



# RTI: A Framework for Math

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# Today's Presentation:

## Participants will be able to:

- Discuss the Response to Intervention (RTI) model
- Design and implement instructional interventions specific to computation
- Design and implement progress monitoring strategies
- Develop strategies for communicating student progress with families



# Math Concerns

- Low student achievement
  - According to researchers, 5–8% of the school-age population have some form of mathematical learning problem(Fuchs & Fuchs, 2005; Geary, 2004).
- Inconsistencies
  - Curriculum
  - Instruction
  - Assessment
- Standards



# Possible Solutions

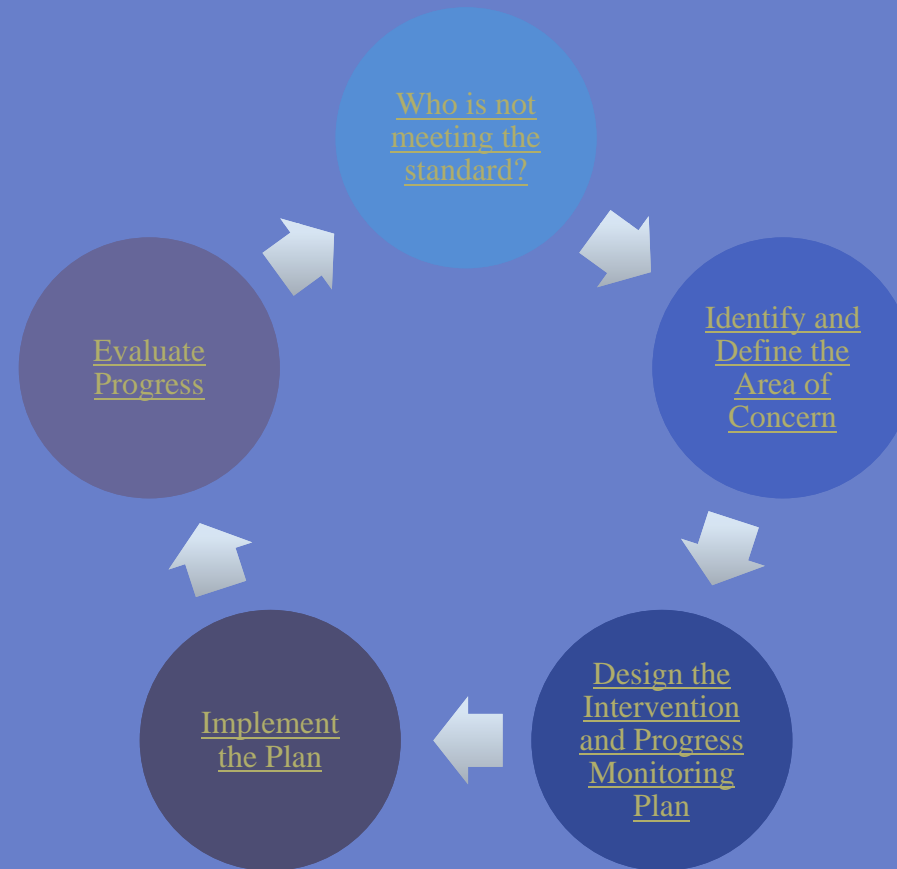
- Educators must use the most efficient problem-solving processes that will lead to the most effective instructional practices.
- Curriculum-based evaluation (CBE), embedded within response to intervention (RTI), is that problem-solving process.



# Response to Intervention (RTI)

- The practice of a) effective teaching based on students' needs and (b) using student data to (c) make instructional decisions.
- Success of RTI depends on effective collaboration between general and special education teachers.
- RTI practices are proactive and effective at all levels from early childhood through high school.

# Reviewing RTI (Problem Solving) Class-wide (School-wide) Decision Making



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# Building Level Blueprints

- Component 3: Implementation
  - Action 2: Implement logistics of assessments
    - School-wide assessment plans
      - Assessment calendar
      - Schedule, Support
    - Consistent standards and competencies
      - Research (Stein et. al. 2006)
      - NCTM (www.nctm.org )
      - OSPI
    - Assessment data system (www.aimsweb.com )
    - Valid and reliable assessment tools

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Problem  
solving  
process



# Identify and Define the Area of Concern

- Identify the specific math area
  - Computation
    - Addition, subtraction, multiplication, division
  - Application
    - Measurement, geometry, algebra
  - Problem solving
- Determine the specific skill deficit
  - Conceptual, declarative, strategic knowledge



# Building Level Blueprints

- Component 3: Implementation
  - Action 3: Implement logistics core, supplemental, and intensive instruction
    - Ensure that core curriculum and instruction is responsive to classroom/school diversity
    - Implement supplemental and intensive instruction that is based on student need
    - Implement *efficient* interventions
    - Teach for generalization



# Design Intervention/Instruction Plans

- Intervention/instruction plan includes:
  - Measureable objective
  - Effective teaching components
- Plan remediates skill deficit
- Intervention is research based



# Sample Teaching Objectives

- Given 10 two-digit subtraction problems, 5 requiring trading and 5 that do not require trading, S. will identify 5/5 problems that need trading on two separate occasions.
- Given 10 two-digit subtraction problems, S. will correctly demonstrate trading in ones and tens column in 10/10 problems using a strategy card on two separate occasions.
- Given 10 two-digit subtraction problems, S. will correctly solve 10/10 problems using a strategy card on two separate occasions.



