A Multi-Level Prevention System in Mathematics

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Presentation Outline

1. RTI: A Multi-Level Prevention System
2. Primary Prevention: Creating Routines to Differentiate Instruction
3. Secondary Prevention: Standard Protocols for Small-Group Tutoring
4. Assessment: An Essential Component of Primary and Secondary Prevention and at the Core of Tertiary Prevention
5. Tertiary Prevention: Experimental Teaching to Individualize Instruction

Responsiveness-to-Intervention

Responsiveness-to-intervention (RTI) integrates assessment and intervention within a multi-level prevention system to identify and reduce risk for poor learning outcomes.

The purpose of RTI is to reduce the risk of serious, long-term, negative consequences associated with exiting school without the skills need to succeed in life.

Typical RTI Procedure

Primary Prevention

- All children receive the universal, core instructional program.
- All children are tested once in the fall to identify students as potentially at-risk for academic failure.
- The progress of potentially at-risk students is monitored for 6-8 weeks to (dis)confirm risk and identify students for secondary prevention.

Typical RTI Procedure

Secondary Prevention

- For at-risk students, a second level of prevention is implemented using research-validated tutoring programs. Some schools incorporate more than one tier of secondary prevention services.
- Student progress is monitored throughout intervention, and students are re-tested following intervention.
- Growth/performance is classified as responsive or unresponsive.
- Students who respond well return to this primary prevention, with ongoing progress monitoring.

Typical RTI Procedure

Tertiary Prevention

- Those who do not respond move to tertiary prevention where
  - Individual student goals set ambitiously.
  - Ongoing progress monitoring used to
    - Inductively design individualized programs
    - Identify when students have met benchmarks that permit return to secondary or primary prevention (with progress monitoring so re-entry to tertiary prevention occurs as needed).

The Origins of RTI

- The notion of a multi-level prevention system is borrowed from the health-care system.

Health Care Analogy

- High blood pressure (HBP) can lead to heart attacks or strokes *(like academic failure can produce serious long-term negative consequences).*
- At the annual check-up (primary prevention), HBP screening *(like annual fall screening for low reading or math scores).*
- If screening suggests HBP, then monitoring over 6-8 weeks occurs to verify HBP *(like PM to ([dis]confirm risk).*

Health Care Analogy (cont'd)

- If HBP is verified, secondary prevention occurs with relatively inexpensive diuretics, which are effective for vast majority, and monitoring continues *(like small-group secondary preventive tutoring, using a standard treatment protocol, with PM to index response).*
- For patients who fail to respond to secondary prevention (diuretics), then tertiary prevention occurs—experimentation with more expensive medications (e.g., ACE inhibitors, beta blockers), with ongoing monitoring to determine which drug or combination of drugs is effective *(like individualized instructional programs inductively formulated with progress monitoring).*

The Origins of RTI

- The notion of a multi-level prevention system is borrowed from the health-care system.

- A press to consider a multi-level prevention system emanates from the federal law on disabilities and procedural innovations in identifying learning disabilities.

Defining LD with RTI

LD as nonresponders to validated instruction (unexpected underachievement).

RTI eliminates poor instructional quality as a viable explanation for learning difficulty.

Two key assumptions:

1. If child does not respond to instruction that is effective for the vast majority of children, then something is different about the child that explains the nonresponse (i.e., disability).

2. If child does not respond to standard forms of instruction (general education and validated tutoring, individualized (special) intervention is needed.

Why Primary, Secondary, and Tertiary Prevention Levels, Not Tiers?

Eliminating Confusion over Tiers

- Your Tier 2 may be same as my Tier 4.
- For example, some schools use a series of small-group tutoring programs, referring to them as different tiers, even though they represent the same level of intensity.
- We use prevention LEVELS to communicate distinct differences in intensity.
- Schools can organize more than one intervention within any given level of the prevention system.

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Primary Prevention: Defining Features

- Instructional practices general educators conduct
  - Core curriculum, based on research principles (but rarely validated)
  - Classroom routines that provide opportunities for instructional differentiation
  - Accommodations that permit access to the primary prevention program for all students
  - Strategies to address students' motivational problems that interfere with them performing the academic skills they possess.

Enhancing Teachers' Capacity for Instructional Differentiation

Primary Prevention:

Creating Routines

to Differentiate Instruction

An Example from Our Work

Math Peer-Assisted Learning Strategies (PALS)

Developed by Lynn S. Fuchs, Douglas Fuchs, and colleagues
Vanderbilt University

www.peerassistedlearningstrategies.net

Math PALS

- Supplements the general education core program
- Implemented 2 times per week in math
- Creates a "routine" for teachers to differentiate instruction by creating many simultaneous peer-mediated lessons rather than one teacher-directed lesson
- Available in math at kindergarten, first grade, grades 2-6

PALS Research

- Over 20 years of experimental research
- Title I and Non-Title I schools
- Urban and suburban schools
- High, average, and low achievers
- Students with learning disabilities
- “Validated Practice” status

Math PALS at Grades 2-6

Skills Sequence
Grade 2

Computation

- Adding Basic Facts
- Adding without regrouping
- Adding with regrouping
- Subtracting Basic Facts
- Subtracting without regrouping
- Subtracting with regrouping

Applications

- Applied Computation
- Charts and Graphs
- Counting
- Fractions
- Measurement
- Money
- Number Concepts
- Names of numbers
- Word problems

Skills Sequence
Grade 3

Computation

- Adding
- Subtracting without regrouping
- Subtracting with regrouping using 0
- Multiplying Basic Facts
- Multiplying
- Dividing Basic Facts

Applications

- Applied Computation
- Charts and Graphs
- Counting
- Decimals
- Fractions
- Measurement
- Money
- Number Concepts
- Names of numbers
- Word problems

Skills Sequence

Grade 4

Computation

- Adding
- Subtracting
- Multiplying Basic Facts
- Multiplying by 1 digit
- Multiplying by 2 digits
- Dividing Basic Facts
- One-step dividing
- Two-step dividing
- Adding/Subtracting Basic Fractions
- Adding/Subtracting Mixed Fractions

Applications

- Area and Perimeter
- Charts and Graphs
- Decimals
- Fractions
- Grid Reading
- Measurement
- Number Concepts
- Names of numbers and vocabulary
- Word problems

Skills Sequence
Grade 5

Computation

- Adding
- Subtracting
- Multiplying
- Dividing with 1 digit divisor
- Dividing with 2 digit divisor
- Reducing Fractions
- Renaming Fractions
- Adding/Subtracting Decimals

Applications

- Applied Computation
- Charts and Graphs
- Decimals
- Fractions and Factors
- Geometry
- Measurement
- Money
- Numeration
- Word problems

Skills Sequence
Grade 6

Computation

- Adding
- Subtracting
- Multiplying
- Dividing
- Adding/Subtracting Decimals
- Multiplying Decimals

Applications

- Applied Computation
- Charts and Graphs
- Geometry
- Measurement
- Numeration
- Percentages
- Proportions
- Ratios and Probability
- Variables
- Word problems

Math PALS Basics

- There are 2 PALS sessions each week (3 per week at first grade).
- A “lesson” lasts 2 weeks (4 sessions).
- For each 2-week lesson, the PALS pair is assigned skill, which comes with a coach folder and a player folder.
- Pairs work on different skills, depending on their needs.
- Students are self-sufficient when doing PALS, but teacher facilitates to ensure effectiveness.

