

The Power of Intervention:

There is Something Out There for Math!

High Quality, Differentiated Instruction

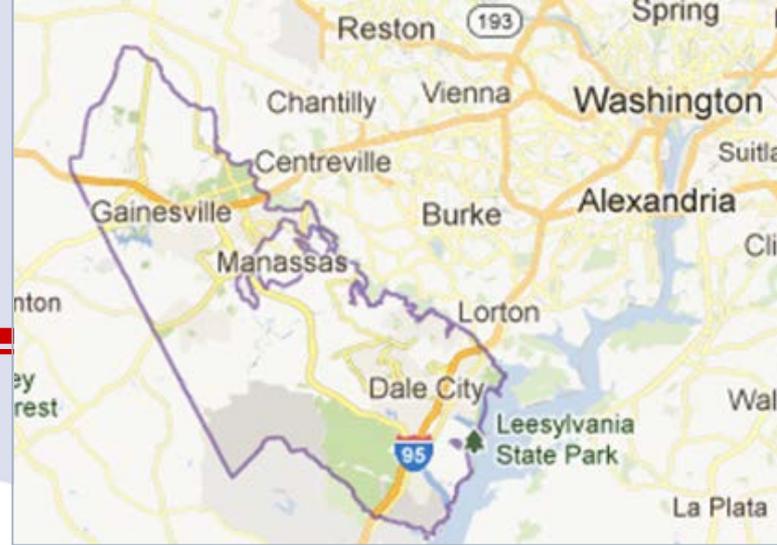


Prince William County
PUBLIC SCHOOLS
Providing A World-Class Education

Donna Stofko
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Who Are We?

- ❑ Located about 30 miles south of Washington D.C.
- ❑ Second largest school district in Virginia
- ❑ Total enrollment – 83,551 students
 - 62 Elementary, 15 middle, 11 high
- ❑ 16.2% ESOL
- ❑ 11.14% Special Education
- ❑ 35.88% Economically Disadvantaged



Outcomes for Today

- Understand what current research is saying regarding interventions for mathematics.
- Understand ways in which some intervention can occur during core instructional time, i.e. tier 1.
- Become familiar with resources we are using in Prince William County to support our intervention programs.



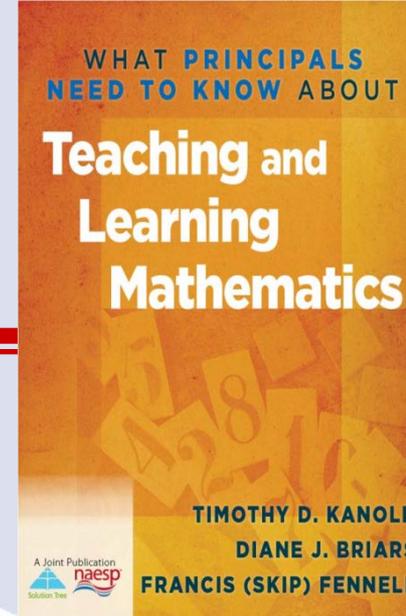
Three Components of High Quality Math Instruction

“Teaching for **conceptual understanding**, developing children’s **procedural fluency**, and promoting **strategic competence** through meaningful problem-solving investigations.”

Shellard, E. and P. S. Moyer. *What Principals Need to Know about Teaching Math*. Alexandria, Va.: National Association of Elementary School Principals and Educational Research Service, 2002.

Research-Informed Instructional Strategies

1. Active engagement
2. Solving challenging problems
3. Connecting ideas, concepts and skills
4. Communicating mathematically
5. Engaging students' prior knowledge
6. Using ongoing, distributed practice with appropriate, timely feedback
7. Using appropriate tools strategically
8. Promoting students positive self-beliefs



The Virginia Standards of Learning

Content Standards

- Number and Number Sense
- Computation and Estimation
- Geometry and Measurement
- Statistics and Probability
- Patterns, Functions, and Algebra



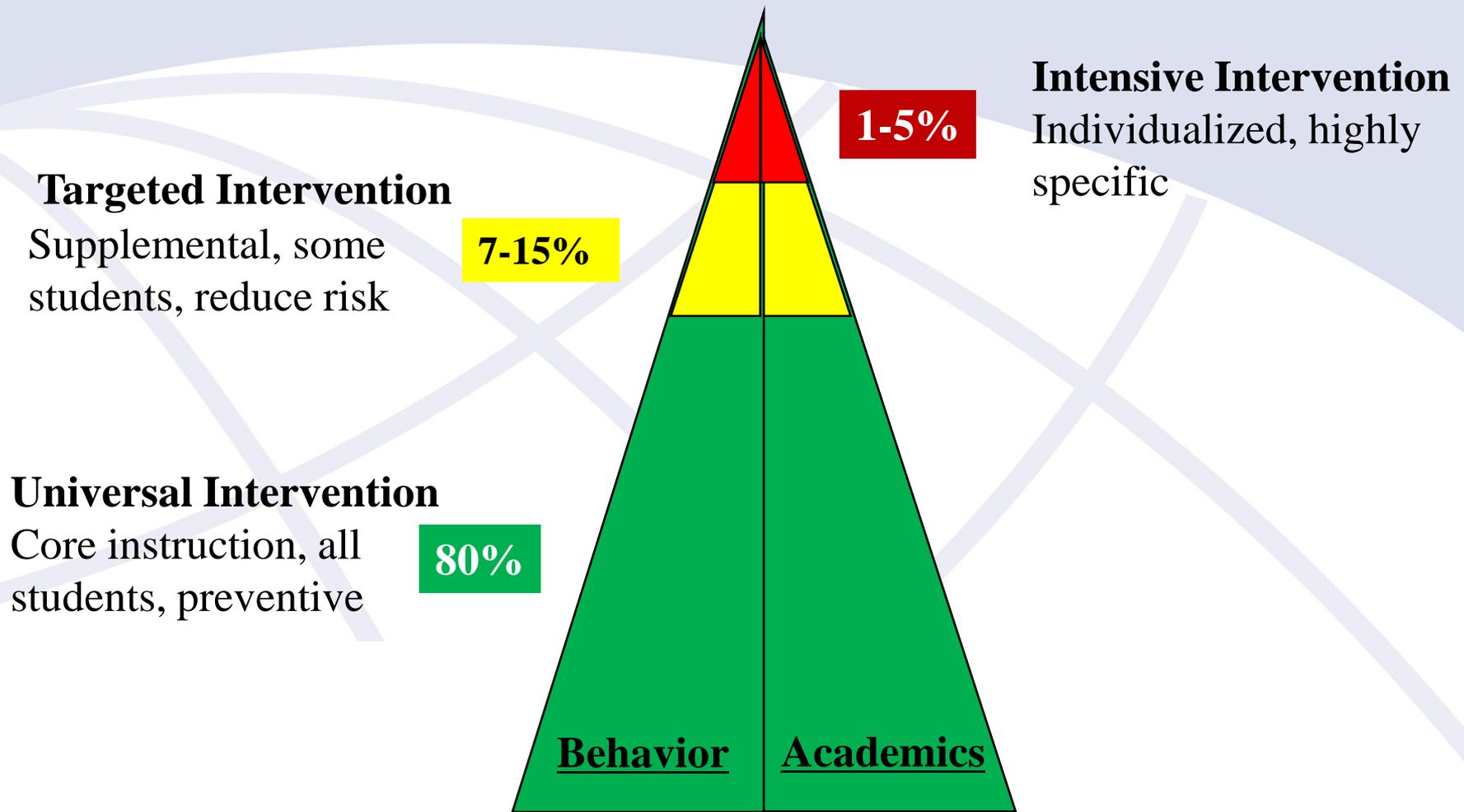
Process Standards

- Problem Solving
- Reasoning and Proof
- Communication
- Connections
- Representation