# Effective Teaching Components

- Preskills
- Clear, measureable objective
- Engaging lesson opening
- Explicit instruction
- Clear, consistent vocabulary
- Visual supports
- Active participation
- Practice opportunities



# List of Preskills

- Math skills
  - Math facts, number sense
- Study skills
  - Organization, memorization
- Language skills
  - Ask questions, vocabulary, pragmatics, “explain your thinking”

(one may need to teach these preskills prior to teaching the targeted math skill)



# Vocabulary

- Vocabulary pre-teaching (if needed)
- Consistent
- Long term applicability
- Visual supports

# Sample Visual Support

## SLIP STRIP

### 2-digit numbers

Look at **ONES** column

Read the problem

Repeat rule

*Write rule here*

Do I need to trade?

Yes – trade

Trade 1 ten for 10 ones

Cross out 1 ten in tens  
column

Add 10 ones in ones column

OR

No

Subtract ones

Write/record answer

Subtract tens

Write/record answer

Check work



# Active Participation

- Frequent
  - Throughout lesson (not just at beginning)
  - Many opportunities for all students
- Varied
  - More than “thumbs up if...”
- Appropriate
  - Student
  - Lesson

# *Smartboard*

- Technology that provides opportunities for students with diverse learning needs



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Effective  
Teaching  
Components



# Practice Opportunities

- Multiple practice opportunities
- Guided practice
- Practice specific to skill taught
- Practice of reviewed skills



# Other Considerations

- Time delay/pacing
- Self monitoring
- Manipulatives ([Miller, S. P. et. al., 1998](#)).
- Diversity Responsive Teaching
  - GLAD training (<http://www.projectglad.com/>)
  - SIOP model (<http://www.siopinstitute.net/>)
  - Price & Nelson text (2007)



# Progress Monitoring Plans

- Progress monitoring includes:
  - Easy administration
  - Sensitive and frequent measures
  - Valid and reliable measures
- Matches instructional objective
- Correlates to standards



# Progress Monitoring Tools

- CBM
  - “...a quick and reliable method for gathering information about student performance...”  
(Kelley, Hosp, Howell, 2008)
- Resources
  - Aimsweb
  - [www.interventioncentral.org](http://www.interventioncentral.org)
- Examples