Assigning Math PALS Pairs

Coach	Player	Pair
Student 1	Student 20	Pair #1
Student 2	Student 19	Pair #2
Student 3	Student 18	Pair #3
Student 4	Student 11	Pair #4
Student 5	Student 12	Pair #5
Student 6	Student 13	Pair #6
Student 7	Student 14	Pair #7

Coach	Player	Pair
Student 8	Student 15	Pair #8
Student 9	Student 16	Pair #9
Student 10	Student 17	Pair #10

PALS Timeline

- Week “0” Training weeks
  - Train using the simplest addition
- Weeks 1-2
  - 2 sessions per week, only computation
- Weeks 3-4
  - Teach helping and explaining
  - Continue with computation PALS
- Weeks 5-7
  - Train strategies for giving mathematical explanations
  - Continue with computation PALS
- Weeks 8-20
  - Train applications problem types
  - Continue with PALS, teacher assigns computation and applications content for PALS

Computation PALS

- Basic math facts
  - Addition, Subtraction, Multiplication, Division

- Teacher leads session using a timer during PALS to keep sessions to 30 minutes and using the PALS Tutoring Command Card (outline of activities during a PALS lesson)

- When pairs are doing computation:
  - Coach circles each correct digit.
  - Coach requires correction and then triangles corrected work.
  - Coach circles entire problems with no mistakes.

3 A1

ADDING

COACH'S QUESTION SHEET

Look at the sign.

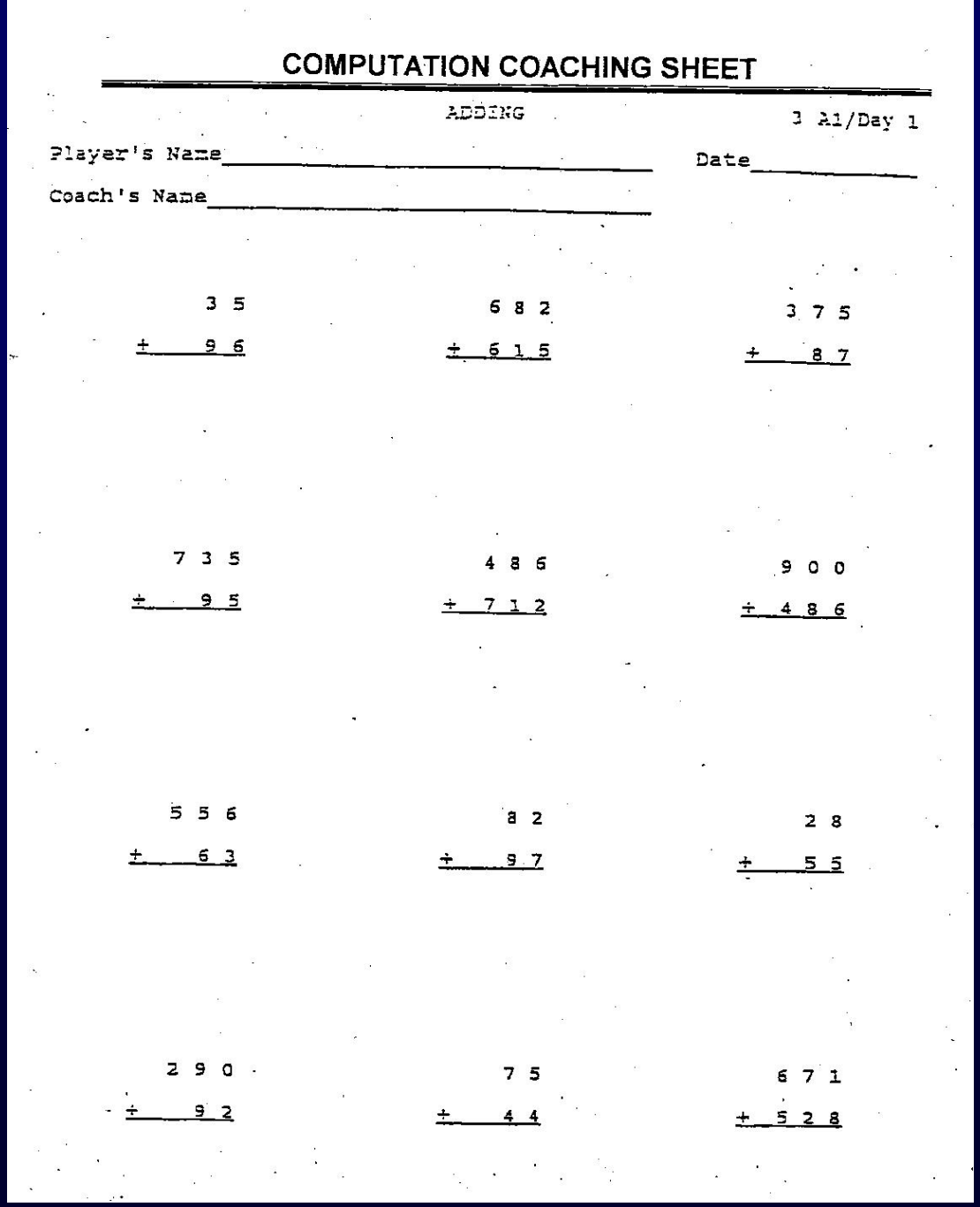
What kind of problem is it?

Where do you start?

1. What plus what?
2. Is your answer 10 or more? Do you need to regroup?

   If yes, do it.
3. Write your answer.
4. Where do you move next?

Sample Coach's Question Sheet



COMPUTATION COACHING SHEET

ADDING

3 A1/Day 1

Player's Name _____ Date _____

Coach's Name _____

3 5 + 9 6	6 8 2 + 6 1 5	3 7 5 + 8 7
7 3 5 + 9 5	4 8 6 + 7 1 2	9 0 0 + 4 8 6
5 5 6 + 6 3	8 2 + 9 7	2 8 + 5 5
2 9 0 + 9 2	7 5 + 4 4	6 7 1 + 5 2 8

