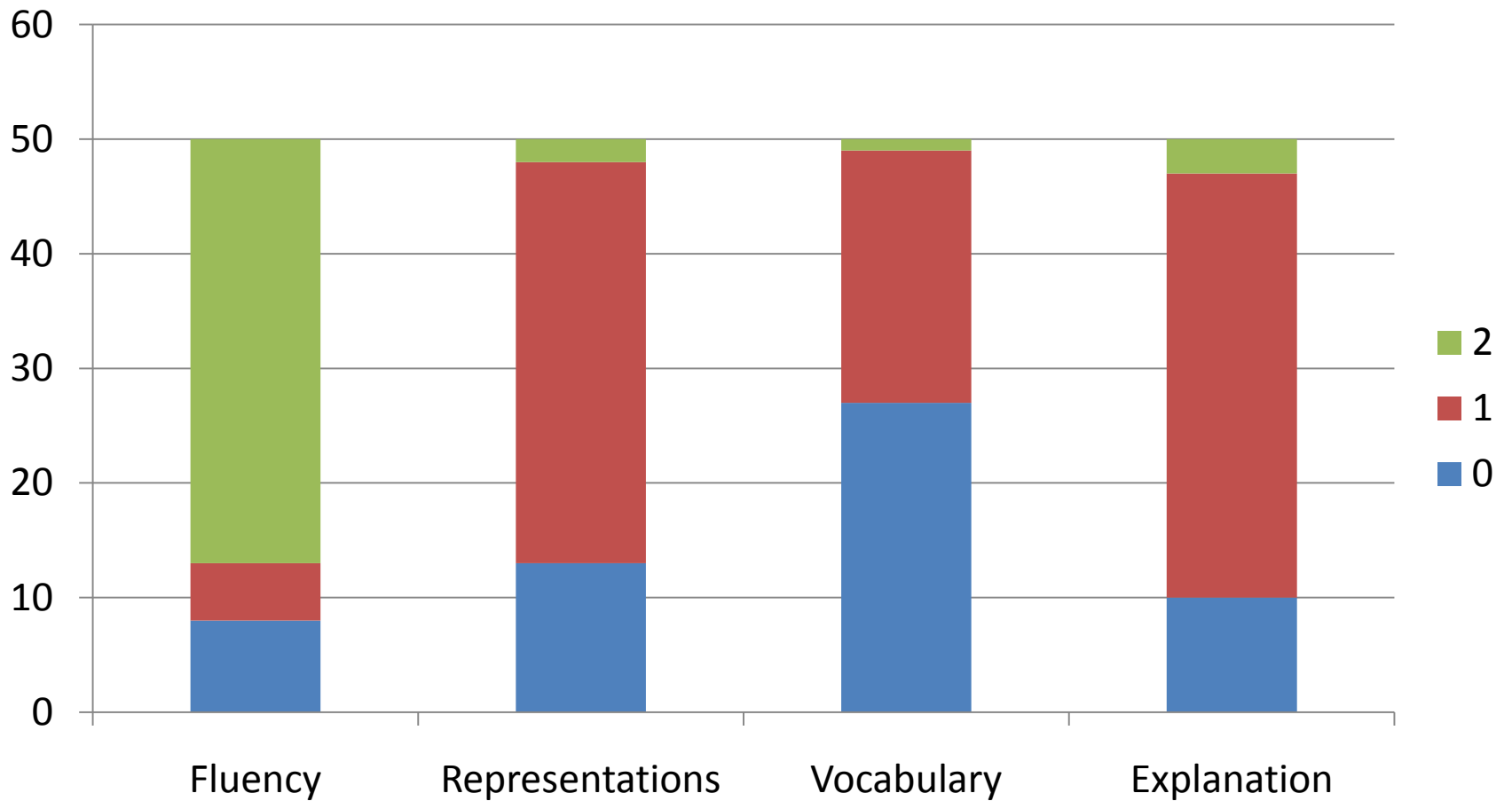


POST-PODCASTS (DEC)



Division Results

EDS 422



Generalized Results

- Use of traditional algorithm for pre-podcast and methods podcasts.
- Procedural explanations
- Little link between multiple representations
- Difficulty interpreting remainder in pictorial representation
- Notational Errors

$$\left(1 \frac{3}{4}\right) \div \frac{1}{2}$$

$$\frac{7}{4} \div \frac{1}{2} \quad \frac{7}{4} \times \frac{2}{1}$$

$$\frac{14}{4}$$

$$\left(1 \frac{3}{4}\right) \div \frac{1}{2} \quad \frac{7}{4} \div \frac{1}{2}$$