# Progress Monitoring Examples

$$\begin{array}{r} 56 \\ -39 \\ \hline \end{array}$$

$$\begin{array}{r} 43 \\ -17 \\ \hline \end{array}$$

$$\begin{array}{r} 83 \\ -46 \\ \hline \end{array}$$

$$\begin{array}{r} 92 \\ -28 \\ \hline \end{array}$$

$$\begin{array}{r} 74 \\ -65 \\ \hline \end{array}$$

$$\begin{array}{r} 61 \\ -35 \\ \hline \end{array}$$

$$\begin{array}{r} 31 \\ -14 \\ \hline \end{array}$$

$$\begin{array}{r} 52 \\ -47 \\ \hline \end{array}$$

$$\begin{array}{r} 28 \\ -19 \\ \hline \end{array}$$

$$\begin{array}{r} 63 \\ -48 \\ \hline \end{array}$$

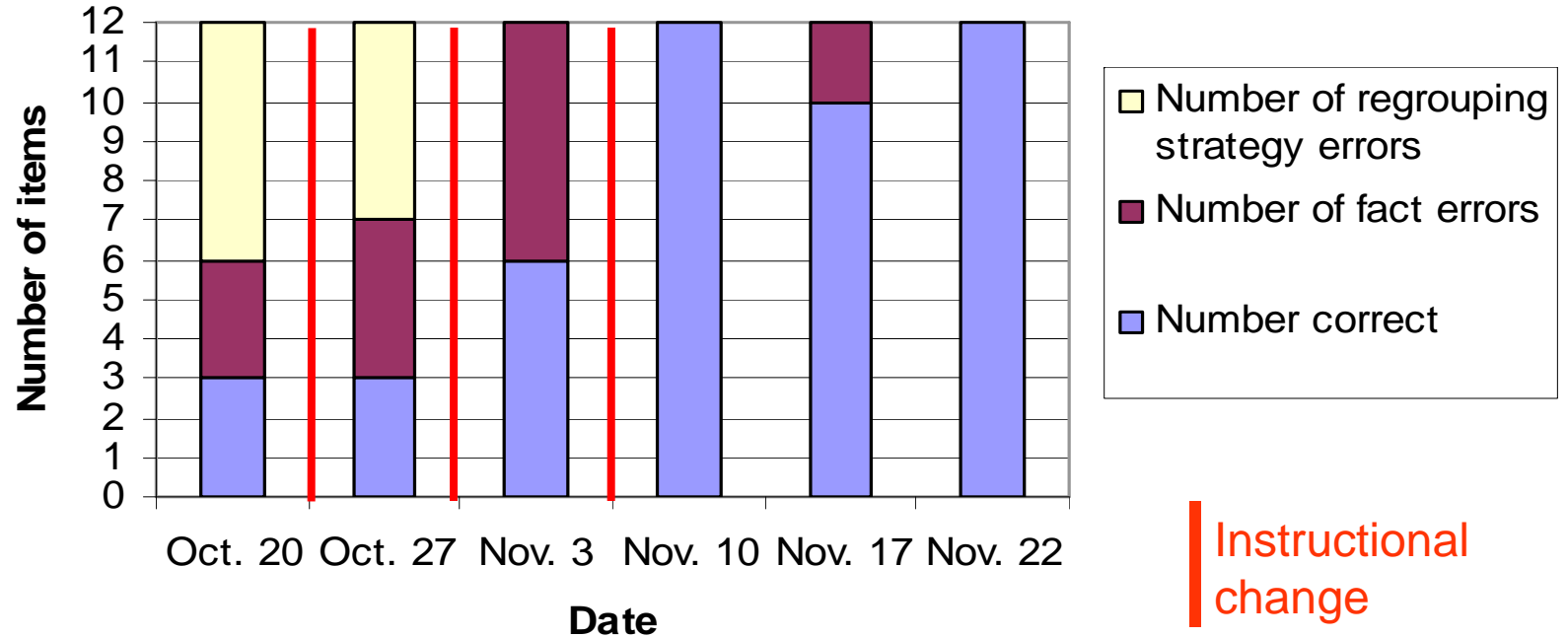
$$\begin{array}{r} 95 \\ -27 \\ \hline \end{array}$$