Sample Coaching Sheet

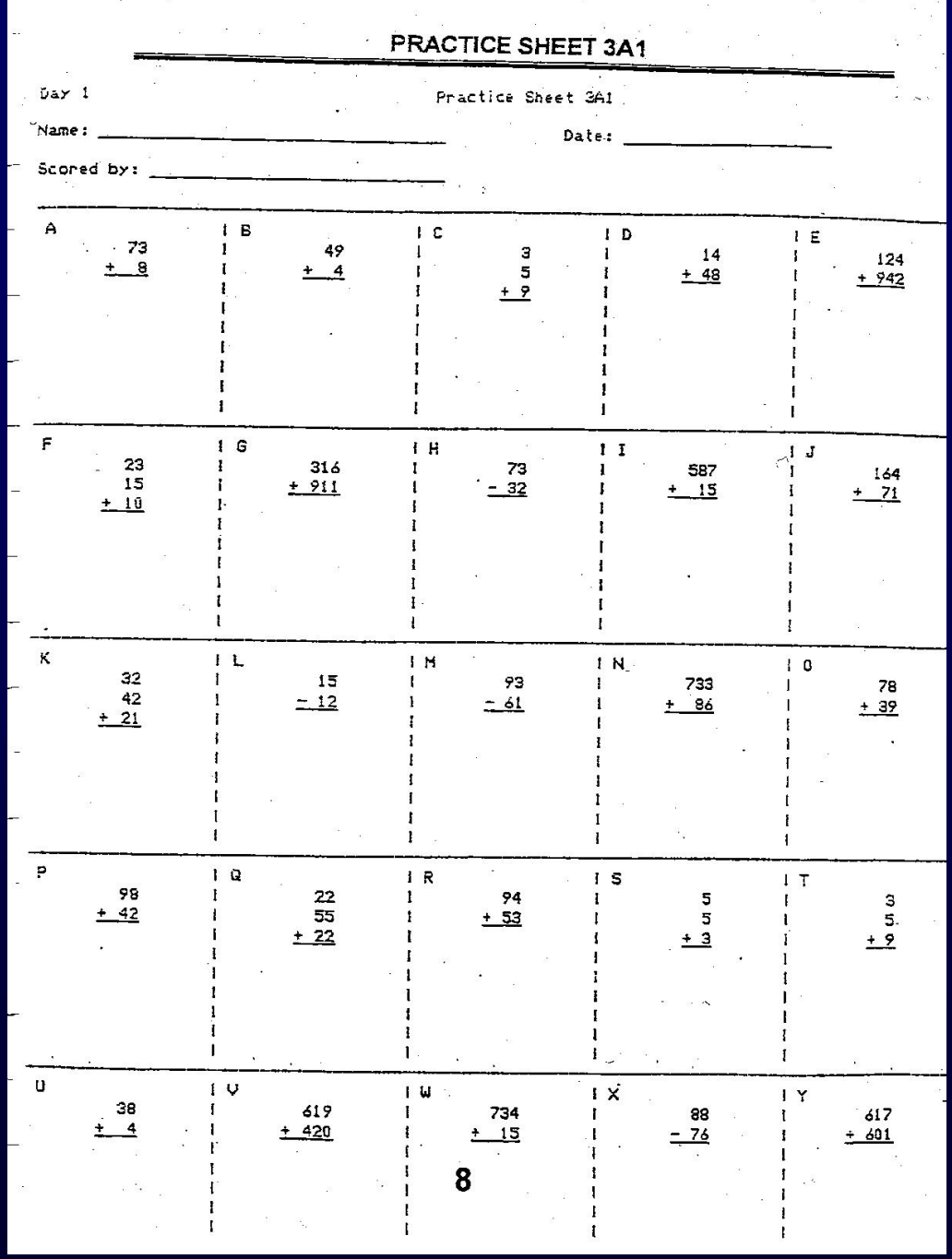
COMPUTATION COACH'S ANSWER SHEET

Coach's Answers

3 A1/Day 1

1 35 + 96 131	682 + 615 1297	1 1 375 + 87 462
1 1 735 + 95 830	486 + 712 1198	900 + 486 1386
1 556 + 63 619	82 + 97 179	1 28 + 55 83
1 290 + 92 382	75 + 44 119	671 + 528 1199

Sample Coaching Answer Sheet



PRACTICE SHEET 3A1

Day 1

Practice Sheet 3A1

Name: _____ Date: _____

Scored by: _____

A	B	C	D	E
73 + 8	49 + 4	3 5 + 9	14 + 48	124 + 942
F	**G**	**H**	**I**	**J**
23 15 + 10	316 + 911	73 - 32	587 + 15	164 + 71
K	**L**	**M**	**N**	**O**
32 42 + 21	15 - 12	93 - 61	733 + 86	78 + 39
P	**Q**	**R**	**S**	**T**
98 + 42	22 55 + 22	94 + 53	5 5 + 3	3 5 + 9
U	**V**	**W**	**X**	**Y**
38 + 4	619 + 420	734 + 15	88 - 76	617 + 601

8

Sample Practice Sheet

PRACTICE SHEETS ANSWERS 3 A1

SHEET #1

A 81	B 53	C 17	D 62	E 1066
F 48	G 1227	H 41	I 602	J 235
K 95	L 3	M 32	N 819	O 117
P 140	Q 99	R 147	S 13	T 17
U 42	V 1039	W 749	X 12	Y 1218

SHEET #2

A 106	B 1	C 505	D 90	E 16
F 354	G 52	H 30	I 1282	J 3
K 1099	L 40	M 177	N 662	O 30
P 15	Q 999	R 99	S 1179	T 99
U 16	V 31	W 1275	X 80	Y 78

SHEET #3

A 64	B 12	C 106	D 13	E 0
F 117	G 73	H 88	I 20	J 751
K 88	L 66	M 820	N 16	O 1488
P 4	Q 316	R 413	S 92	T 1458
U 1368	V 1168	W 1	X 34	Y 175

SHEET #4

A 32	B 1459	C 75	D 495	E 11
F 13	G 120	H 13	I 17	J 56
K 834	L 621	M 1494	N 80	O 11
P 138	Q 65	R 79	S 61	T 48
U 109	V 1072	W 142	X 1659	Y 412

Sample Practice Sheet

Giving Mathematical Explanations Weeks 5-6

- Teacher trains students on strategies for giving mathematical explanations
  - Lesson 1 Real-Life Examples
  - Lesson 2 Discuss the Meaning
  - Lesson 3 Make Marks
  - Lesson 4 Use Manipulatives
  - Lesson 5 Review
- After training, teacher ends every PALS session by giving students opportunity to talk about good explanations they gave.

Applications PALS

- Training for Applications occurs at Week 8 (or when teacher decides to introduce applications lessons; any time after Week 7).
- Point out how Applications differs from Computation.
- Training is one day.

TF2

3CG

Charts and Graphs

Coach's Question Sheet

For each new graph:

1. Look at the graph. What is the graph about?
2. What does the key tell you?

For each question:

1. Read the question aloud.
2. What do you need to do to find the answer?
3. Do you need to add or subtract two numbers?
   If yes, do it. SHOW YOUR WORK!
4. Write your answer in the blank.

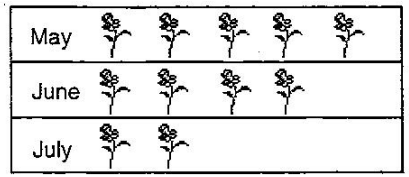
Charts and Graphs
Coaching Sheet

TF3

Player's Name _____ Date _____

Coach's Name _____

Number of Flowers Planted



Key: Each  means 5 flowers

How many flowers were planted in May? _____

How many more flowers were planted in June than July? _____

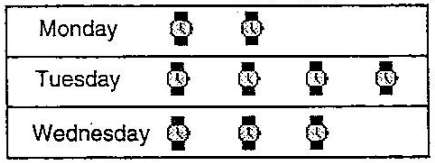
How many flowers were planted altogether? _____

How many flowers were planted in July? _____

How many flowers were planted in June and July altogether? _____

How many fewer flowers were planted in June than May? _____

Number of Watches Sold



Key: Each  means 10 watches

How many watches were sold on Monday? _____

How many more watches were sold on Tuesday than Monday? _____

How many watches were sold altogether? _____

How many watches were sold on Tuesday? _____

How many watches were sold on Tuesday and Wednesday altogether? _____

How many fewer watches were sold on Monday than Wednesday? _____

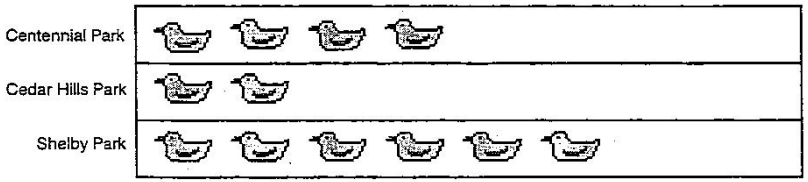
TF4

Charts and Graphs
Practice Sheet

Name _____ Date _____

Scored by _____

Ducks in Parks in Nashville



Key: Each duck means 10 ducks.

Fill in the blanks. (Each blank counts 2 points.)

How many ducks are there at Shelby Park? **A.** _____

How many ducks are there at the three parks altogether? **B.** _____

How many fewer ducks are there at Cedar Hills Park than at Shelby Park? **C.** _____

How many more ducks are there at Centennial Park than at Cedar Hills Park? **D.** _____

How many ducks are there at Centennial Park? **E.** _____

How many ducks are at Shelby Park and Centennial Park altogether? **F.** _____

Solve. (1 point each)

G. 654 − 34	**H.** 25 + 18	**I.** 43 − 16	**J.** 657 + 432	**K.** 52 + 15
L. 81 − 23	**M.** 417 − 61	**N.** 84 − 56	**O.** 700 + 604	**P.** 234 − 43
	Q. 74 − 15	**R.** 47 − 28	**S.** 125 + 45	

