



# Curriculum Alignment

Mathematics Summit  
Rhode Island College  
May 21, 2008

# Goals for this Session

TO:

- Define Curriculum Alignment
- Model Process for Aligning Curriculum
- Encourage Educators in K-16 Discussions

# Curriculum Alignment

## The Whole Picture

- District and School Plans
- Vertical ~ Horizontal Articulation K-16
- Programs ~ Textbooks ~ Resources
- Distribution of Emphasis
- Depth of Knowledge
- Teacher Practice
- Teacher Content Knowledge
- Formative ~ Interim ~ Summative Assessment
- Professional Development
- Supports for Students



# District and School Plans

- Build systemic district and school plans that focus on improvement of student performance in mathematics K-12 (define mathematics program)
- Identify and target resources and supports for enhancement of mathematics education K-12
  - Article 31
  - Title I
  - IDEA



# Vertical and Horizontal Articulation

- K-16 Curriculum Focus
  - Teachers and faculty identify the big picture and their responsibilities
  - K-16 faculty understands and implements the GLEs/GSEs
- Grade Level Curriculum Focus
  - Teachers across each grade level work together and focus on identified concepts



# Programs ~ Textbooks ~ Resources

- Cohesive K-12 program based on district plan
- Criteria and process for the selection of texts and resources (GLEs/GSEs)
- Use of supplemental resources (GLEs/GSEs)





# Working with the GLEs and GSEs

## Functions and Algebra Strand

Stem K-1 to 8-1

**Identifies and extends to specific cases a variety of patterns**

Stem 10-1

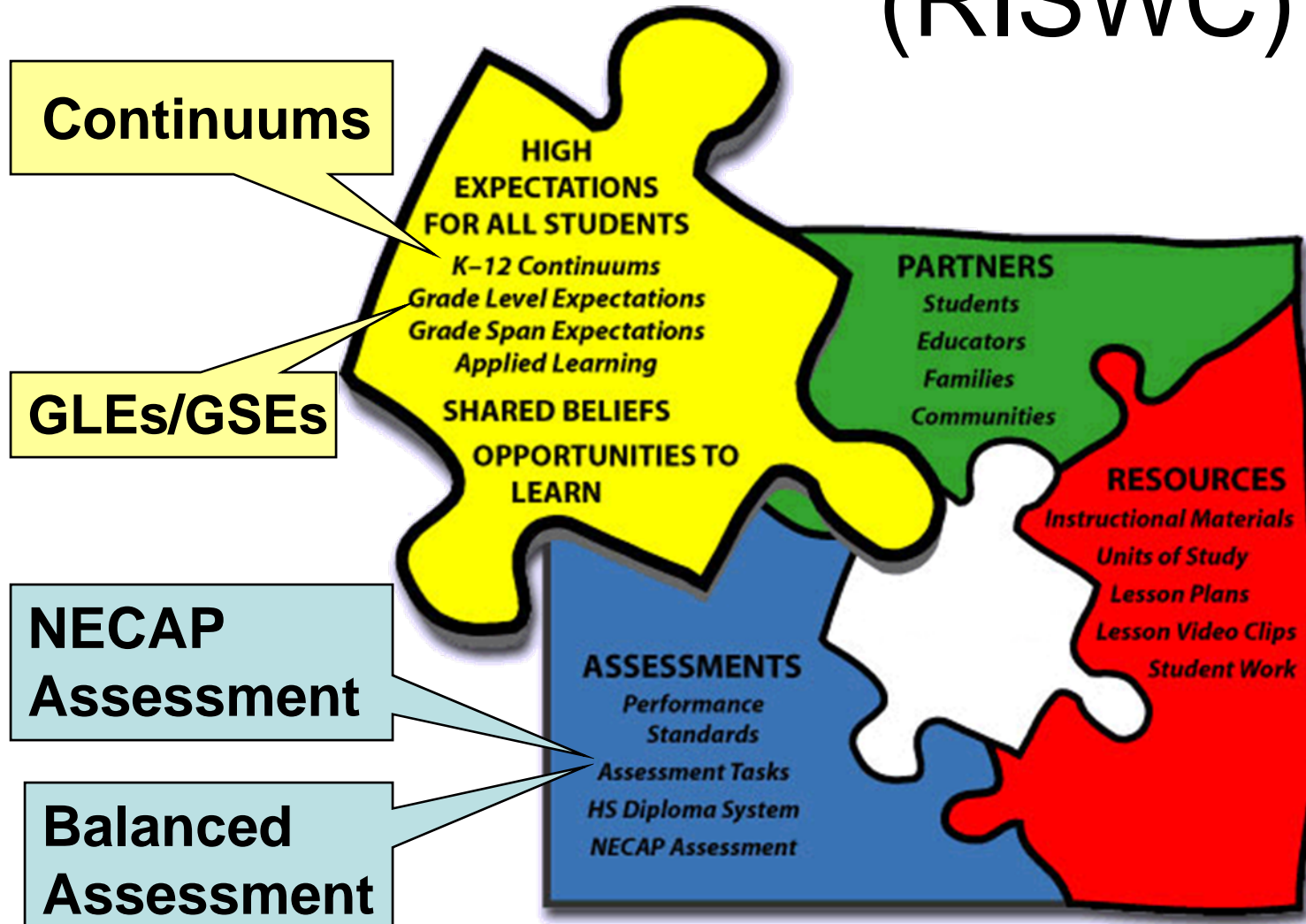
**Identifies, extends, and generalizes a variety of patterns**

Stem 12-1

**Identifies arithmetic and geometric sequences and uses the generalization to find a specific term**



# RI Statewide Curriculum (RISWC)



# Grade 3 Released Item (F&A 2-1)

This table shows the number of vans needed to take students on a camping trip.