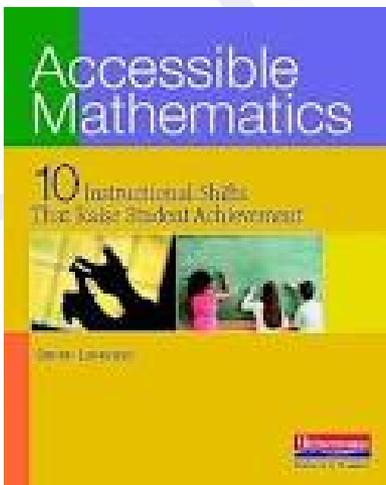
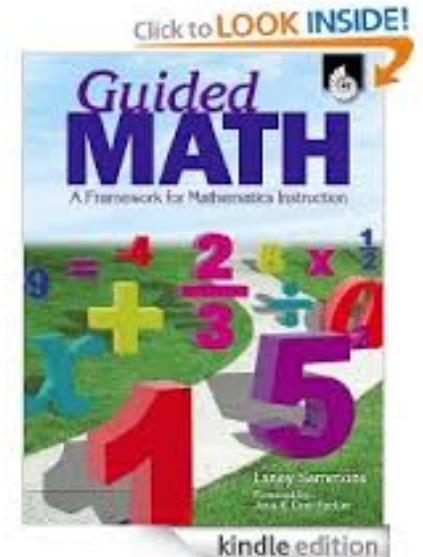
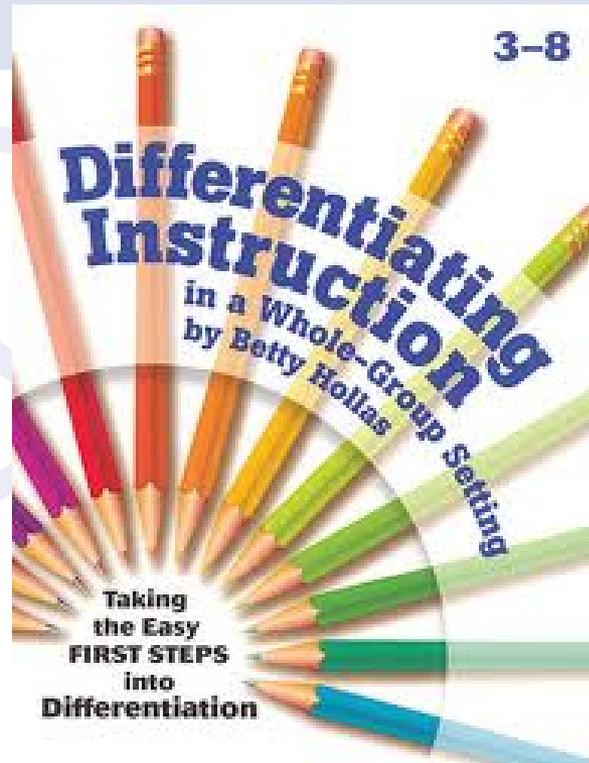
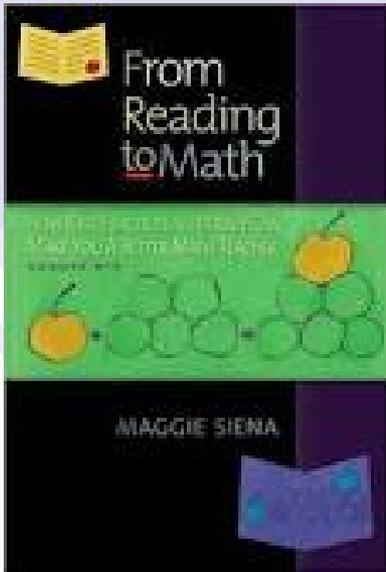
“A major goal of the mathematics program is to help students become competent mathematical problem solvers.”

VDOE, 2009

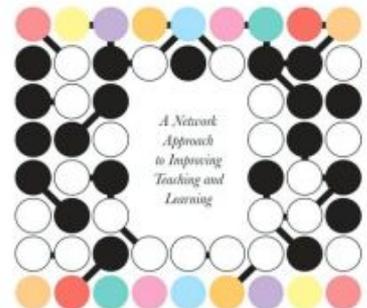
Response to Intervention (RtI) Model



Structuring the Math Block for Differentiated Instruction



INSTRUCTIONAL ROUNDS in EDUCATION



Elizabeth A. City, Richard F. Elmore, Sarah E. Fiarman, and Lee Teitel

With a foreword by Andrew Lachman

What Does “Differentiated Instruction” Mean?

Differentiated instruction means that teachers proactively plan **varied approaches** to **what** students need to learn, **how** they will learn it, and/or **how they will show** what they have learned in order to increase the likelihood that each student will learn as much as he or she can, as efficiently as possible (Tomlinson, 2003).

Content

Process

Product

Students can (and should) work in a variety of arrangements ...

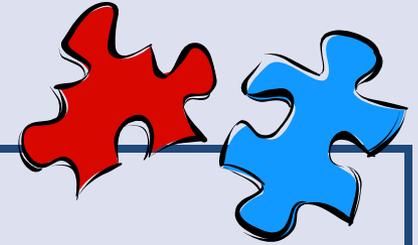
- **in small groups** with students of **similar** (or **different**) readiness, interest, or learning profile,
- **with a partner** of **similar** (or **different**) readiness, interest, or learning profile
- **individually**
- as a **whole class**

Note: Grouping assignments may be selected by the teacher, by the student, or randomly.





The Math Block

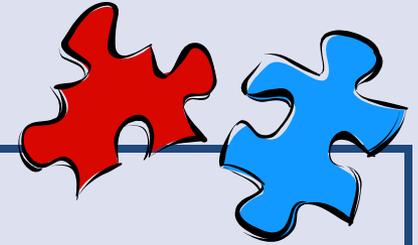


One Way....

Warm up	15 Min / day Review previously learned content
Math Lesson	50 Min / day Includes whole group and small group and/or partner work
Whole Group Discussion	10 Min / day Share strategies, bring to closure



The Math Block

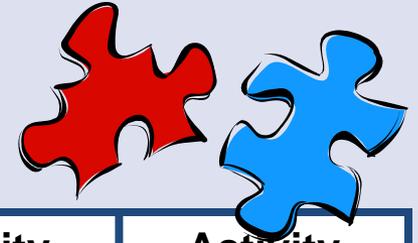


Another Way....

Warm up	10 Min / day Review previously learned content
Math Lesson	35 Min / day Includes whole group and small group or partner work
Flexible & Targeted	30 Min / day Review, Reteach, Extend (small groups)



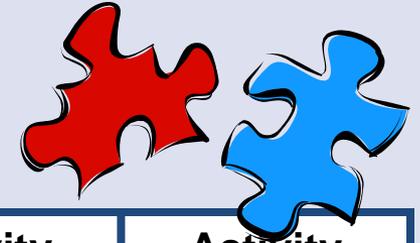
Math Block with Small Groups One Way....