A46

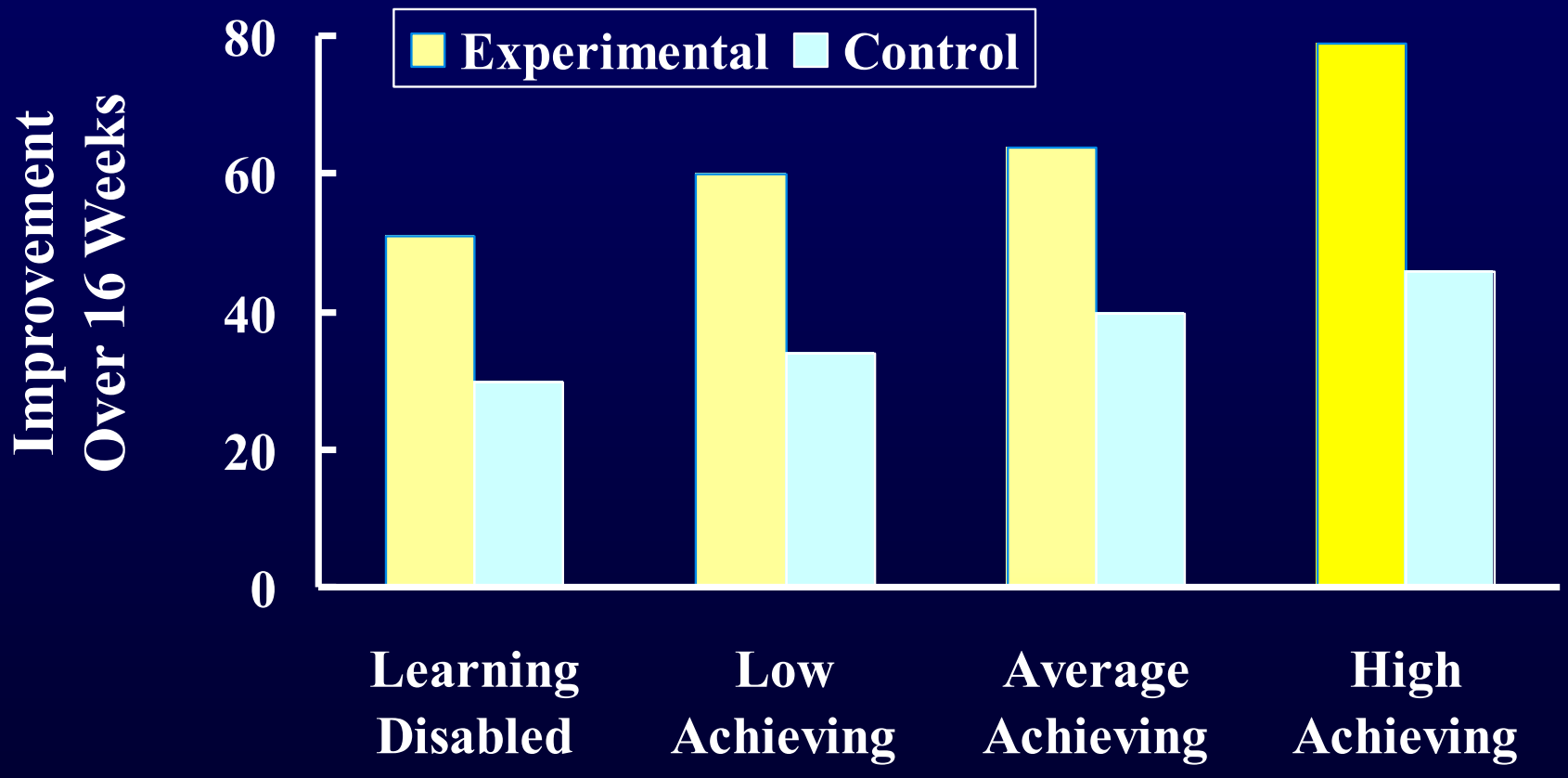
Training Overhead for Applications

Math PALS Best Practice

- After the first 2 weeks (1 PALS skill), pairs work on different skills.

- Teachers assign skills students need to review, enabling teachers to differentiate instruction.
  - The skill is targeted to the needs of the lower-performing student.

Improvement in Math



Report Card Scores Based on Students' Performance on the TCAP (CTB/McGraw-Hill)

	GOWER			
Subject	'93		'94	
MATH	76.0	(61)	107.8	(12)
READING	74.0	(60)	112.5	(25)
Language Arts	61.7	(60)	91.8	(33)
Science	74.4	(58)	95.6	(24)
Social Studies	60.1	(61)	81.4	(53)

Note 1: A score of 100 means that students of a school are progressing at a rate equivalent to that of the national rate.

Note 2: The numbers in parentheses represent Gower's standing in relation to the Metro Schools' other 66 elementary schools.

United States Department of Education

Program Effectiveness Panel

presents this

Certificate of Validation

for

Peabody Peer-Assisted Learning Strategies in Reading (PALS-R)

in recognition of your contributions to excellence in education

Assistant Secretary
Office of Educational Research and Improvement

May 1, 1995 to May 2, 2001
Effective Dates

Best Practice Web Sites

- What Works Clearinghouse
- Best Evidence Encyclopedia
- RTI Practice Guide

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Secondary Prevention: Defining Features

- Validated small-group tutoring program

- Specified instructional procedures and duration (typically 10-15 weeks of 20- to 40-minute sessions) and frequency (2-4 times per week), in place during validation studies

Secondary versus Primary Prevention

- Empirically validated (rather than research principled)
- Relies entirely on adult-led small-group tutoring (whereas primary prevention relies heavily on whole-class instruction)
- Support staff (e.g., reading/math coaches), sometimes training and supervising paraprofessionals to serve as tutors.

Secondary Prevention Validated Standard Protocol

An Example from Our Work

GALAXY MATH

First-Grade Numerosity Tutoring
with Counting Strategies
to Solve Arithmetic Problems

Numerosity

- Number recognition
- Counting
- Number line concepts 0-20
- Addition and subtraction concepts and word problems
- +/- 1
- +/- 2
- Zero with adding/subtracting 0
- Number families, with word problems
- Number line concepts: 0-100
- Place value
- 2-digit calculations (no regrouping)
- Missing addends

Adding/Subtracting Counting Strategies

For addition, recognize

- Plus sign means addition
- Smaller number and bigger number
- Commutativity

For subtraction, recognize

- Minus sign means subtraction
- Minus number and other number

“Know It or Count”