<b>Number of Vans</b>	<b>Number of Students</b>
2	14
3	21
4	28
5	?
6	42

Each van takes the same number of students.  
How many students can 5 vans take on the camping trip?

# Grade 4 Released Item (F&A 3-1)

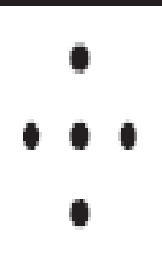
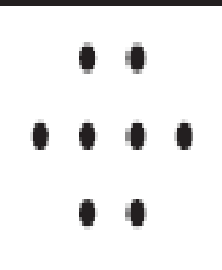
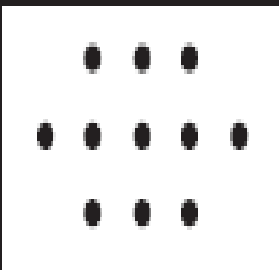
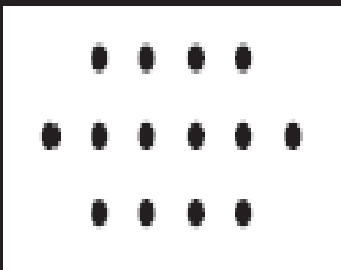
Holly started this table to show how much money she earns walking dogs. Holly always earns the same amount of money for each dog she walks.

**Money Earned  
Walking Dogs**

Number of Dogs Walked	Money Earned
2	\$ 4.00
4	\$ 8.00
6	\$12.00
8	\$16.00
10	
12	
14	

# Grade 6 Released Item (F&A 5-1)

Look at this pattern.

Step 1	Step 2	Step 3	Step 4
			
5 dots	8 dots	11 dots	14 dots

How many dots will be used in Step 20? Show your work or explain how you know.

# Student Response

(EXAMPLE A)

13

Each picture adds one vertical line of three dots in the middle, but the end dots stay the same. There will be 62 dots in step 20.



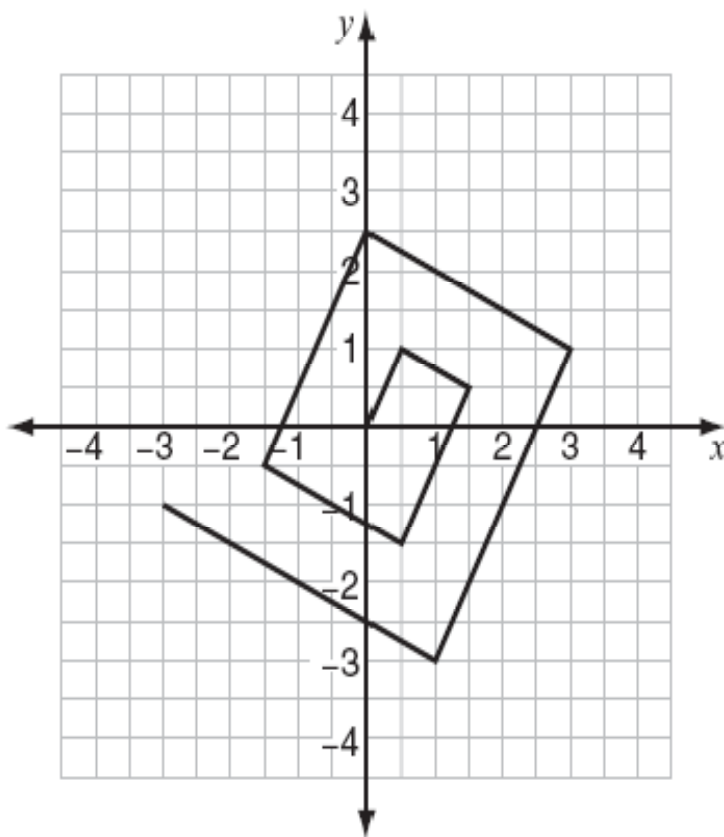
20 rows of 3 dots.

$$20 \times 3 + 2 = 62$$

Student's answer is correct, with correct strategy shown. (Note: The student's diagram shows only 19 columns of dots, but the annotation shows correct numbers.)

# Grade 11 Released Item (F&A10-1)

- 20 Starting at the origin, Nadia drew eight line segments on this coordinate grid.



Nadia continues her pattern. What is the slope of the 25th line segment she will draw? Show your work or explain how you know.