$$\begin{array}{r} 81 \\ -49 \\ \hline \end{array}$$

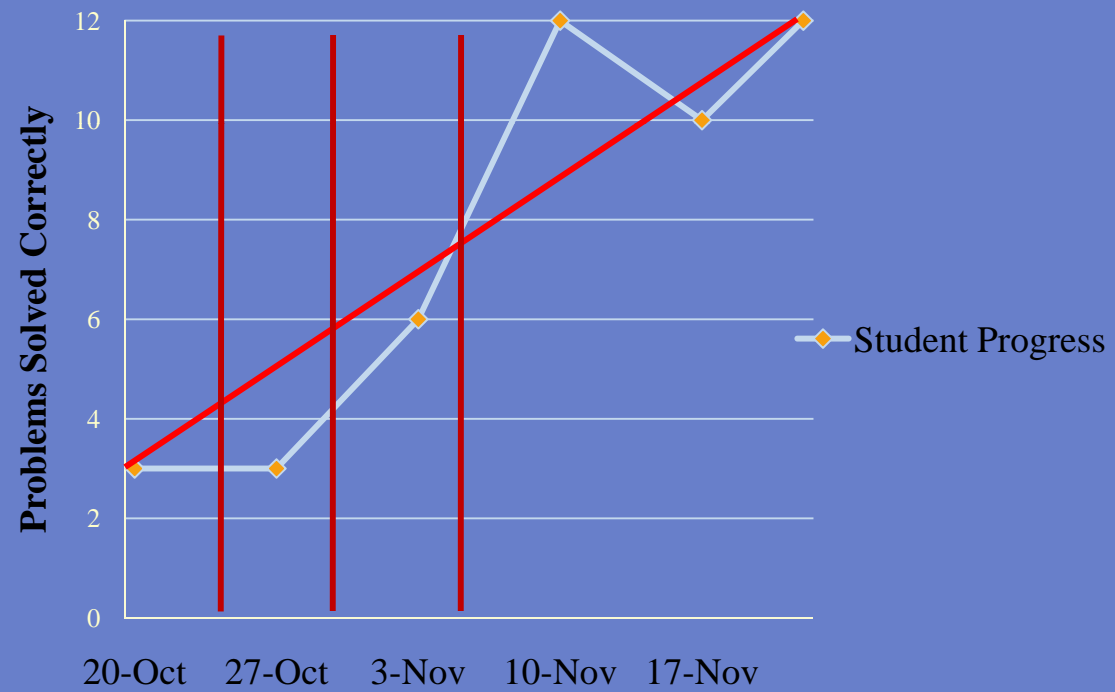
2 digit subtraction with trading

# Progress Monitoring

## Regrouping Progress Chart



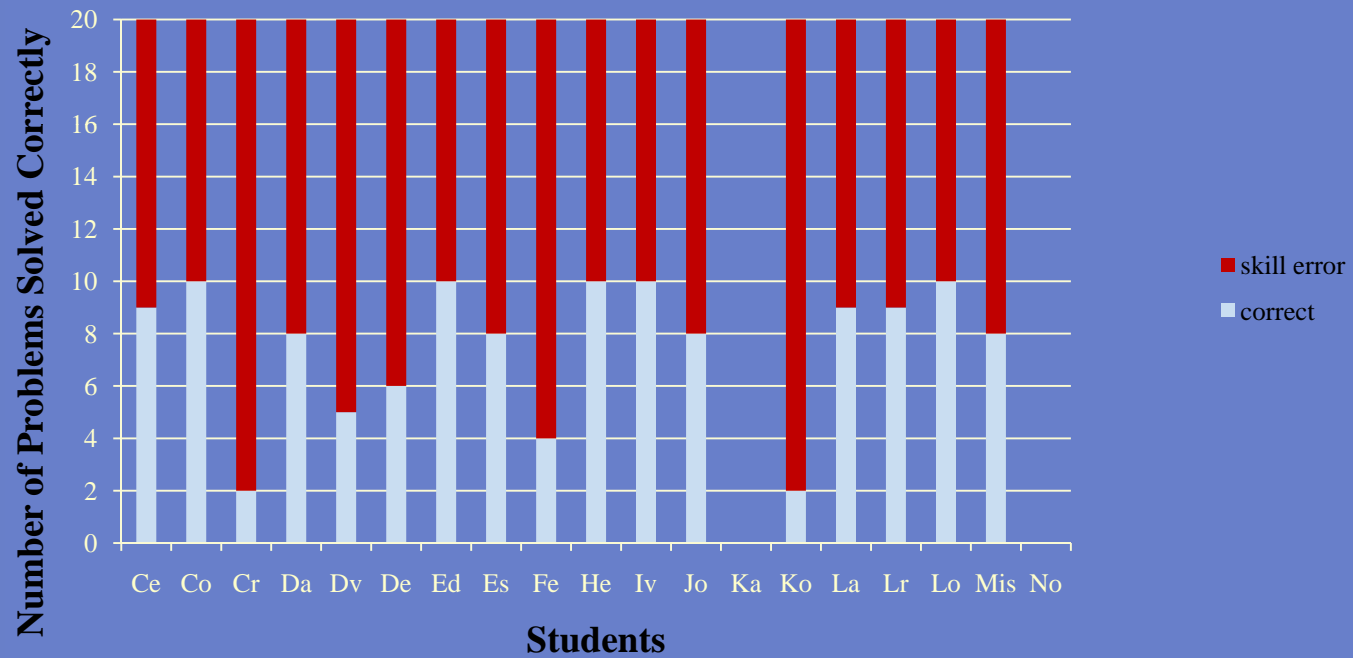
## Student Progress



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# Classroom Data

## Pre-test for Subtraction with Regrouping

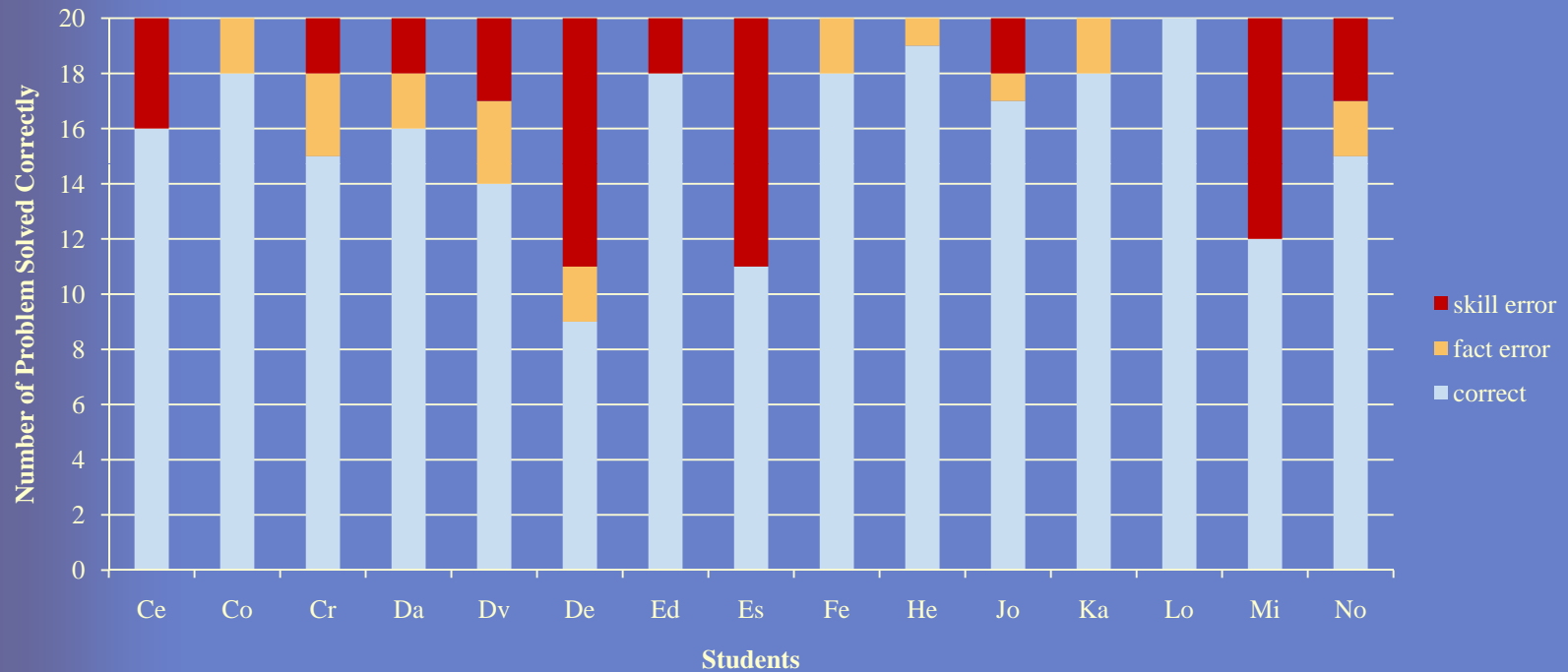


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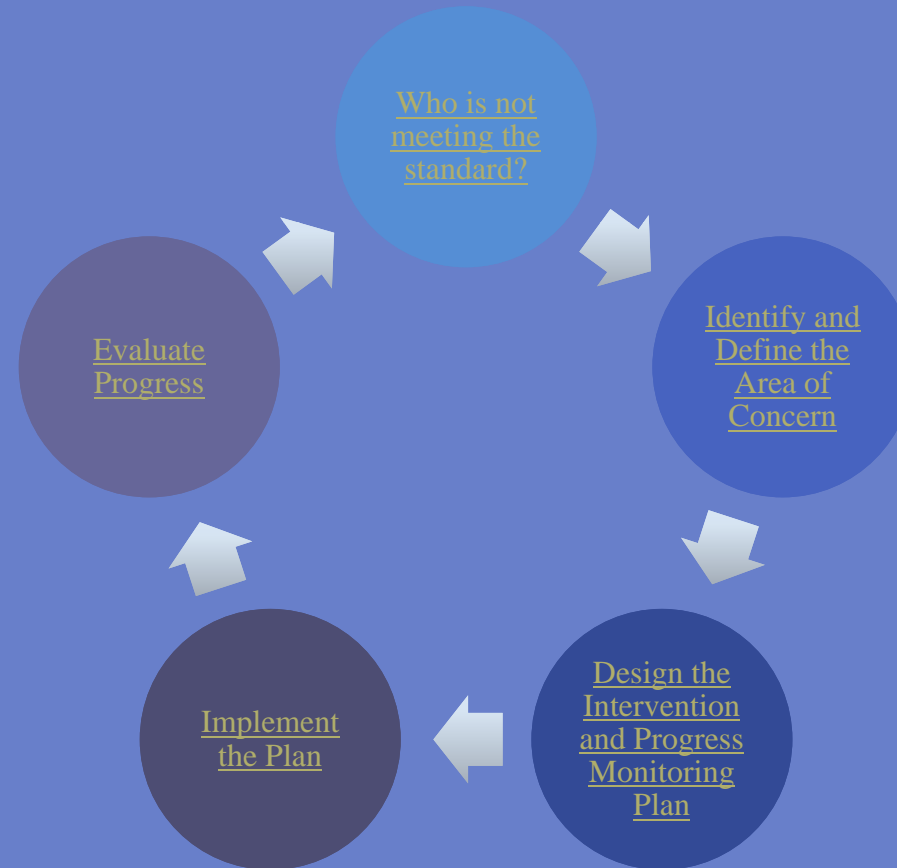
Problem  
solving  
process

# Sample Class Data

## Post-test for Subtraction with Regrouping



# Reviewing RTI (Problem Solving) Class-wide (School-wide) Decision Making



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# Resources

- Howell, K. (2000). *Resources for implementing Howell and Nolet's curriculum-based evaluation: Teaching and decision making (3<sup>rd</sup> )*.
- Howell, K.W. & Nolet, V. (2000). *Curriculum-based evaluation: Teaching and decision making (3<sup>rd</sup>)*. Belmont, CA: Wadsworth/Thomson Learning.
- Belmont, CA: Wadsworth/Thomson Learning.
- Miller, S. P. (1998). Validated practices for teaching mathematics to students with learning disabilities: A review of literature. *Focus on Exceptional Children, 31, 1, 24 pgs.*
- Price, K.M., & Nelson, K.L. (2007). *Planning effective instruction: Diversity responsive methods and management*. Belmont, CA: Wadsworth/Thomson Learning.
- Stein, M., Kinder, D., Silbert, J., & Carnine, D. (2006). *Designing effective mathematics instruction: A direct instruction approach (4th ed.)*. Columbus, OH: Merrill/Prentice Hall.