Two Ways to Solve Math Problem

- Know it

  - Adding and subtracting 0, 1, or 2

- Count

  - Count in for addition

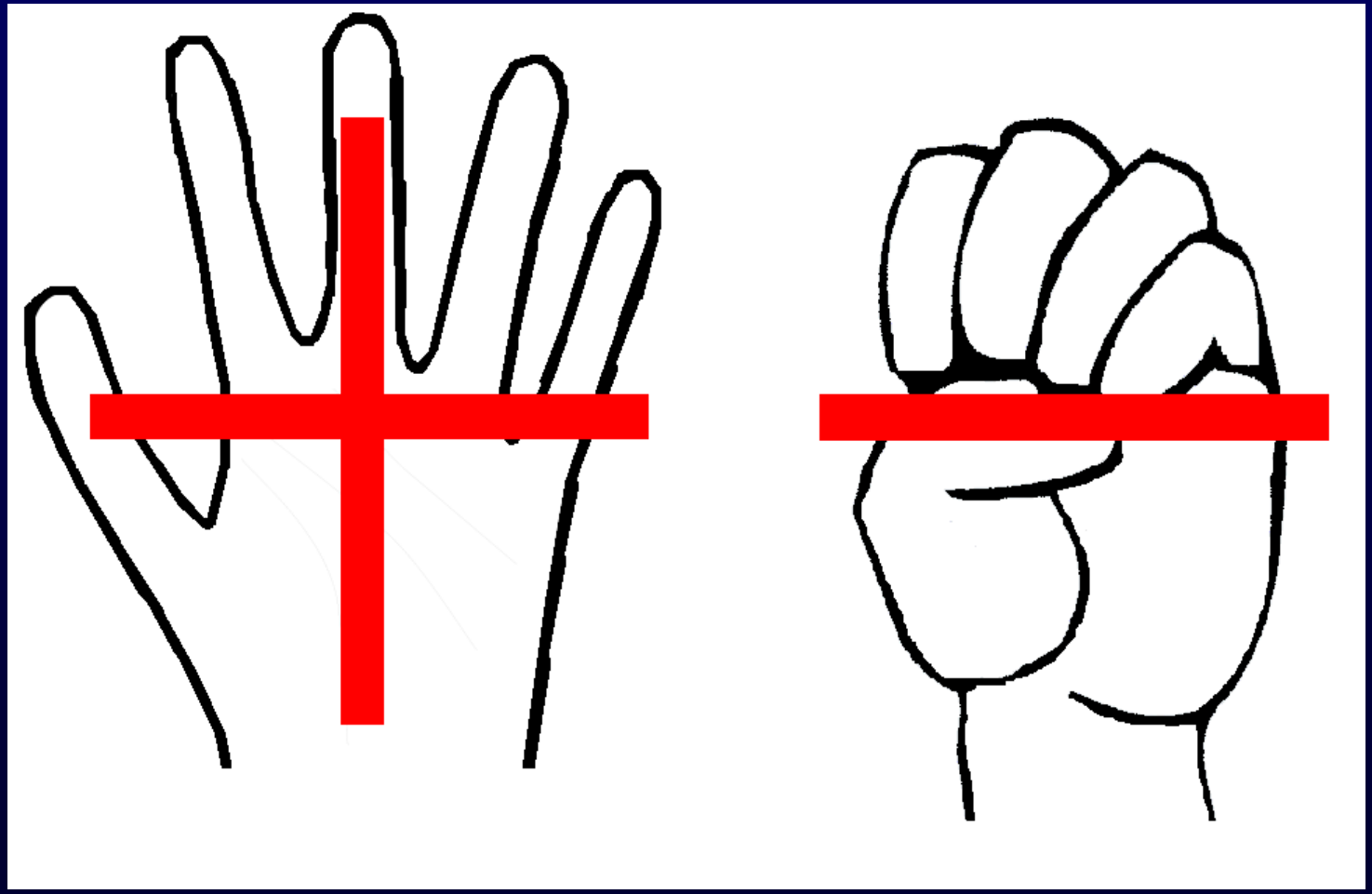
  - Count up for subtraction

Open Hand vs. Closed Hand

- For addition, open hand to show the smaller number.

- For subtraction, close hand to hold the minus number.

Open/Closed Hand Poster



Counting in for Addition

- Open hand to show smaller number.
- Start counting with bigger number (bump wrist and state bigger number).
- Count in to add the smaller number into your hand.
- Answer is last number said.

2 + 3 = 5

Two fingers up.

Hit wrist (“3”).

Count “4” and lower finger.

Count “5” and lower finger: Answer is 5.

Counting Up for Subtraction

- Close hand to hold the minus number. Say the minus number as you close your hand.
- Count up to the other number.
- Answer is number of fingers used to count up.

5 – 2 = 3

Close hand and say 2.

Count “3” and raise a finger.

Count “4” and raise another finger.

Count “5” and raise another finger.

Answer is 3 (3 fingers up).

Study Conditions

- Galaxy Math with Drill/Practice
  - Each session: 25 minutes numerosity with 5 minutes drill/practice
- Galaxy Math with Games
  - Each session: 25 minutes numerosity with 5 minutes of games
- Control (no tutoring)

Intervention

- 16 weeks, 3 times per week, 30 minutes per session
- Tutors: Noncertified teachers employed by grant
- Sessions audiotaped; tapes sampled for fidelity (high for both conditions)

Participants

- Four cohorts, each followed through 3rd grade
- Preliminary findings for Cohorts 1-2 from fall to spring of first grade
- Sample size to date
  - 169 Not at risk
  - 99 At-risk Control (no tutoring)
  - 104 At-risk Galaxy Math + Drill/Practice
  - 107 At-risk Galaxy Math + Games

Results After Two Years

- Basic Facts 0-10
  - Drill/Practice > NAR
  - Drill/Practice > Games > Control
- Basic Facts 0-12
  - NAR > Control, Games
  - Drill/Practice > Control, Games
- Procedural Calculations: Addition
  - NAR, Drill/Practice > Control
  - Drill/Practice > Games
- Procedural Calculations: Subtraction
  - NAR > Control
  - Drill/Practice, Games > Control

Results After Two Years

- Wide Range Achievement Test
  - Drill/Practice, Games > Control
- Story Problems
  - NAR > Drill/Practice, Games, Control
- KeyMath Number Concepts
  - NAR > Drill/Practice > Control

Why Advantage for Drill/Practice?

- Sampled audiotapes of 4 sessions for each child (one randomly selected for each child from each 4-week period across the 16 weeks).
- Coded number of practice opportunities in the last 5 minutes (with 98% IOA).
  - DP: mean 40.40 (*SD*=16.23)
  - Games: mean 6.70 (*SD*=2.16)
  - $F(1,134)=279.35$, $p<.001$

How Did Children Feel about "Drill and Kill"?

- No differences between GM Drill/Practice and GM Games in terms of how children felt about
  - How much they enjoyed tutoring
  - How much they felt they learned in tutoring
- Children identified Drill/Practice as one of their favorite tutoring activities

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Screening and Progress Monitoring within RTI

Let's take a break from the three levels of the prevention system.

Let's think about assessment

- An important component of primary and secondary prevention
- The essential tool for individualizing intervention within tertiary prevention

Curriculum-Based Measurement

A Validated Assessment Framework within RTI

CBM

- Does not refer to a product.
- Refers to an approach to assessment.
- A brief test is used to assess students' overall competence in an academic area.
- Many (10-30) alternate forms of the test within a grade level are available.

CBM
2-Stage Screening

Universal Screen: 2 alternate forms are administered in 1 sitting near the beginning of the year. The scores are averaged to obtain an estimate of the student's overall competence.

Targeted follow-up for students who fail the screen: 6-8 weeks of progress monitoring or an in-depth individual test.

2-stage screening may be repeated in Winter and Spring.

CBM
Progress Monitoring

One alternate form is administered each week. The slope of improvement (rate of increase per week) is used to index the student's rate of development.

Two scores are averaged to estimate the student's level of performance.

Together, slope and final level (or projected final level at end of year) are used to index responsiveness.

CBM

- Primary Prevention
  - Stage 1 Screening: CBM (average of 2 alternate forms in 1 sitting) is used to identify students suspected to be at risk
  - Stage 2 Screening: CBM slope (weekly rate of improvement over 6-8 weeks) is used to confirm or disconfirm risk status.
- Secondary Prevention
  - CBM slope (weekly rate of improvement over course of tutoring) and CBM final status (average of 2 final CBM scores) are used to determine responsiveness.
- Tertiary Prevention
  - CBM is used to set goals, to formulate individualized programs, and to determine responsiveness.

Why Focus on CBM?

CBM Is A
Scientifically Validated
Approach to Progress
Monitoring

A Primer on Math CBM

Curriculum-Based Measurement (CBM) . . .

- CBM is the result of 30+ years of research.
- CBM is a signature feature of quality special education.
- Increasingly, CBM is used in general education within RTI.
- CBM demonstrates strong reliability, validity, and instructional utility.

Research Shows

- CBM produces accurate, meaningful information about students' academic levels and their rates of improvement.
- CBM is sensitive to student improvement.
- CBM corresponds well with high-stakes tests.
- When teachers use CBM to inform their instructional decisions, students achieve better.