# Student Response

SCORE POINT 2  
(EXAMPLE A)

$$9 = \frac{10}{5}$$
$$10 = \frac{-5}{10}$$
$$11 = \frac{12}{6}$$
$$12 = \frac{-6}{12}$$

$$25 = \frac{26}{13}$$

$$m = \frac{26}{13}$$

The pattern of all the slopes is  $\frac{2}{1}$  for the first time, then the neg reciprocal follows. You can assume this by counting or because all the lines are perpendicular

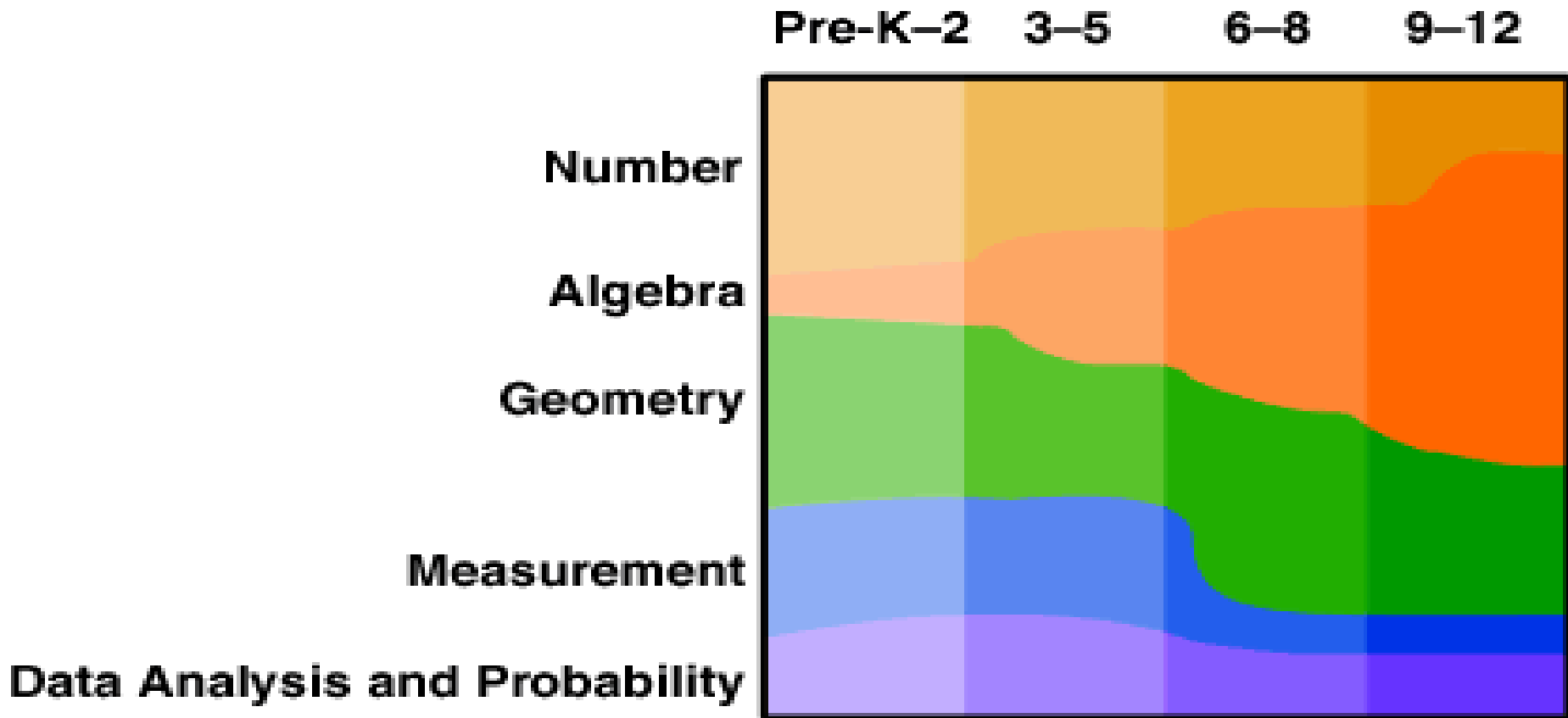
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## The Whole Picture

- District and School Plans
- Vertical ~ Horizontal Articulation K-16
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- **Distribution of Emphasis**
- **Depth of Knowledge**
- Teacher Practice
- Teacher Content Knowledge
- Formative ~ Interim ~ Summative Assessment
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- Supports for Students



# Distribution of Emphasis



**Table 2-7. 2006-07 NECAP Mathematics – Grades 3 through 11: Distribution of Emphasis (in targeted percentage of test).**

Emphasis	GLE/GSE grade (grade tested)						
	2 (3)	3 (4)	4 (5)	5 (6)	6 (7)	7 (8)	10 (11)
Numbers and Operations	55%	50%	45%	40%	30%	20%	20%
Geometry and Measurement	15%	20%	20%	25%	25%	25%	25%
Functions and Algebra	15%	15%	20%	20%	30%	40%	40%
Data, Statistics, and Probability	15%	15%	15%	15%	15%	15%	15%
Total	100%	100%	100%	100%	100%	100%	100%