Warm Ups 10'	Introduce 10-15'	Activity Teacher 12 – 15'	Activity Station 12 – 15'	Activity Station 12 – 15'	Activity Station 12 – 15'
<p style="font-size: 2em; color: red; margin: 0;">A</p> <p style="font-size: 2em; color: red; margin: 0;">L</p> <p style="font-size: 2em; color: red; margin: 0;">L</p>	<p style="font-size: 1.5em; color: purple; margin: 0;">1st Rotation</p> <p style="font-size: 2em; color: purple; margin: 0;">A</p>	<p style="font-size: 2em; color: blue; margin: 0;">A</p>	<p style="font-size: 2em; color: black; margin: 0;">D</p>	<p style="font-size: 2em; color: green; margin: 0;">C</p>	<p style="font-size: 2em; color: blue; margin: 0;">B</p>
	<p style="font-size: 1.5em; color: purple; margin: 0;">2nd Rotation</p> <p style="font-size: 2em; color: purple; margin: 0;">L</p>	<p style="font-size: 2em; color: blue; margin: 0;">B</p>	<p style="font-size: 2em; color: blue; margin: 0;">A</p>	<p style="font-size: 2em; color: black; margin: 0;">D</p>	<p style="font-size: 2em; color: green; margin: 0;">C</p>
	<p style="font-size: 1.5em; color: purple; margin: 0;">3rd Rotation</p> <p style="font-size: 2em; color: purple; margin: 0;">L</p>	<p style="font-size: 2em; color: green; margin: 0;">C</p>	<p style="font-size: 2em; color: blue; margin: 0;">B</p>	<p style="font-size: 2em; color: blue; margin: 0;">A</p>	<p style="font-size: 2em; color: black; margin: 0;">D</p>
	<p style="font-size: 1.5em; color: purple; margin: 0;">4th Rotation</p> <p style="font-size: 2em; color: purple; margin: 0;">L</p>	<p style="font-size: 2em; color: black; margin: 0;">D</p>	<p style="font-size: 2em; color: green; margin: 0;">C</p>	<p style="font-size: 2em; color: blue; margin: 0;">B</p>	<p style="font-size: 2em; color: blue; margin: 0;">A</p>



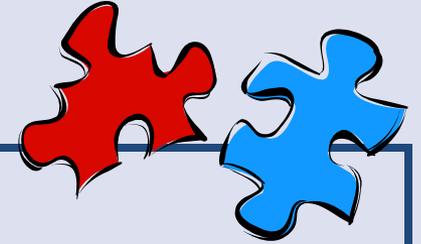
Math Block with Small Groups One Way....



Warm Ups 10'	Introduce 10-15'	Activity Station 12 – 15'			
<p>A</p> <p>L</p> <p>L</p>	<p>1st Rotation</p> <p>A</p>	A	D	C	B
	<p>2nd Rotation</p> <p>L</p>	B	A	D	C
	<p>3rd Rotation</p> <p>L</p>	C	B	A	D
	<p>4th Rotation</p> <p>L</p>	D	C	B	A



The Math Block



Another Way....

**Warm
up**

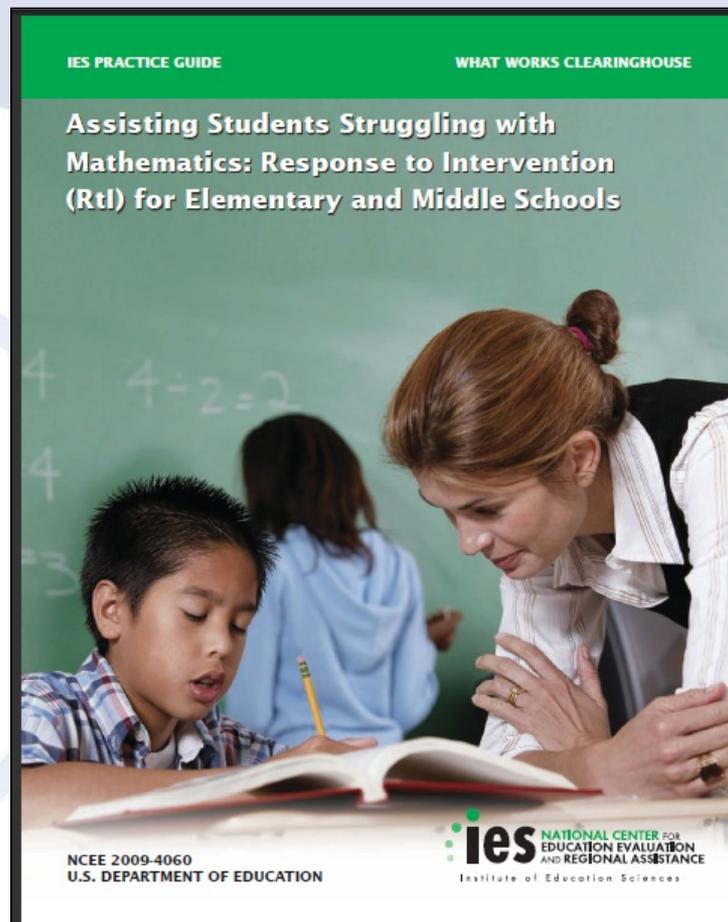
10 Min / day

Review previously learned content.

Your Thoughts?

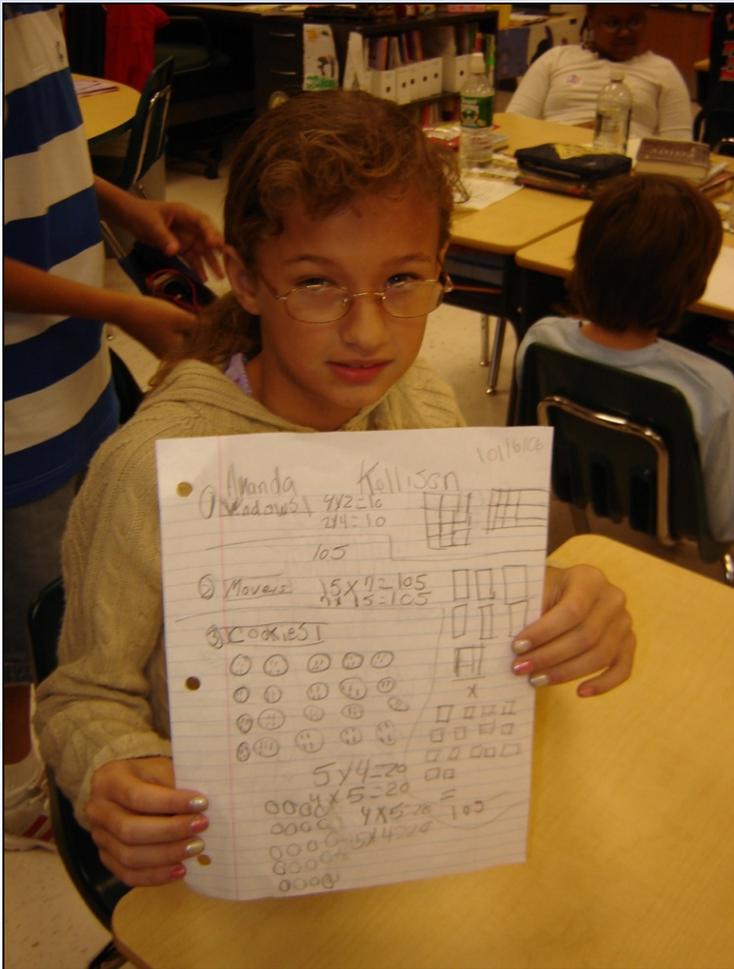
Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools

Eight recommendations for using Response to Intervention (RtI) to identify students who need assistance in mathematics and to address the needs of these students through focused interventions.



Click image to download this guide.

Recommendation



Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk.