Most Progress Monitoring: Mastery Measurement

CBM is **NOT**

Mastery Measurement

MASTERY MEASUREMENT Tracks Mastery of Short-term Instructional Objectives

To implement Mastery Measurement, the teacher

- Determines the sequence of skills in an instructional hierarchy
- For each skill, develops a criterion-referenced test

Mastery Measurement

An Example

Fourth-Grade Math Computation

Hypothetical Fourth-Grade Math Computation Curriculum

1. ***Multidigit addition with regrouping***
2. Multidigit subtraction with regrouping
3. Multiplication facts, factors to 9
4. Multiply 2-digit numbers by a 1-digit number
5. Multiply 2-digit numbers by a 2-digit number
6. Division facts, divisors to 9
7. Divide 2-digit numbers by a 1-digit number
8. Divide 3-digit numbers by a 1-digit number
9. Add/subtract simple fractions, like denominators
10. Add/subtract whole number and mixed number

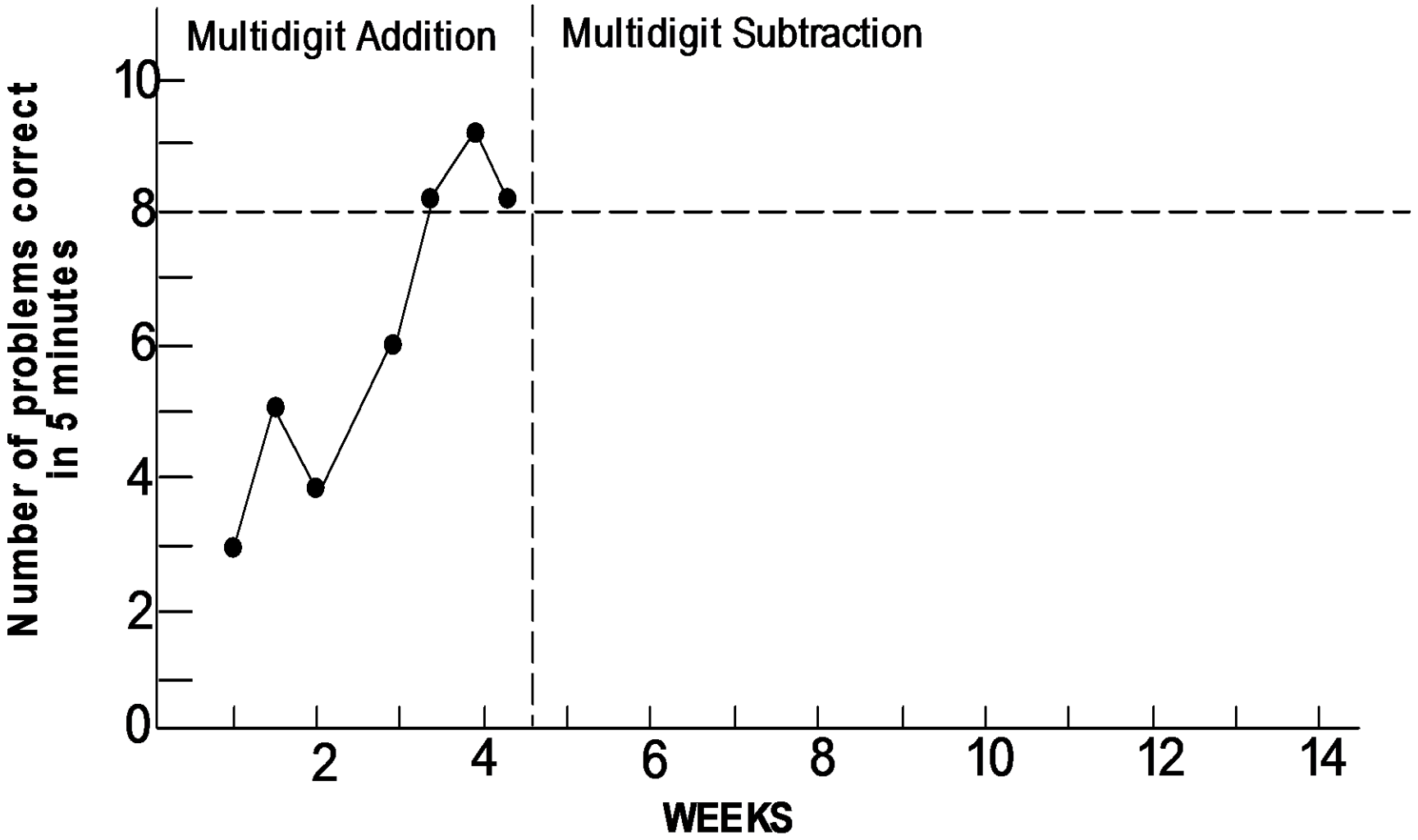
Multidigit Addition Mastery Test

Name: _____ Date _____

Adding

36521 + 63758	53429 + 63421	84525 + 75632	67842 + 53937	57321 + 46391
56382 + 94742	36422 + 57529	34824 + 69426	32415 + 85439	45321 + 86274

Mastery of Multidigit Addition



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4. Multiply 2-digit numbers by a 1-digit number
5. Multiply 2-digit numbers by a 2-digit number
6. Division facts, divisors to 9
7. Divide 2-digit numbers by a 1-digit number
8. Divide 3-digit numbers by a 1-digit number
9. Add/subtract simple fractions, like denominators
10. Add/subtract whole number and mixed number

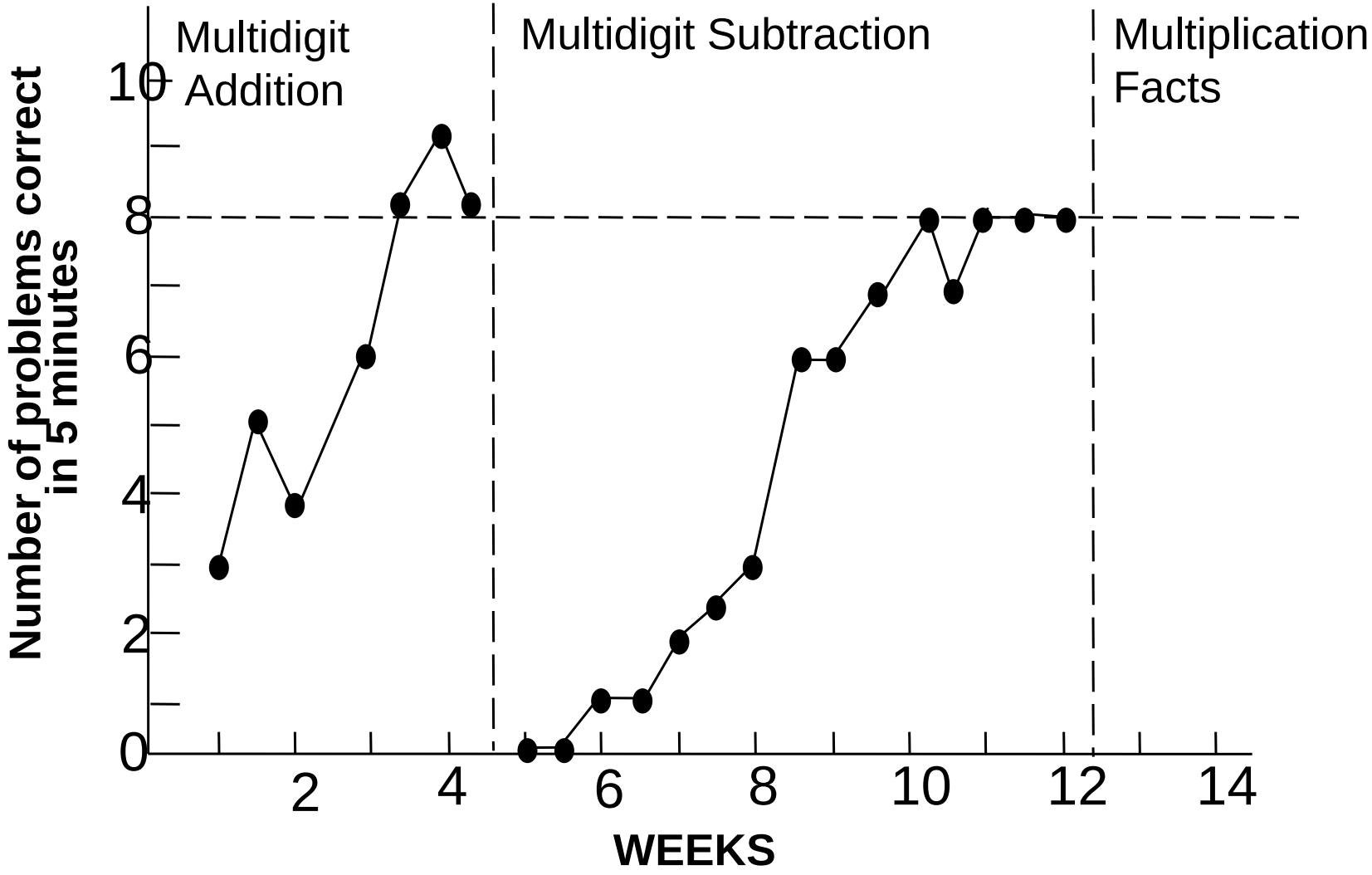
Multidigit Subtraction Mastery Test

Name: _____ Date _____

Subtracting

6521 - 375	5429 - 634	8455 - 756	6782 - 937	7321 - 391
5682 - 942	6422 - 529	3484 - 426	2415 - 854	4321 - 874

Mastery of Multidigit Addition and Subtraction



Problems with Mastery Measurement

- Hierarchy of skills is logical, not empirical.
- Performance on single-skill assessments can be misleading.
- Assessment does not reflect maintenance or generalization.
- Assessment is designed by teachers or sold with textbooks, with unknown reliability and validity.
- Number of objectives mastered does not relate well to performance on high-stakes tests.