# Resources

- Aimsweb - <http://www.aimsweb.com/measures/math/>
- Worksheet generator  
<http://www.interventioncentral.org/>
- Otter Creek Institute - <http://www.ocisems.com/Products/ProductLine.aspx?cat=501>
- Flashcard creator  
[http://www.aplusmath.com/Flashcards/Flashcard\\_Creator.html](http://www.aplusmath.com/Flashcards/Flashcard_Creator.html)

# Possible Instructional Plan

Schedule for Math

January 8, 2009

- Practice facts
- Fact timings
- Whole group skill lesson
- Independent work

OR

Small group lesson

OR

Math activity

- Assessment
- Get ready to go home

Problem  
solving  
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# Assessment Calendar

- School Calendar

[Blueprints](#)

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# Screening/Benchmarking

$\begin{array}{r} 2 \\ +3 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 3 \\ +4 \\ \hline \end{array}$	$\begin{array}{r} 35 \\ +3 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ +7 \\ \hline \end{array}$	$\begin{array}{r} 42 \\ +25 \\ \hline \end{array}$
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$\begin{array}{r} 58 \\ +36 \\ \hline \end{array}$	$\begin{array}{r} 364 \\ +421 \\ \hline \end{array}$	$\begin{array}{r} 758 \\ +486 \\ \hline \end{array}$	$\begin{array}{r} 8865 \\ +3498 \\ \hline \end{array}$	$\begin{array}{r} 76 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 82 \\ -6 \\ \hline \end{array}$
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$\begin{array}{r} 58 \\ -46 \\ \hline \end{array}$	$\begin{array}{r} 63 \\ -29 \\ \hline \end{array}$	$\begin{array}{r} 598 \\ -143 \\ \hline \end{array}$	$\begin{array}{r} 619 \\ -325 \\ \hline \end{array}$	$\begin{array}{r} 504 \\ -375 \\ \hline \end{array}$	$\begin{array}{r} 4000 \\ -2985 \\ \hline \end{array}$
--	--	--	--	--	--

$\begin{array}{r} 4 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 63 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 43 \\ \times 21 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ \times 84 \\ \hline \end{array}$	$\begin{array}{r} 364 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 675 \\ \times 38 \\ \hline \end{array}$
--	---	--	--	--	---

$\begin{array}{r} 732 \\ \times 498 \\ \hline \end{array}$	$\overline{3/18}$	$\overline{2/19}$	$\overline{43/287}$	$\frac{2}{3} + \frac{1}{3} =$	$4\frac{1}{4} + 3\frac{2}{5} =$
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Ji -5<sup>th</sup> Grade Student

$$\begin{array}{r} 2 \\ +3 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 8 \\ -6 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 3 \\ 6 \\ +2 \\ \hline 11 \end{array}$$

$$\begin{array}{r} 39 \\ +4 \\ \hline 143 \end{array}$$

$$\begin{array}{r} 46 \\ -3 \\ \hline 43 \end{array}$$

$$\begin{array}{r} 51 \\ -28 \\ \hline 39 \end{array}$$

$$\begin{array}{r} 601 \\ 39 \\ +427 \\ \hline 1067 \end{array}$$

$$\begin{array}{r} 9062 \\ -4185 \\ \hline 5000 \\ 51 \end{array}$$

$$\begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array}$$

$$\begin{array}{r} 47 \\ \times 5 \\ \hline 9 \end{array}$$

$$4 \overline{)24}$$

$$8 \overline{)37}$$

$$\begin{array}{r} 41 \\ 3075 \\ \times 62 \\ \hline 3,439 \end{array}$$

$$74 \overline{)3061}$$

$$\frac{4}{20} = \frac{1}{5}$$

$$\frac{3}{11} + \frac{2}{11} =$$

$$\frac{1}{2} - \frac{5}{18} =$$

$$2\frac{3}{4} \times 5\frac{1}{3} =$$

$$6\frac{3}{4} \div 3\frac{1}{6} =$$

$$\begin{array}{r} 2.43 \\ \times 2.5 \\ \hline \end{array}$$

$$1.5 \overline{)24.39}$$

$$7^2 =$$

$$\sqrt{144}$$

$$\frac{7}{8} = \text{---}\%$$

## Computation Math Status Sheet

Objective	CL	Item	S1	S2	S3
<b>Multiplication</b>					
Solve one-digit by one-digit number; CAP 100%	4	9	N	N	N
<b>Subtraction</b>					
Solve four-digit from four-digit number w/zero in the hundreds column; CAP 100%	4	8	N	N	N
Solve two-digit from two-digit number with renaming from tens to ones; CAP 100%	3	6	N	N	N
Solve one-digit from two-digit number with no renaming required; CAP 100%	2	5	P	P	P
Solve conceptual introduction subtraction facts; CAP 100%	1	2	P	P	P
<b>Addition</b>					
Solve three-digit and a two-digit number with renaming from ones to tens; CAP 100%	3	7	P	P	P
Solve two-digit and one-digit number with renaming from ones to tens; CAP 100%	2	4	P	P	P
Solve three-single digit addition problems; CAP 100%	2	3	P	P	P
Solve basic addition facts; CAP 100%	1	1	P	P	P