Some Screening Options in PWCS

Grades K-2

Assessing Math Concepts (D, U, P)

Gr. 2 End-of-Unit CFA (P)

AIMSweb (U, P)

Easy CBM or Dibbles (P)

Math Recovery assessments (D)

Grades 3-5

SOL test from previous year (U)

Math Navigator (U)

End-of-Unit CFA (P)

AIMSweb (U, P)

Easy CBM or Dibbles (P)

PWCS Math Intervention assessments (D)

Grades 6-9

SOL test from previous year (U)

Algebra Readiness Diagnostic
Test (U, D, P)

Unit and Benchmark Tests (P)

Iowa Algebra Aptitude Test (D)

Mathematics Reasoning Inventory (D)



U – Universal Screening

P – Progress Monitoring

D – Diagnostic

Error Analysis

Analyzing Student Work (Joey)

$$\begin{array}{r} 2 \\ 27 \\ \times 4 \\ \hline 168 \end{array}$$

$$\begin{array}{r} 2 \\ 34 \\ \times 6 \\ \hline 304 \end{array}$$

$$\begin{array}{r} 3 \\ 45 \\ \times 7 \\ \hline 495 \end{array}$$

What is Joey's misconception?

What intervention strategies could be used to help Joey with this concept?



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27

x 4

Another strategy....

$$4 \times 20 = 80$$

$$4 \times 7 = 28$$

$$80 + 28 = 108$$

Or...

$$4 \times 25 = 100$$

$$4 \times 2 = 8$$

$$100 + 8 = 108$$



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Diagnostic Assessments: Interviews (usually one-on-one)

- ❑ Evidence of **prior knowledge, understandings** and **ways of thinking**
- ❑ Students **verbalize their thinking** and/or demonstrate their ideas
- ❑ Teacher uses errors to **identify barriers** of understanding and to **inform instructional decisions**



Meet Cena



- Cena is 7 $\frac{1}{2}$ years old and in the second grade.
- Observe her in a whole group setting and in a small group setting with an eye on her understanding of place value.



1 ten = 10 ones

Circle groups of tens.
Write how many tens and ones.



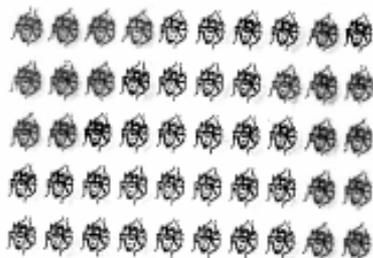
2 tens = 20 ones



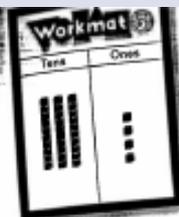
_____ tens = _____ ones



_____ tens = _____ ones



_____ tens = _____ ones



1 ten = 10 ones

is the same as



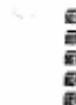
3 tens 4 ones = 34



Use Workmat 3 and .
Write how many tens and ones.
Then write the number.



2 tens 7 ones = 27



_____ tens _____ ones = _____



_____ tens _____ ones = _____



_____ tens _____ ones = _____



_____ tens _____ ones = _____



_____ tens _____ ones = _____

Talk About It - Critical Thinking

How many ones are there in a group of ten?
How can you tell?

Recommendation

Instructional materials for students receiving interventions should focus intensely on in-depth treatment of **whole numbers** in kindergarten through grade 5 and on **rational numbers** in grades 4 through 8.



Recommendation

Interventions should include instruction on solving word problems that is based on common underlying structures.



Part-Part-Whole Problem Structure

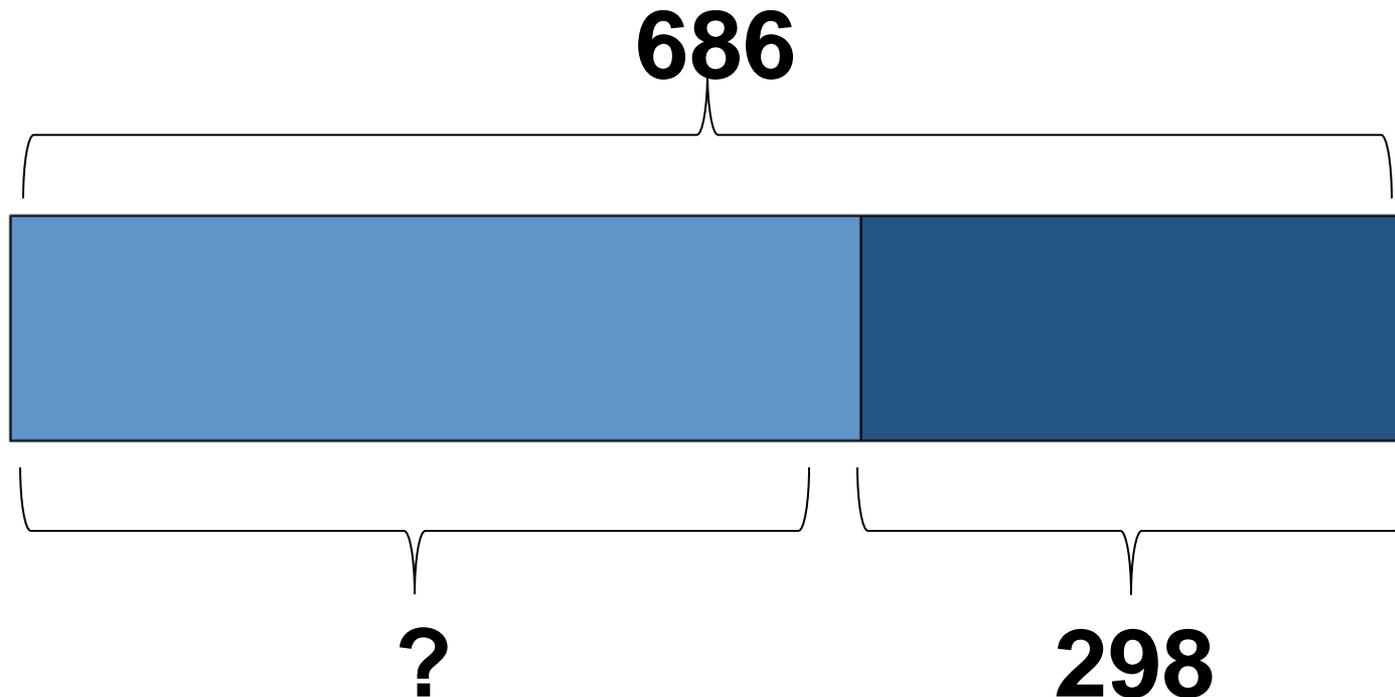


Lynette has 4 fiction and 3 nonfiction books. How many books does she have?