Curriculum-Based Measurement (CBM) was designed to address these problems.

An Example of CBM:

Fourth-Grade Math Computation

Hypothetical Fourth-Grade Math Computation Curriculum

Multidigit addition with regrouping

Multidigit subtraction with regrouping

Multiplication facts, factors to 9

Multiply 2-digit numbers by a 1-digit number

Multiply 2-digit numbers by a 2-digit number

Division facts, divisors to 9

Divide 2-digit numbers by a 1-digit number

Divide 3-digit numbers by a 1-digit number

Add/subtract simple fractions, like denominators

Add/subtract whole number and mixed number

- Random numerals within problems
- Random placement of problem types on page

Sheet #1 Computation 4

Password: ARM

Name: _____ Date _____

A $\frac{3}{7} - \frac{2}{7} =$	B $1\frac{6}{7} + 3 =$	C $4\overline{)6}$	D $6\overline{)78}$	E 875×7
F 6×7	G 9×0	H 244×7	I $6\overline{)48}$	J $5\overline{)20}$
K $2\overline{)50}$	L $6144 - 4420$	M 33×10	N 6×0	O $7\overline{)30}$
P $95225 + 75268$	Q $8\overline{)32}$	R $1156 + 2824 + 83$	S $7\frac{4}{7} - 2 =$	T 38×33
U $\frac{3}{5} + \frac{1}{5} =$	V $982 - 97$	W 9×5	X 4×1	Y $7\overline{)56}$

- Random numerals within problems
- Random placement of problem types on page

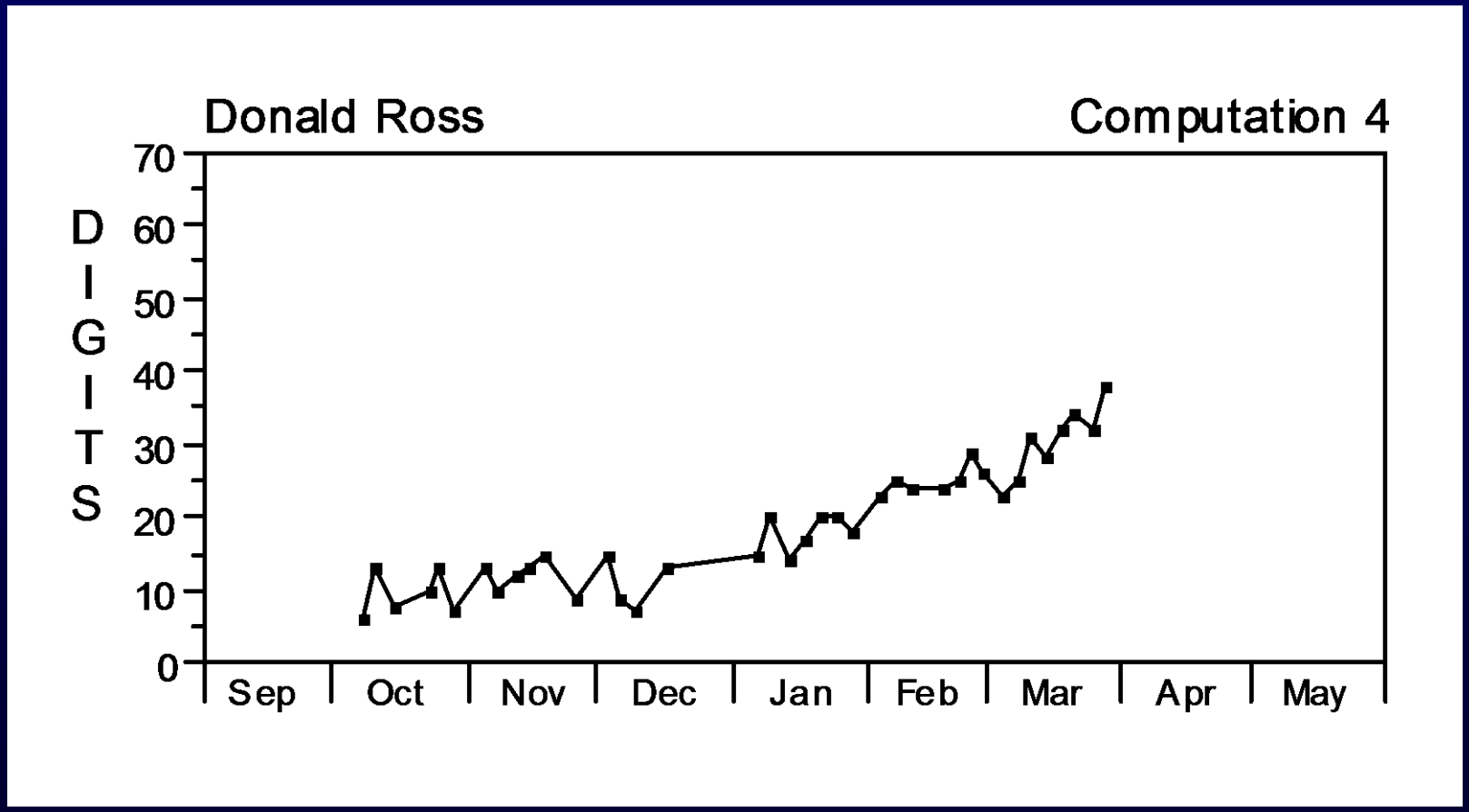
Sheet #2 Computation 4

Password: AIR

Name: _____ Date _____

A $9\overline{)24}$	B 52852 +64708	C 9 x 0	D $4\overline{)72}$	E 8285 4304 + 90
F $6\overline{)30}$	G 35 x 74	H 4 x 5	I 7 x 9	J $\frac{2}{3} - \frac{1}{3} =$
K 32 x 23	L 8 x 6	M $5\overline{)65}$	N $6\overline{)30}$	O $3\frac{4}{7} - 1 =$
P 107 x 3	Q $2\overline{)9}$	R 416 - 44	S $\frac{5}{11} + \frac{3}{11} =$	T 6 x 2
U $4\frac{1}{2} + 6 =$	V 1504 - 1441	W $9\overline{)81}$	X 130 x 7	Y $5\overline{)10}$

Donald's Progress in Digits Correct Across the School Year



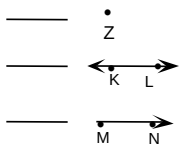
One page of a 3-page CBM in math concepts and applications (24 total problems)

Name _____ Date _____ Test 4 Page 1

Column A — Applications 4 — Column B

(1)

Write the letter in each blank.



(A) line segment
(B) line
(C) point
(D) ray

(2)

Look at this numbers.:

356.17

Which number is in the hundredths place? _____

(3)

Solve the problem by estimating the sum or difference to the nearest ten.

Jeff wheels his wheelchair for 33 hours a week at school and for 28 hours a week in his neighborhood. About how many hours does Jeff spend each week wheeling his wheelchair?

_____

(4)

Write the number in each blank.