# Determining Specific Skill Deficit

Survey Level  
Subtraction Assessment

$$\begin{array}{r} 3 \\ -2 \\ \hline 1 \end{array}$$

1a

$$\begin{array}{r} 16 \\ -7 \\ \hline X \end{array}$$

1a

$$\begin{array}{r} 10 \\ -4 \\ \hline 04 \end{array}$$

$$\begin{array}{r} 14 \\ -5 \\ \hline \end{array}$$

$$\begin{array}{r} 19 \\ -2 \\ \hline 17 \end{array}$$

$$\begin{array}{r} 68 \\ -5 \\ \hline 63 \end{array}$$

$$\begin{array}{r} 50 \\ -10 \\ \hline 40 \end{array}$$

$$\begin{array}{r} 40 \\ -30 \\ \hline \end{array}$$

3a

$$\begin{array}{r} 60 \\ -60 \\ \hline 60 \end{array}$$

4a

$$\begin{array}{r} 80 \\ -5 \\ \hline 85 \end{array}$$

$$\begin{array}{r} 23 \\ -6 \\ \hline \end{array}$$

4a

$$\begin{array}{r} 63 \\ -9 \\ \hline 66 \end{array}$$

$$\begin{array}{r} 93 \\ -61 \\ \hline 32 \end{array}$$

$$\begin{array}{r} 58 \\ -23 \\ \hline \end{array}$$

$$\begin{array}{r} 46 \\ -13 \\ \hline 33 \end{array}$$

6a

$$\begin{array}{r} 53 \\ -29 \\ \hline 36 \end{array}$$

6a

$$\begin{array}{r} 64 \\ -27 \\ \hline 43 \end{array}$$

6a

$$\begin{array}{r} 8942 \\ -5961 \\ \hline 3081 \end{array}$$

7a

$$\begin{array}{r} 400 \\ -165 \\ \hline 235 \end{array}$$

7a

$$\begin{array}{r} 5906 \\ -248 \\ \hline 5658 \end{array}$$

### Status Sheet for Sam's Assessment

<i>MASI* Subtraction Survey Level Status Sheet</i>					
<i>Objectives</i>	<i>Problem #</i>	<i>Curriculum Level</i>	<i>Expected Pass</i>	<i>Pass/No Pass</i>	<i>Discrepancy?</i>
<b>Addition</b>					
Solve three multi-digit number with renaming from ones to tens, tens to hundreds and hundreds to thousands; CAP 100%	20	4	YES	<b>NO</b>	<b>YES</b>
Solve a four-digit number and a three digit number with renaming from ones to tens, tens to hundred sand hundreds to thousands; CAP 100%	19	4	YES	<b>NO</b>	<b>YES</b>
Solve three three-digit numbers with renaming from ones to tens and tens to hundreds; CAP 100%	18	3	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number with renaming from ones to tens; CAP 100%	17	3	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number with renaming from ones to tens; CAP 100%	16	3	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number without renaming from ones to tens; CAP 100%	15	3	YES	<b>YES</b>	<b>NO</b>
Solve two-digit and a two-digit number without renaming from ones to tens; CAP 100%	14	3	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number without renaming from ones to tens; CAP 100%	13	3	YES	<b>YES</b>	<b>NO</b>
Solve two-digit and one-digit number with renaming from ones to tens; CAP 100%	12	3	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and one-digit number with renaming from ones to tens; CAP 100%	11	2	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and one-digit number with renaming from ones to tens; CAP 100%	10	2	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number with zeroes in tens column; CAP 100%	9	2	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number with zeroes in tens column; CAP 100%	8	2	YES	<b>NO</b>	<b>YES</b>
Solve two-digit and a two-digit number with zeroes in tens column; CAP 100%	7	2	YES	<b>YES</b>	<b>NO</b>
Solve two-digit subtraction from one-digit without regrouping; CAP 100%	6	2	YES	<b>YES</b>	<b>NO</b>
Solve basic subtraction facts (0-20); CAP 100%	5	1	YES	<b>YES</b>	<b>NO</b>
Solve basic subtraction facts (0-20); CAP 100%	4	1	YES	<b>NO</b>	<b>YES</b>
Solve basic subtraction facts (0-20); CAP 100%	3	1	YES	<b>NO</b>	<b>YES</b>
Solve basic subtraction facts (0-20); CAP 100%	2	1	YES	<b>NO</b>	<b>YES</b>
Solve basic subtraction facts (0-20); CAP 100%	1	1	YES	<b>YES</b>	<b>NO</b>

\*MASI - *Multilevel Academic Skills Inventory* (Howell, K., Zucker, S., & Moorehead, M.K., 2000).