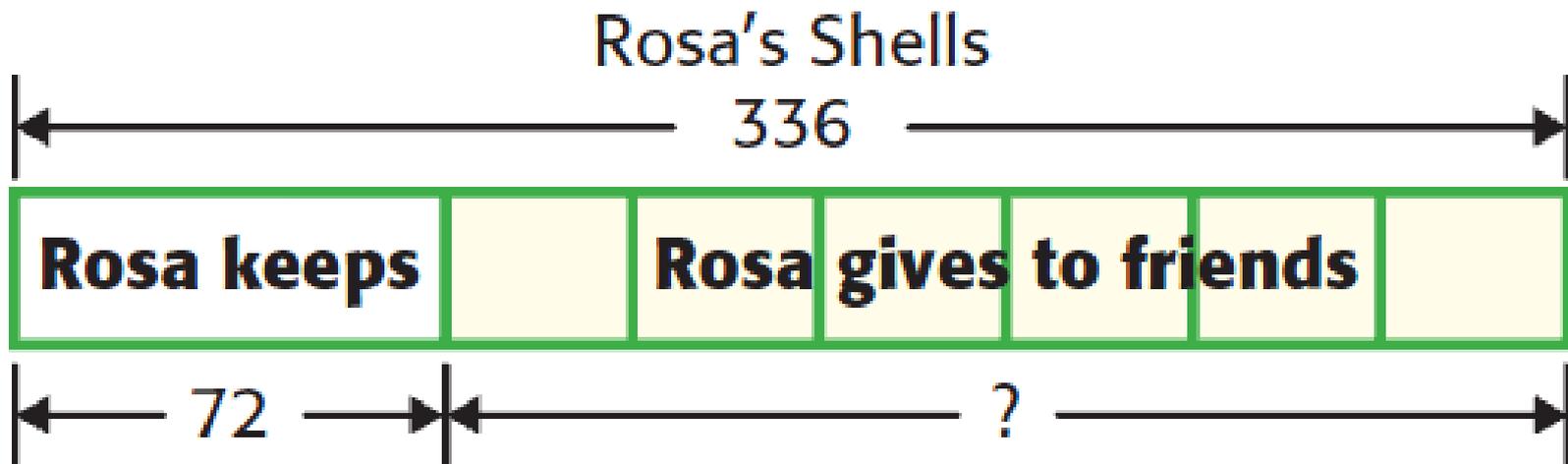
Singapore Bar Models

Mary made 686 biscuits. She sold some of them. If 298 were left over, how many biscuits did she sell?



Rosa has 336 shells. She keeps 72 of the shells for herself and divides the remaining shells evenly among 6 friends. How many shells does Rosa give each of her friends?

Multi-Step





Why use these structures?

Key word strategies don't work.

- No development of meaning-making
- No building of structures for more advanced learning (decimals, fractions, algebra)
- Many problems do not have key words
- Students use key words inappropriately
- Multi-step problems are **impossible** to solve with key words.



Meet Marissa

School Bus Problem:

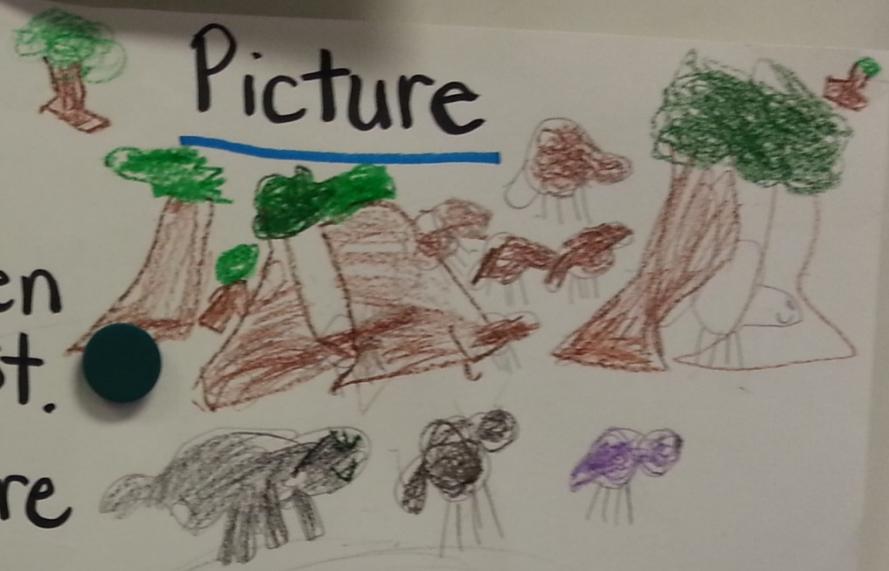
There are 295 students. School buses hold 25 students. How many buses are needed for all of the students?



Story Problem

9 dogs were lost in the forest. Then 1 more dog got lost. How many dogs are lost?

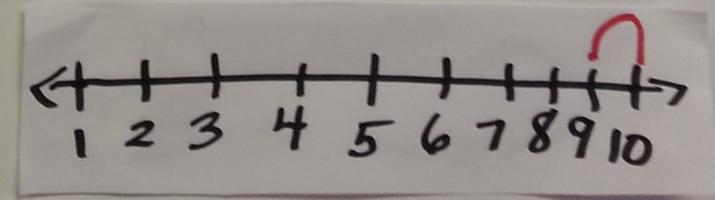
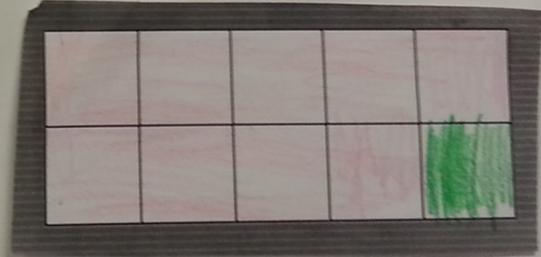
Picture



Equation

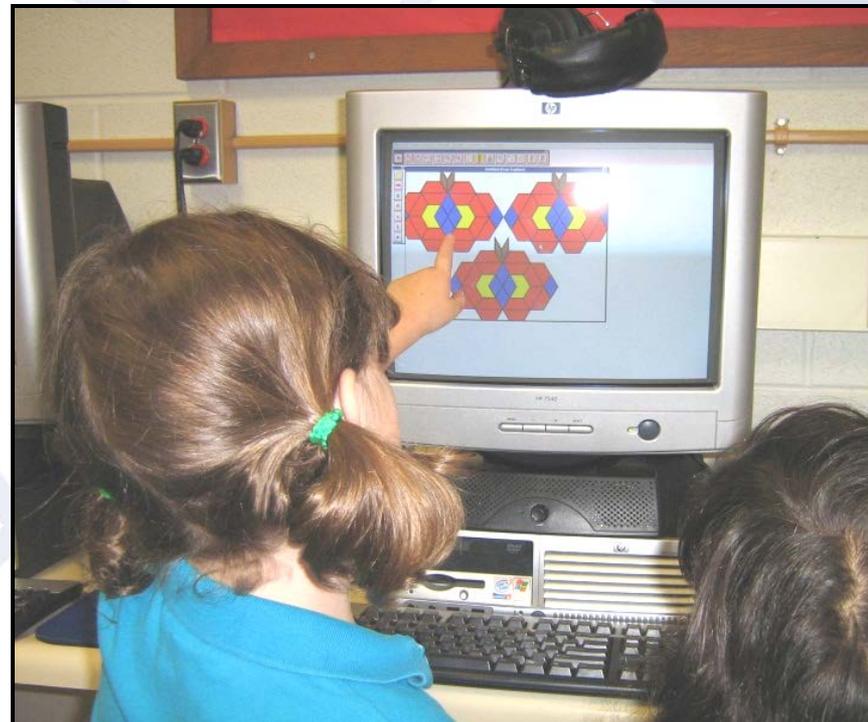
$9 + 1 = 10$

Show another way!