# Depth of Knowledge (DoK)

## Levels of Knowing

- Level 1 Recall

Name ~ List ~ Use

- Level 2 Skill/Concept

Compare ~ Classify ~ Organize

- Level 3 Strategic Thinking

Construct ~ Draw Conclusions

- Level 4 Extending Thinking

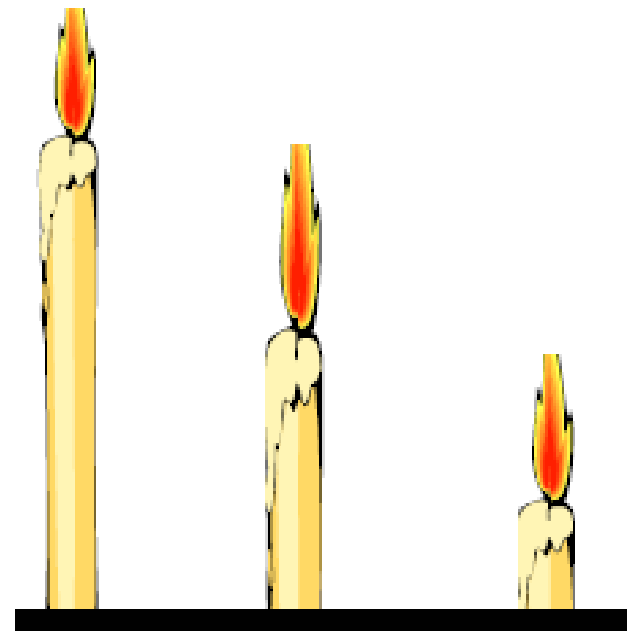
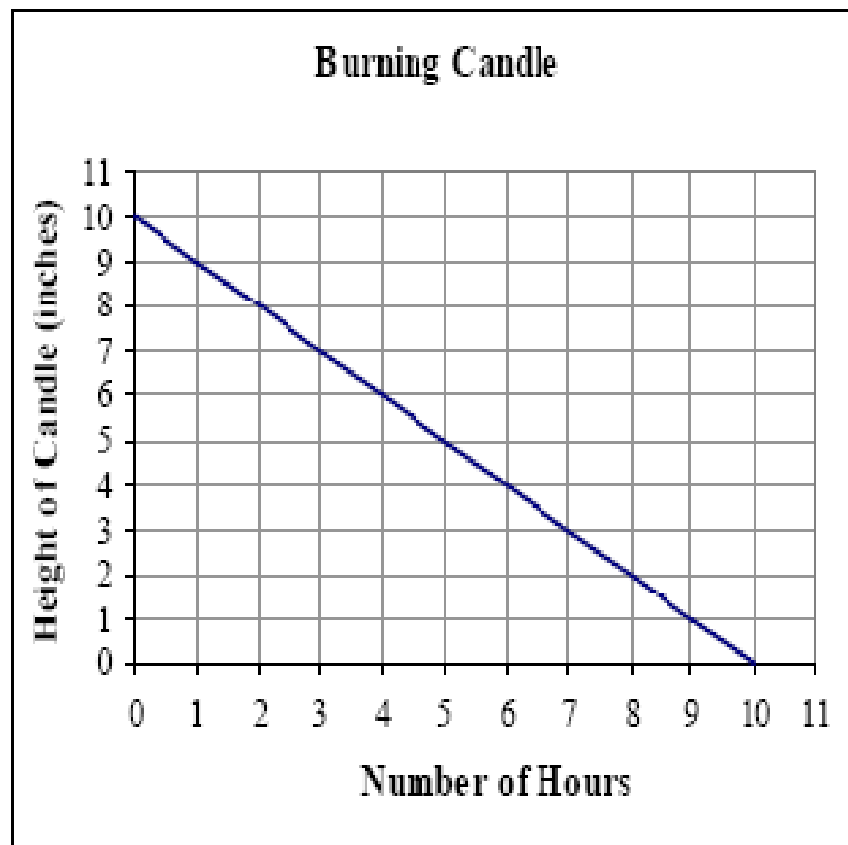
Critique ~ Design ~ Synthesize

# Example of DoK

- Level 1 Name the type of triangle
- Level 2 Compare two triangles
- Level 3 Construct a design using different kinds of triangles and other polygons leaving no space between the polygons
- Level 4 Research architecture, determine reasons for using certain geometric designs in construction, and create a new design of your own based on your research.



**Example 15.1:** What is the meaning of the slope in this situation? What is the meaning of the  $y$ -intercept in this situation?



Answer: The slope represents that the candle burns at a constant rate of 1 inch per hour and the  $y$ -intercept represents the initial height of the candle (10 inches).