# RIOT Matrix

	Review	Interview	Observe	Test
Instruction	Work/practice sheets without non-examples	Teacher: "Tried everything" and need to 'move on'	Conceptual, limited explicit instruction. Independ. practice.	
Curriculum	Multiplication facts in general education classroom.	Teacher: Subtraction a concern	General ed teacher uses Investigations and manipulatives	
Environment			Good arrangement; good peer interactions	
Learner	Ji 5 <sup>th</sup> grade Healthy, good vision, hearing, good attend.	Ji says that he likes math	Ji counts on his fingers, uses dash lines	Subtraction

# Additional Assessment

Specific level  
1 digit from 2 digit w/ regrouping

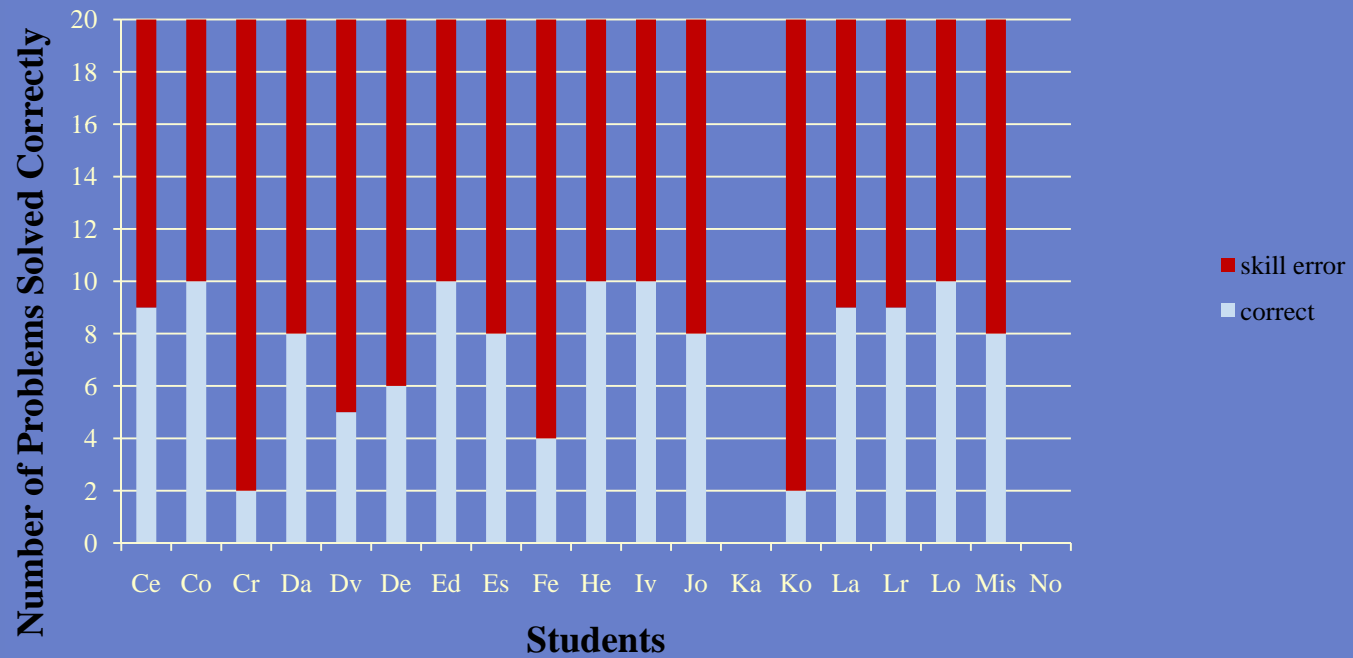
The image shows six handwritten subtraction problems, each circled in red. Each problem includes a regrouping calculation. A green box at the bottom right contains the text 'Strategic or conceptual errors'.

- Problem 1:  $88 - 9 = 87$ . Regrouping:  $9 - 8 = 1$ .
- Problem 2:  $70 - 5 = 75$ . Regrouping:  $5 - 0 = 5$ .
- Problem 3:  $36 - 8 = 32$ . Regrouping:  $8 - 6 = 2$ .
- Problem 4:  $30 - 2 = 32$ . Regrouping:  $2 - 0 = 2$ .
- Problem 5:  $72 - 5 = 73$ . Regrouping:  $5 - 2 = 3$ .
- Problem 6:  $60 - 9 = 69$ . Regrouping:  $9 - 0 = 9$ .

Strategic or conceptual errors

# Classroom Data

## Pre-test for Subtraction with Regrouping



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Problem  
solving  
process



# Who is not meeting the standard?

- For each unit/area
- In each classroom
- At each grade level
- Within each school

# Problem-solving/standard protocol

- Assess
  - Identify and analyze skill deficit
  - Intervention is based on indepth error analysis
  - Monitor progress
- Assess
  - Identify skill deficit
  - Intervention is based on as standard research based protocol (i.e., DI or CAI)
  - Monitor progress

(Christ, Burns, Ysseldyke ,2005)

Problem  
solving  
process



# Monitor Progress

- Progress is monitored frequently
- Student data are analyzed
- Instructional decisions are based on student data