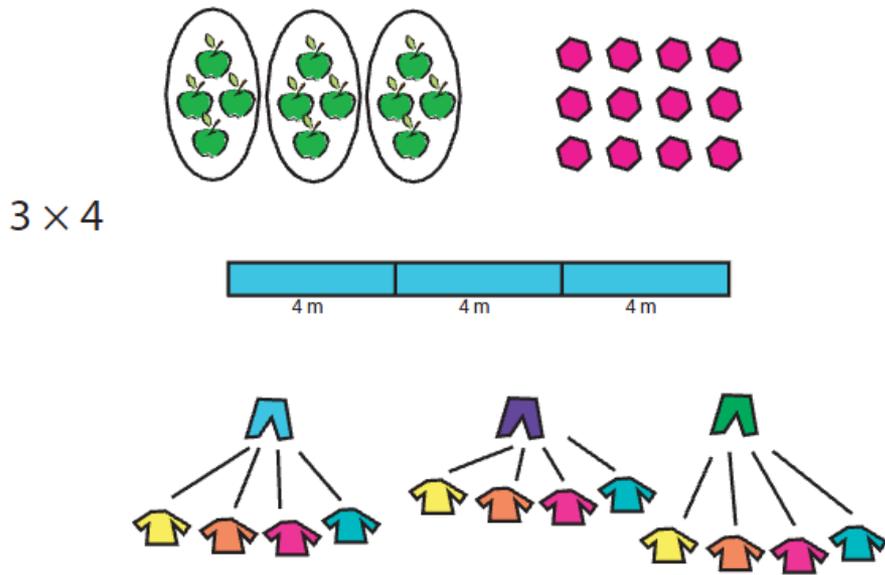


Recommendation

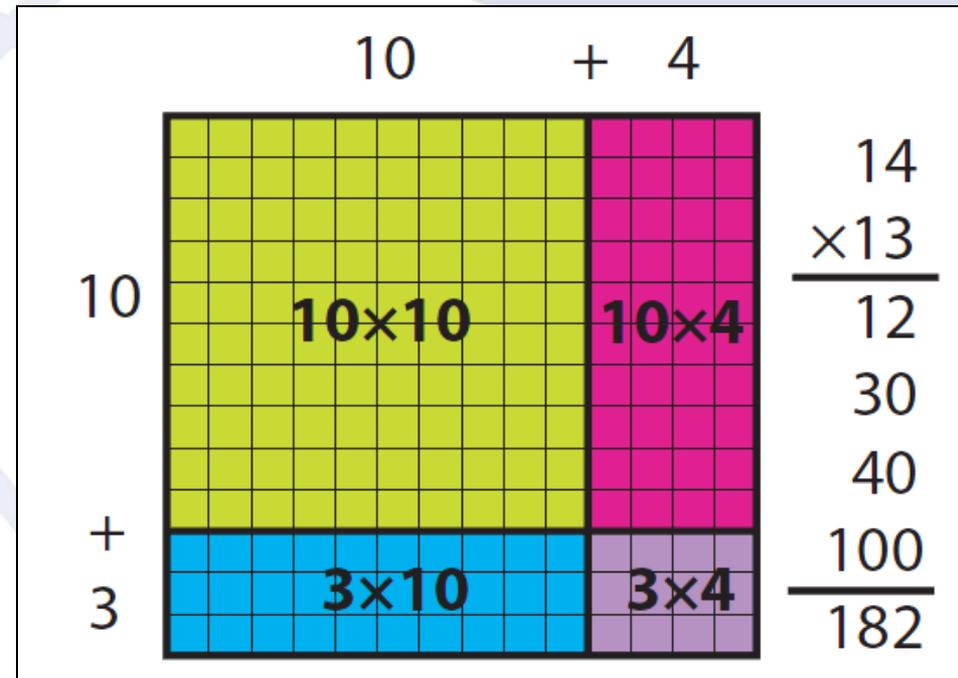
Intervention materials should include opportunities for students to work with **visual representations** of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.



Visual Representations

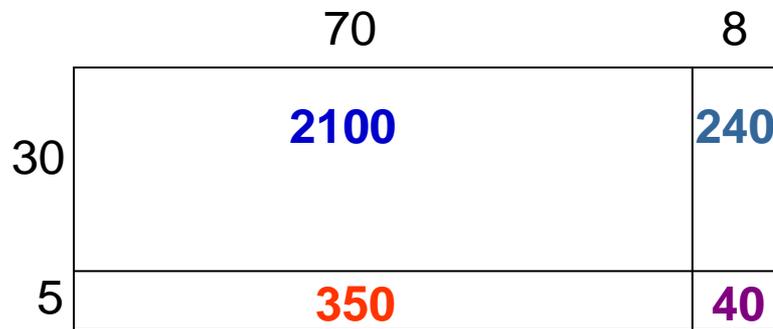


$$13 \times 14 = 182$$



Visual Representations that Connect to Related Concepts

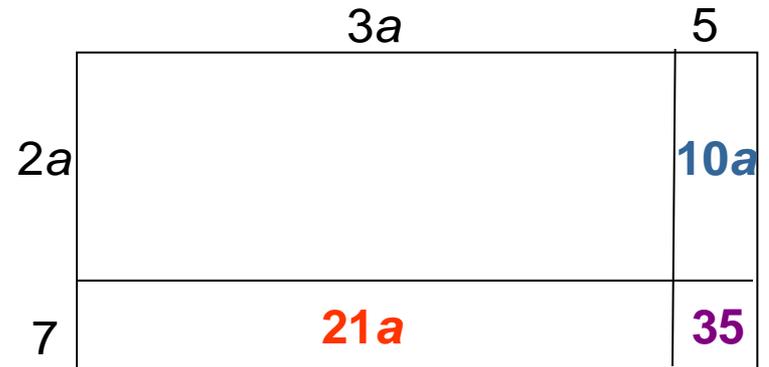
Area Model - Open Array
(4th grade)



$$(70 + 8)(30 + 5)$$

$$2100 + 350 + 240 + 40 = 2,730$$

Area Model - Open Array
(Algebra I - binomials)