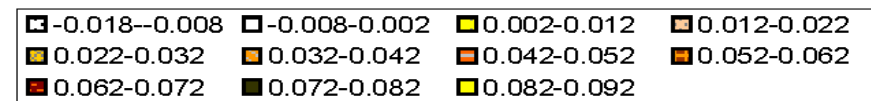
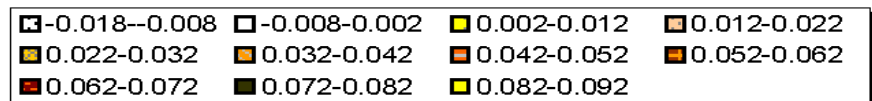
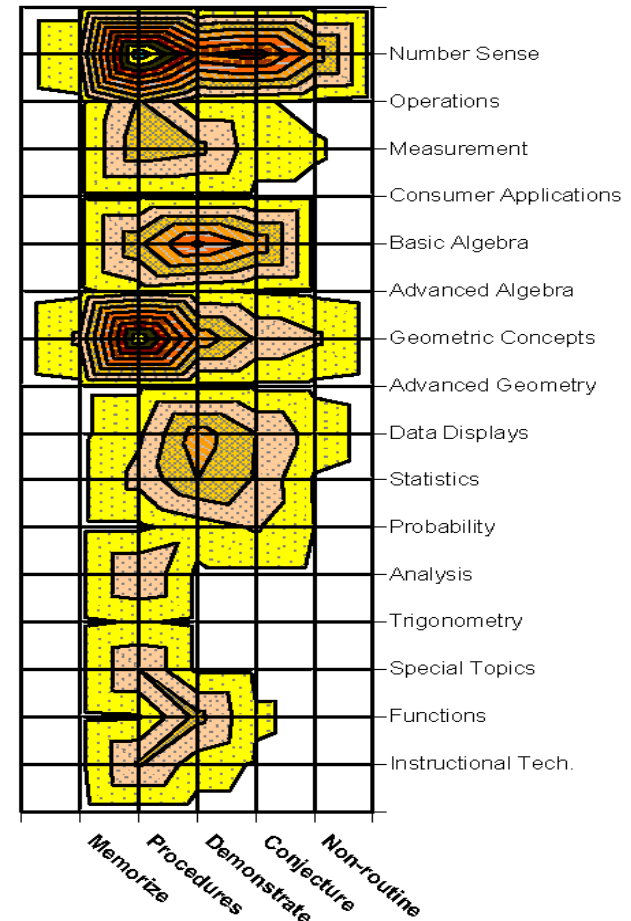
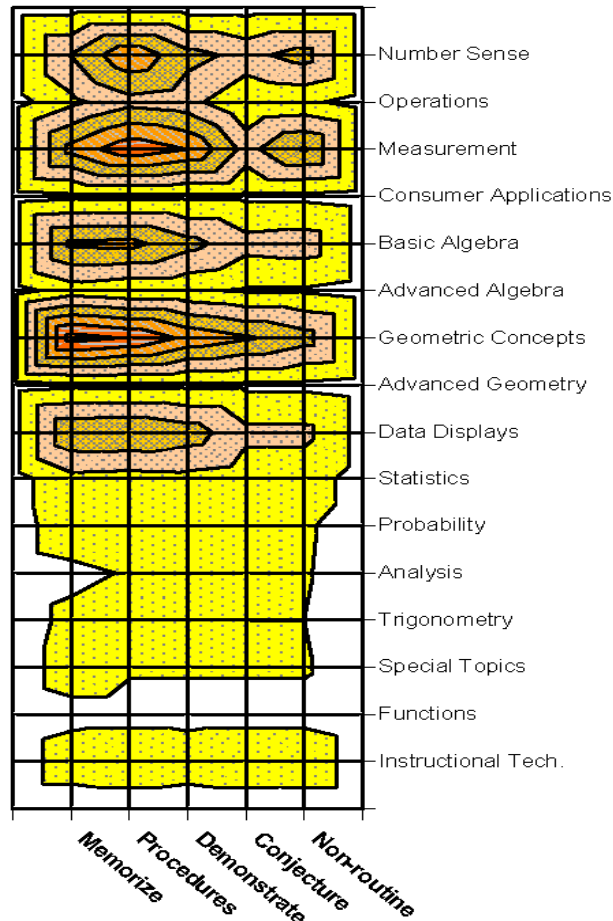
## Content Analysis & Teacher Reflection

Alignment Index: **0.23**

Coarse Grain: **0.55**

Gr. 8 (2006) [24489]  
Grade Gr. 8  
All Content Areas

PA Stnds Gr. 8  
Document  
All Content Areas



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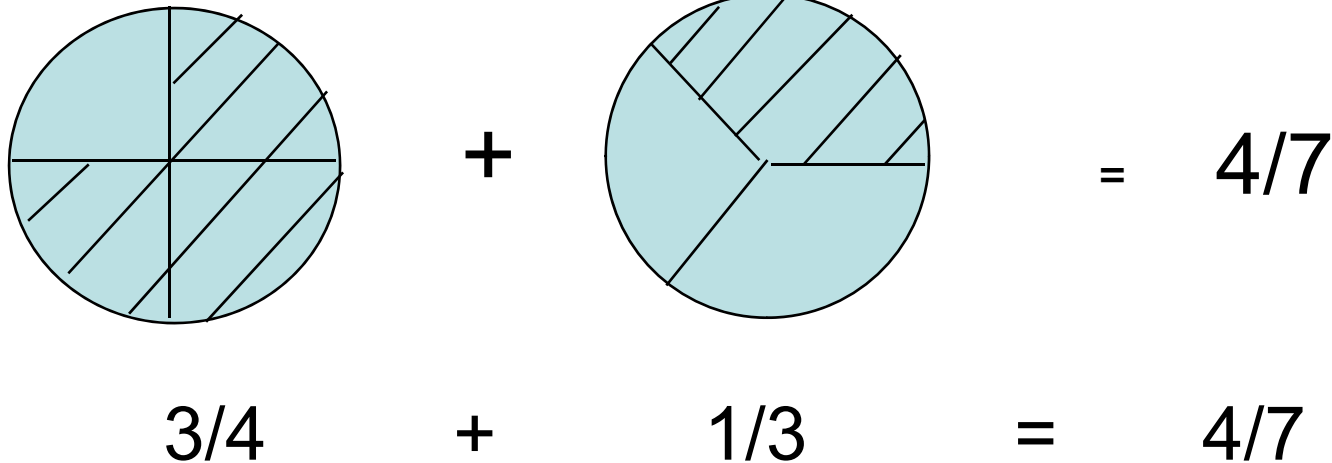
# Teacher Practice