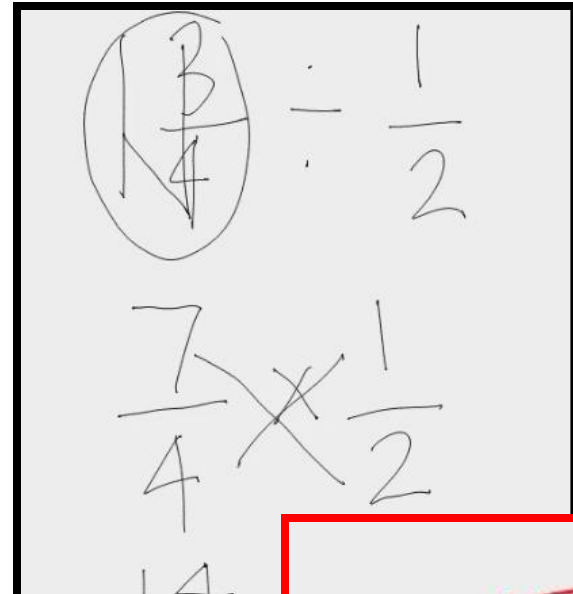
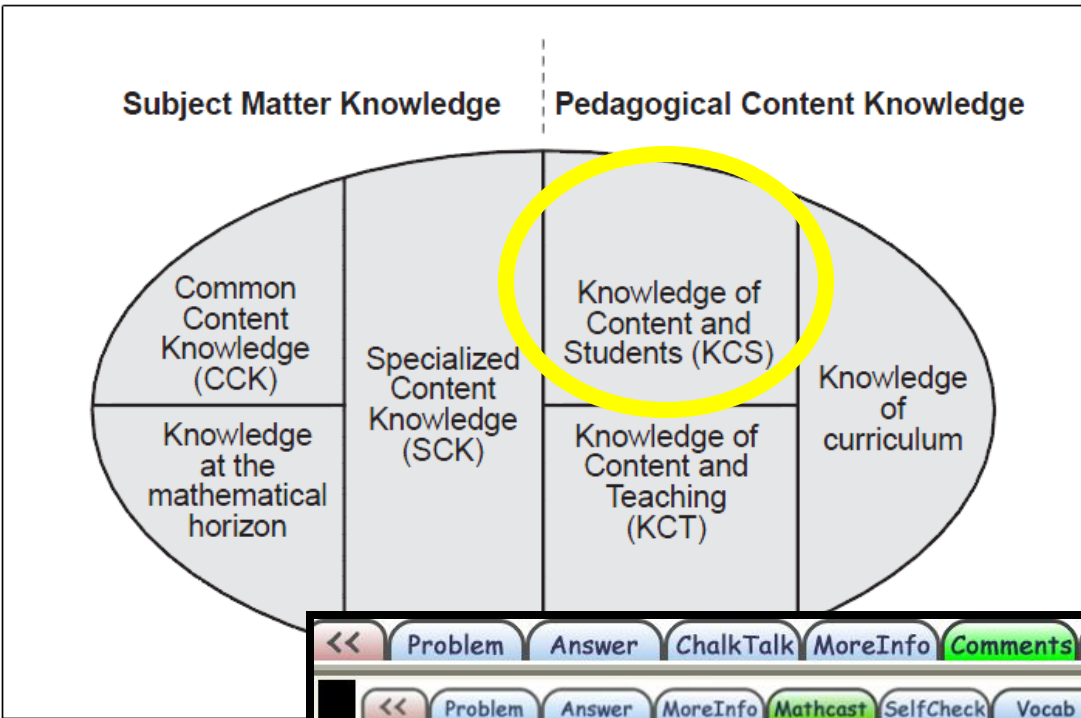
$$\frac{4}{4} + \frac{3}{4} = \frac{7}{4} \quad \frac{1}{2} = \frac{2}{4}$$

$$\frac{7}{4} \div \frac{2}{4} = 3 \frac{1}{4}$$

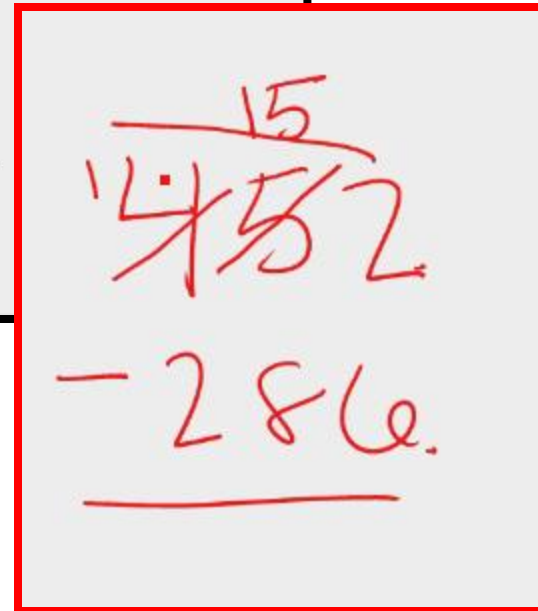
$$1 \frac{3}{4} \div \frac{1}{2}$$

$$1 \frac{3}{4} \quad 1 = \frac{4}{4} + \frac{3}{4} = \frac{7}{4}$$

Other Projects or Uses for Podcasting?



A screenshot of a math problem solver interface. The interface includes a navigation bar with buttons for Problem, Answer, ChalkTalk, MoreInfo, Comments, SelfCheck, and Vocab. Below the navigation bar, there is a video player showing a math problem: "Solve the inequality. If a solution exists write it using interval notation, use a single interval if possible." The problem is $|2x+5| \geq 5$. The solution shown is $2x+5 \geq 5$, $-5 \leq 2x$, $\frac{2x}{2} \geq \frac{0}{2}$, and $x \geq 0$. The video player has a progress bar and a volume icon.



Selected MKT References

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