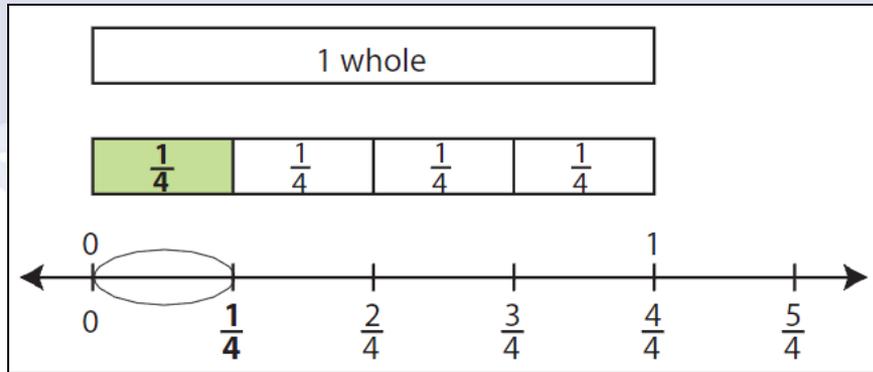


$$(3a + 5)(2a + 7)$$

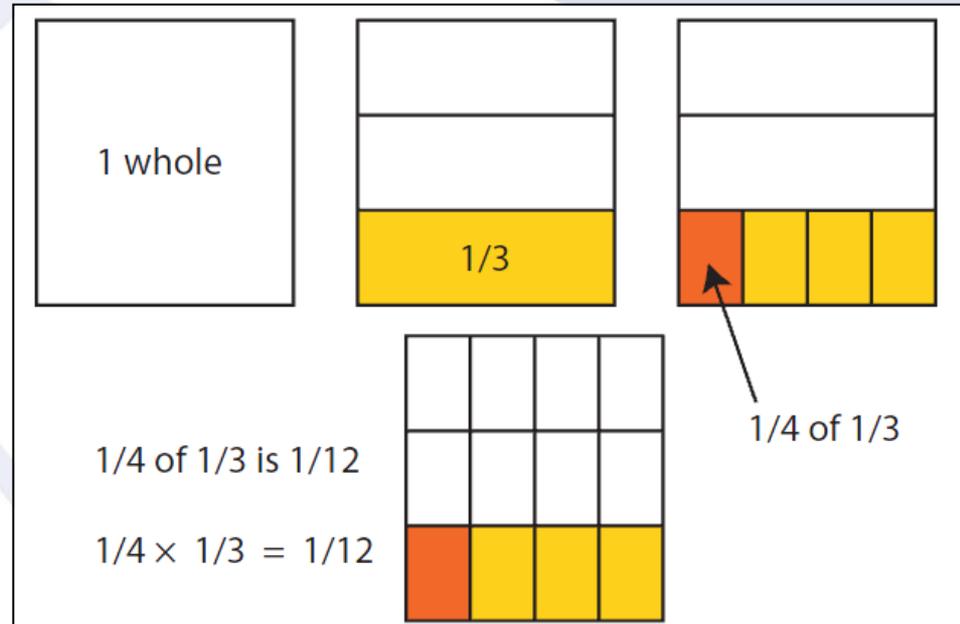
$$6a^2 + 21a + 10a + 35$$

$$6a^2 + 31a + 35$$

Visual Representations



$$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

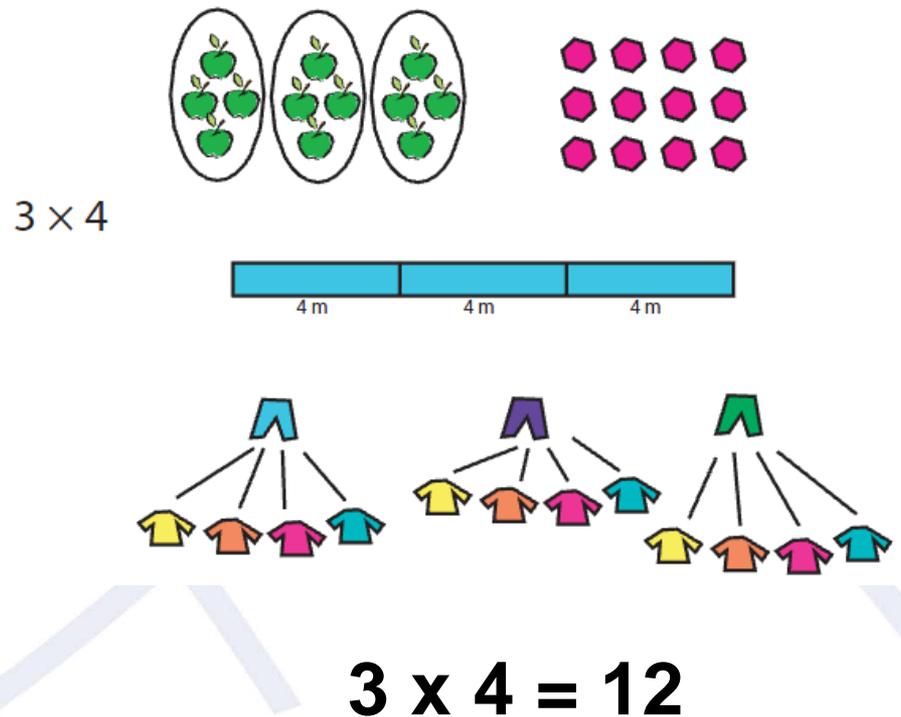
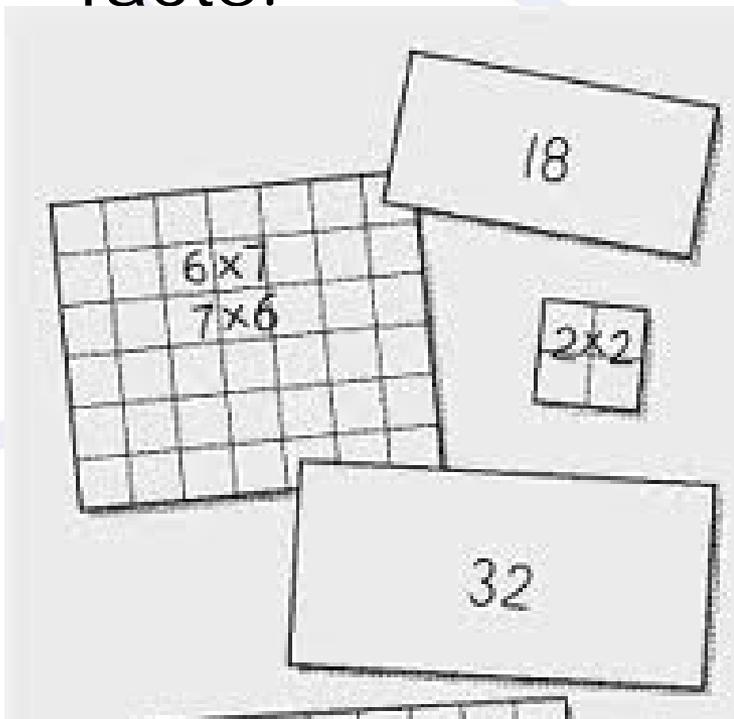


What fraction
of the balloons
are yellow?



Recommendation

Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.



Box of Facts by Origo



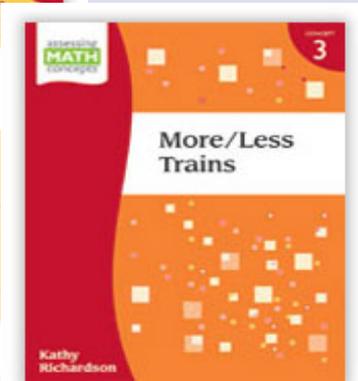
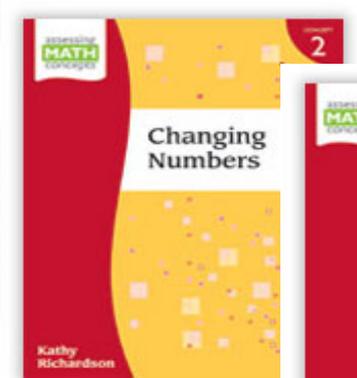
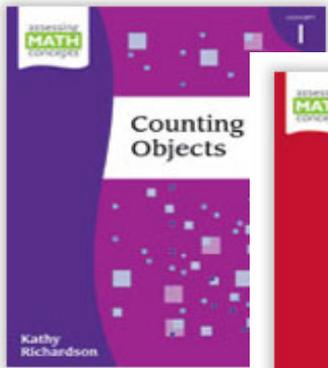
Addition/
Subtraction



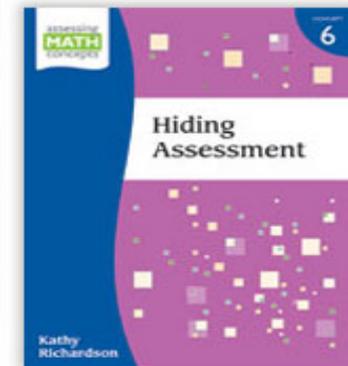
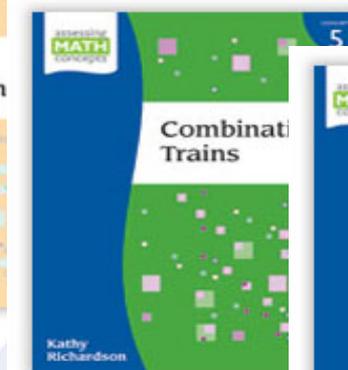
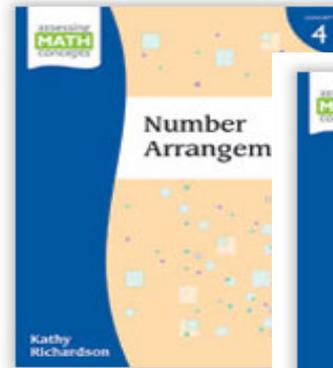
Multiplication/
Division