- Employ multiple strategies to meet student needs
- Use formative assessment daily to make instructional decisions
- Reflect on effectiveness of lessons
- Work with colleagues and partners to enhance practices



# Area Model

Students are given 2 circles and asked to add the shaded portion of the circles.



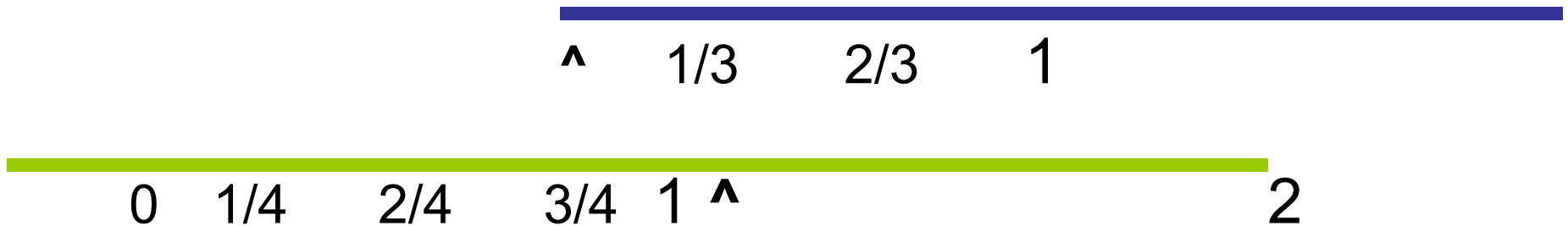
# Another Area Model

Add  $\frac{3}{4} + \frac{1}{3}$



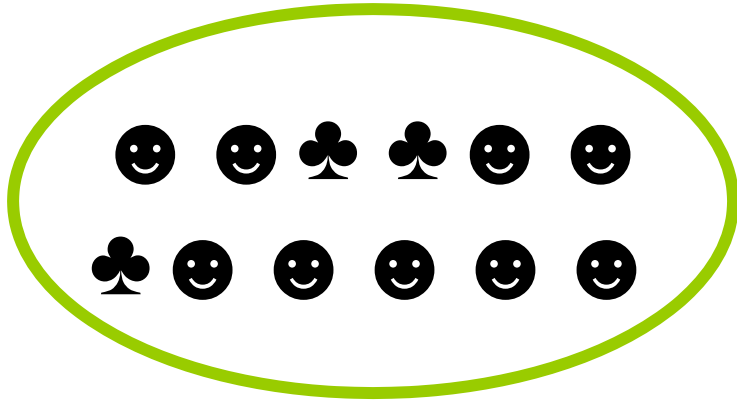
# Linear Model

The teacher uses strips of paper to show another way of thinking about the problem.

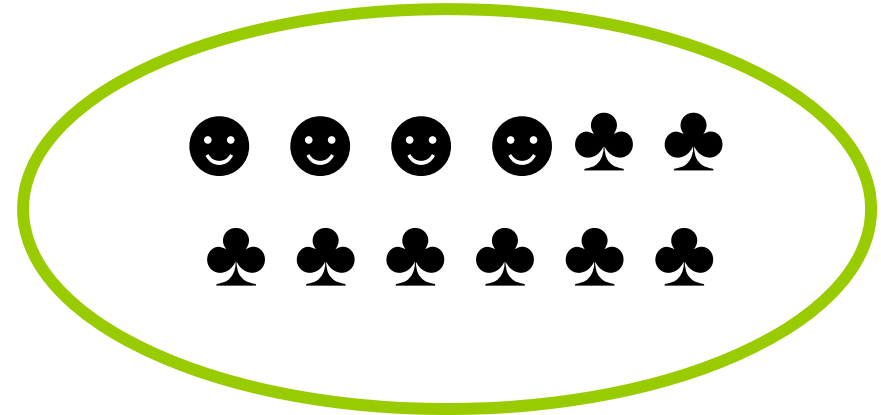


# Set Model

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



$\frac{3}{4}$      $\frac{6}{8}$      $\frac{9}{12}$



$\frac{1}{3}$      $\frac{2}{6}$      $\frac{3}{9}$      $\frac{4}{12}$

$$\frac{9}{12} + \frac{4}{12} = \frac{13}{12}$$

$$\frac{13}{12} = \frac{12}{12} + \frac{1}{12}$$

$$1 \frac{1}{12}$$

# Teacher Content Knowledge

- Engage in continued professional development to enhance knowledge of teaching mathematics
- Partner with community members to enhance knowledge and skills (higher education faculty, business, informal educators)
- Create a safe, friendly environment for teachers to learn



# Deborah Ball's Research

Common content knowledge (CCK)

Calculate:

$$\frac{5}{6} \div \frac{1}{3}$$

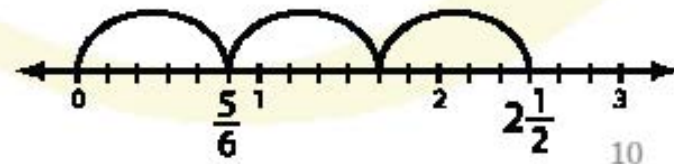
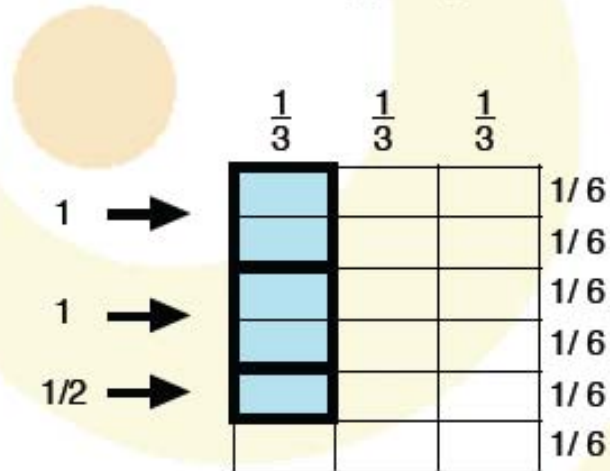
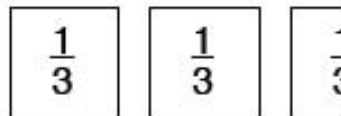
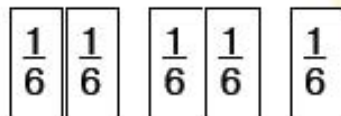
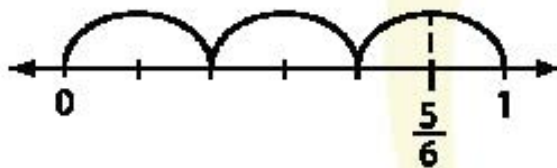
## Specialized content knowledge (SCK)

$$\frac{5}{6} \div \frac{1}{3} = \frac{10}{12} \div \frac{4}{12} = 10 \div 4 = 2\frac{1}{2}$$

Is this a fluke?  
Does it work in general?  
If so, why does it work?

# Specialized content knowledge (SCK)

Which of these can be used to represent  $\frac{5}{6} \div \frac{1}{3}$  ?



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# Formative ~ Interim ~ Summative Assessments

## Use each form of assessment appropriately

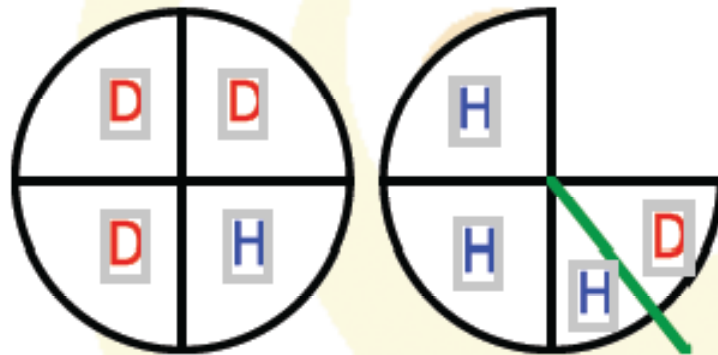
- Use summative assessment to make curriculum decisions
- Use interim assessments to identify progress
- Use formative assessment daily in every classroom to make instructional decisions and give constructive feedback to students

# Division of fractions

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

1. Calculate the answer.
2. Write a story problem, or describe a situation, that corresponds to  $1\frac{3}{4} \div \frac{1}{2}$ .

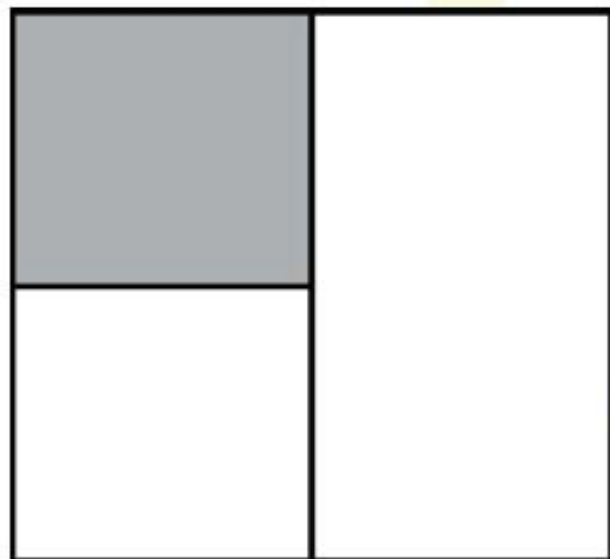
I have two pizzas. My friend eats one quarter of one of the pizzas. I have one and three quarters pizzas left. Then I split it evenly between two of my other friends. Each person gets three and a half pieces of pizza.