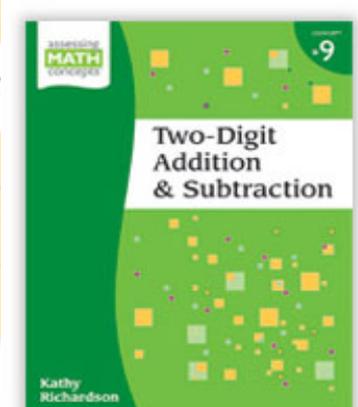
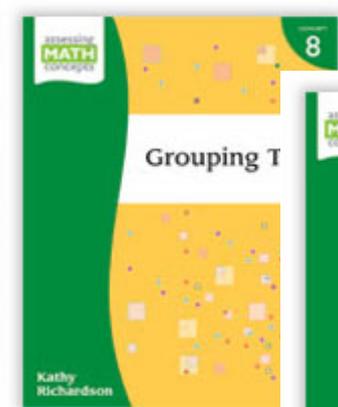
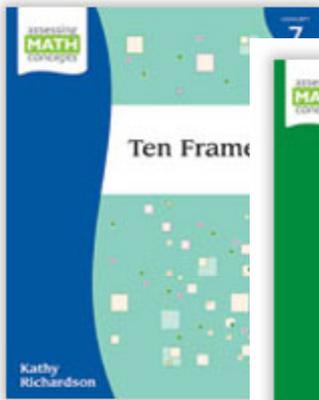
Counting/Number Relationships



Number Composition & Decomposition



Place Value/Numbers as Tens & Ones



The assessments are the beginning, not the end.

The information you get tells you what you need to do for your students.

What you learn can truly guide your instruction.

AMC Anywhere™ - Class Instruction Report

Grouping Tens

Teacher: I

Date Range: 08/01/2012 - 04/03/2013

Grouping Tens				
Student	Date	Decomposing Tens and Ones to 20	Composing Tens and Ones to 100	Adding and Subtracting Tens
Working on Decomposing Tens and Ones to 20 (5 Students)				
Wilder Jr., Carlos	03/08/2013		N	
Campbell, Deonte R.	03/05/2013		P	A
Whitney, Christopher H.	03/01/2013		P+	I
Thomas, Justin	03/04/2013		A	A
Pinilla, Laura V.	03/05/2013		A	N
Working on Composing Tens and Ones to 100 (6 Students)				
Aguilera, Ariana E.	03/04/2013	A		
Mohamed, Ayanna M.	03/05/2013	A		
Vallejos, Raul X.	03/12/2013	A		
Alvarado-Reyes, Sheila M.	03/05/2013	A		N
Fox, Michael R.	03/05/2013	A		
Soto, Jayda P.	03/08/2013	A		
Working on Adding and Subtracting Tens (5 Students)				
Clark, Paris T.	03/01/2013	A	A	
Flowers, Aaja T.	03/01/2013	A	A	
Osoyo-Osoyo, Mariandre	03/01/2013	A	A	
Duncan, Sidnie M.	03/01/2013	A	A	
Yeboah, Breanna A.	03/04/2013	A	A	
Ready to Apply (5 Students)				
Badu, Erica A.	03/04/2013	A	A	A
Bui, Tim N.	03/01/2013	A	A	A
Castro, David A.	03/01/2013	A	A	A
Panjshiri, Amber S.	03/01/2013	A	A	A
Smith, Evan R.	03/01/2013	A	A	A
Total Students: 21				

Link Assessment to Instruction

Concept 1: Counting Objects Core Topic: Counting

If children need practice:
 Provide activities requiring the children to keep track of quantities in a variety of situations, such as those listed below from *Developing Number Concepts: Book 1*.

NEEDS PRACTICE (P): COUNTING OUT A PARTICULAR QUANTITY				
TEACHER DIRECTED		TO 5	TO 9	TO 18
1: 1-2	Count and Dump	•	•	
1: 1-4	Counting Stories	•	•	•
1: 1-5	Creatives	•	•	•
1: 1-6	Grow and Shrink	•	•	• Use 2 working space papers
INDEPENDENT ACTIVITIES		TO 5	TO 9	TO 18
1: 1-21	Counting Boards, Level 1	1-6	4-9	EXT.
1: 1-25	Roll-a-Tower Race	•	•	•
1: 1-26	Make-a-Train Race	•	•	•

From *Assessing Math Concepts*

1-8 Grow and Shrink* Small-Group Activity

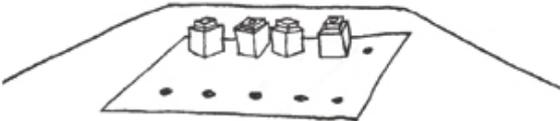
Materials: *Level 1:* Counters • Working-space papers (1 per child) [BLM #1]
Level 2: Same as for Level 1, plus Large dot cube 1-6 (See Materials Preparation, p. 24.)
Level 3: Same as for Level 1, plus Large number cubes 0-5, 1-6, and 4-9 (See Materials Preparation, p. 24.)

Level 1: Counting

This activity appears to be just a simple counting game, but it is one that allows children to begin to see relationships between numbers.

To start the activity, name a number. For example:
Show me four.

The children place that many counters on their working-space papers (one counter on each dot).



Name another number and have children show that number.
Now show me seven.



From *Developing Number Concepts*

AMC is a wonderful tool. The assessments are meaningful, powerful guides that truly delve into having a deeper understanding of our students' math foundations. The one-on-one experience and data collected, allows you to know where to take each individual student.

First Grade Teacher

I use the AMC results as a guide to help me in grouping my students in guided math. AMC helps me to better identify the children that need extra help and where to take the students that “get it”. I have found that the related activities are a good challenge and open up different channels for learning in whole group lessons as well as centers. The AMC assessment gives me a clear picture of where each student is in math and in my opinion makes our math lessons more effective.

Recommendation for Tier 2 (Grades 3-5)



Math Navigator

Highly flexible intervention program that repairs misconceptions and fills critical gaps in students' understanding

Supports English learners and students with special needs

Table 2

Pre- and Post-Test Results for Modules with Matched Students

Note: Matched students were those who took both assessments.

Module	Number of Matched Students	% Correct on Pre-test	% Correct on Post-test	Group % Correct GROWTH
Beginning Place Value	44	56%	81%	25%
Understanding Addition and Subtraction	63	55%	62%	7%
Multiplying Multi-digit Whole Numbers	17	53%	87%	36%
Knowing Fractions	23	33%	45%	12%
Understanding Fractions	30	28%	56%	29%

Table 1

Pre- and Post-Test Results for Modules with Matched Students

Note: Matched students were those who took both assessments.

School	Module	Number of Matched Students	% Correct on Pre-test	% Correct on Post-test	Group % Correct GROWTH
Dale City	Beginning Place Value	6	53%	72%	19%
	Multiplying Multi-digit Whole Numbers	17	53%	87%	36%
Ellis	Understanding Addition and Subtraction	7	58%	72%	14%
Neabsco	Beginning Place Value	12	55%	83%	28%
	Understanding Addition and Subtraction	16	60%	70%	10%



Hylton High School Math Lab



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The greatest danger for most of us is not that we aim too high and we miss it, but we aim too low and reach it.

Michelangelo



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