1. What is wrong with this?
2. Write a story problem that correctly represents the division.

## SCK task #2: Analyzing solutions

What fraction is represented here?



What reasoning could produce each of these answers?

$$\frac{1}{2}$$

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

$$\frac{1}{3}$$

$$1\frac{1}{2}$$

# Balanced Assessment Tasks (grades 3 -10)

- Discuss the need to make sense of the mathematics. What is the problem about?
- Use student work to discuss misconceptions and engage students in the “editing process”
- Build peer support and institutionalize analysis of student work within the culture of the classroom/school

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# Professional Development

Enables educators to:

- Learn mathematics knowledge for teaching
- Help students “make sense” of mathematics
- Implement mathematics curriculum, instruction, and assessment that is aligned to the GLEs/GSEs



# Supports for Students

Create opportunities for all students to learn

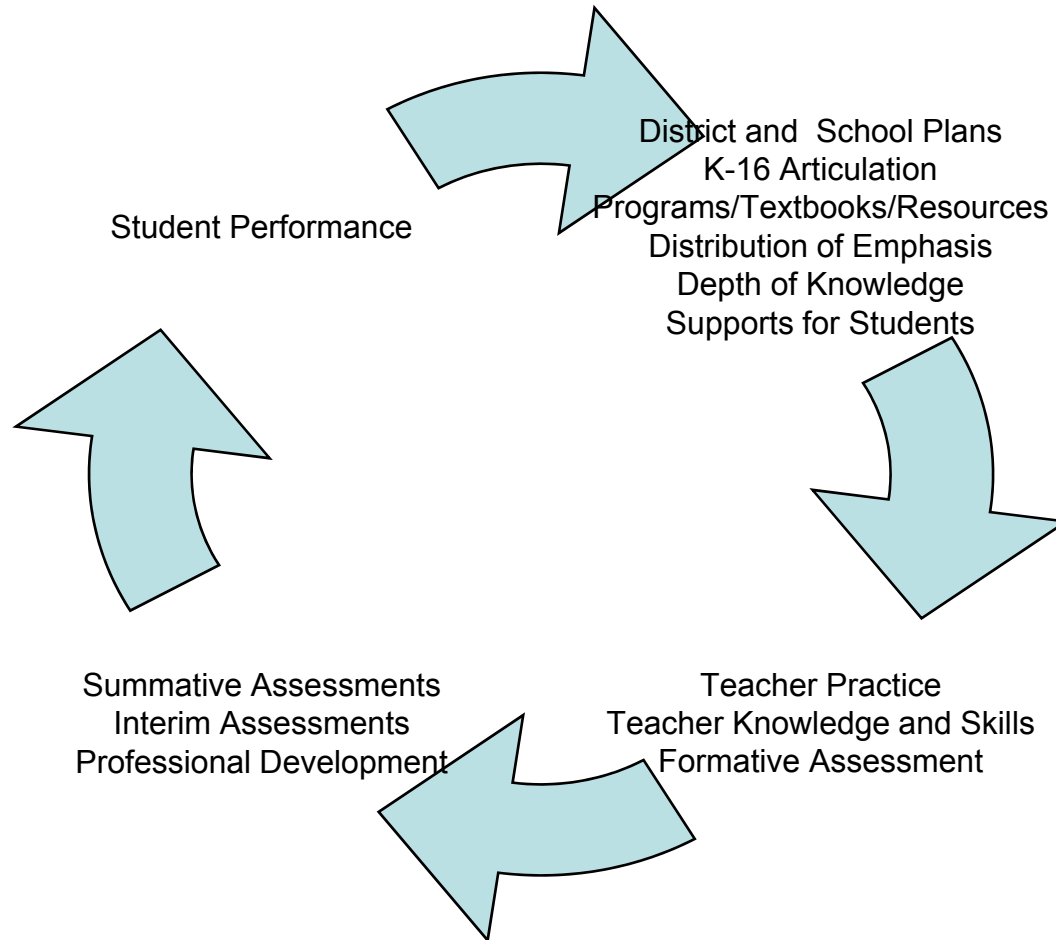
- Differentiate instruction
- Use intensive and supplemental interventions
- Implement extra and co-curricular supports to aid student achievement in mathematics (e.g., tutoring, mentoring, gifted programs)

# Helping All Students Learn

A whole in whose head?

- Make the connect to student knowledge
- Use questions to understand student thinking
- Give specific feedback to enable revisions
- Use different models to illustrate a concept

# Reflective System



# The Work

- Use the 10 Components and identify the degree to which each one is aligned and implemented
- Identify:
  - Accomplishments
  - Areas of concern
  - Target areas of focus
  - Timeline for work and progress

# The Bottom Line...

- Do students have access to learning the mathematics they need?
- Are students learning the mathematics?
- Is our educational system designed to provide the best education possible?
- Are all partners engaged in supporting RI students?



# Changing A Mindset K-16

- Are we educating our students to pass tests?

OR

- Are we educating our students to learn and use concepts and skills to solve problems?



***Rhode Island Department of Elementary and Secondary Education***