3 ten thousands, 6 hundreds, 8 ones

_____

2 thousands, 8 hundreds, 4 tens, 6 ones

_____

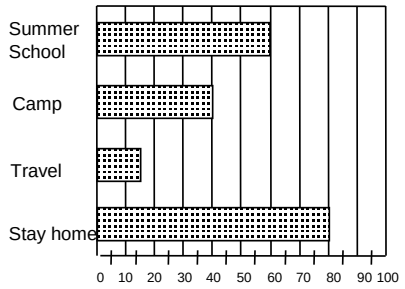
(5)

Write a number in the blank.

1 week = _____ days

(6)

Vacation Plans for Summit School Students



Use the bar graph to answer the questions.

The P.T.A. will buy a Summit School T-Shirt for each student who goes to summer school. Each shirt costs $4.00. How much money will the P.T.A. spend on these T shirts? $ .00

How many students are planning to travel during the summer? _____

How many fewer students are planning to go to summer school than planning to stay home? _____

(7)

To measure the distance of the bus ride from school to your house you would use

(A) meters
(B) centimeters
(C) kilometers

_____

Sampling performance on year-long curriculum for each CBM

- Avoids need to specify a skills hierarchy
- Avoids single-skill tests
- Automatically assesses maintenance/generalization
- Permits standardized procedures for sampling the curriculum, with known reliability and validity
- SO THAT: CBM scores relate well to performance on high-stakes tests

Promising Screener at Kindergarten: Pamela Seethaler's Kindergarten CBM

Group administered

5 minutes

Kindergarten
Computation

Test 1

Name: _____ Date: _____

* * * * ___	* * + * = ___	4 - 2 = ___	Cross out 2 *. * * * * ___
Cross out 4 *. * * * * * * * * ___	* * * * * ___	* + * * * * ___	0 + 4 = ___
2 + 2 = ___	5 - 1 = ___	Cross out 1 *. * * * ___	* + * * * = ___
3 - 3 = ___	Cross out 3 *. * * * * * * * * * * ___	1 + 4 = ___	* * * * * * * * * ___
* * * * + * * = ___	1 + 1 = ___	* ___	5 - 3 = ___

Promising Screener at First Grade: Dave Geary's Number Sets Test

Group administered

3 minutes

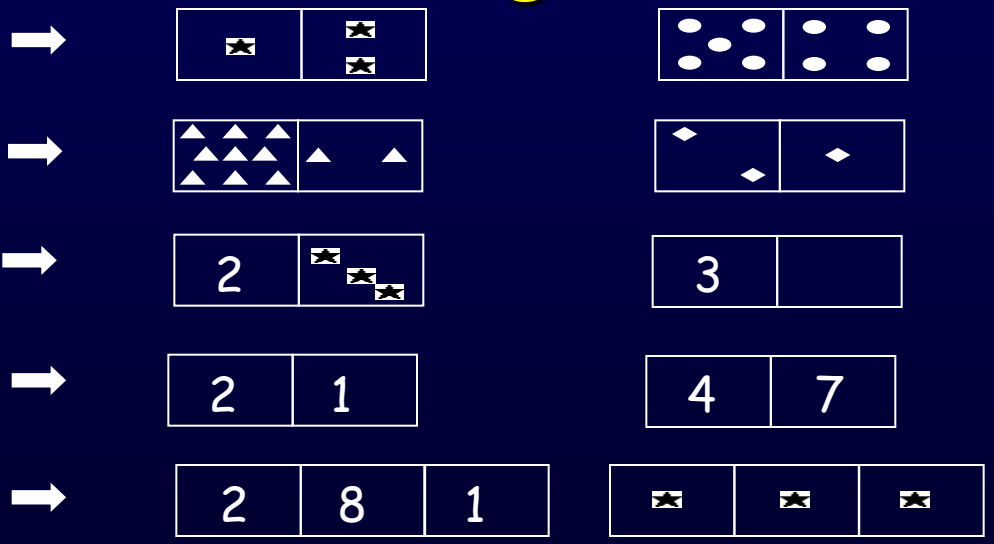
ID _____

Date _____

4

Circle all of the groups that add up to 3.
Work as quickly as you can.

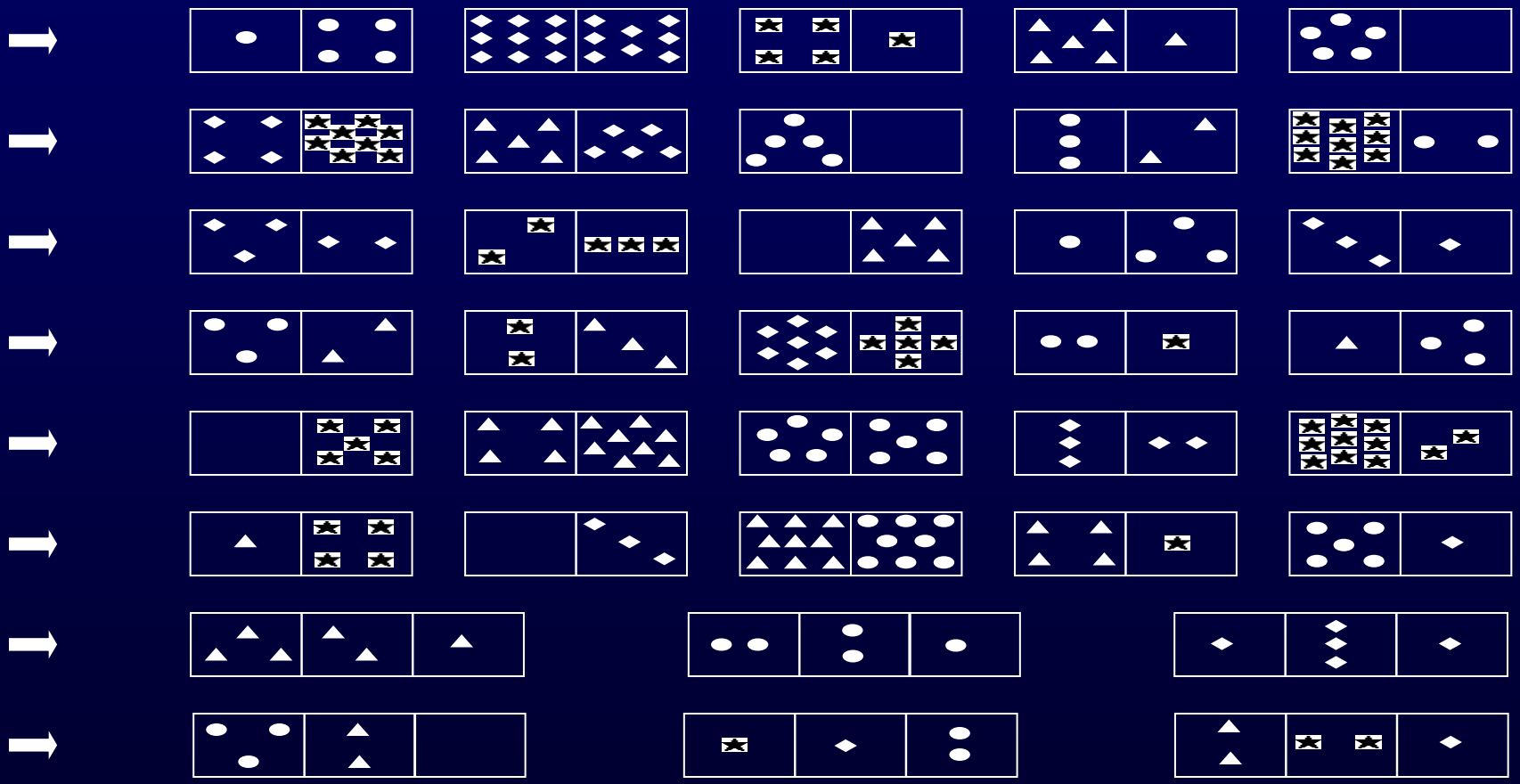
3



ID _____

Circle all of the groups that add up to 5.
Work as quickly as you can.

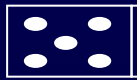
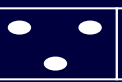
5



ID _____

Circle all of the groups that add up to 5.
Work as quickly as you can.

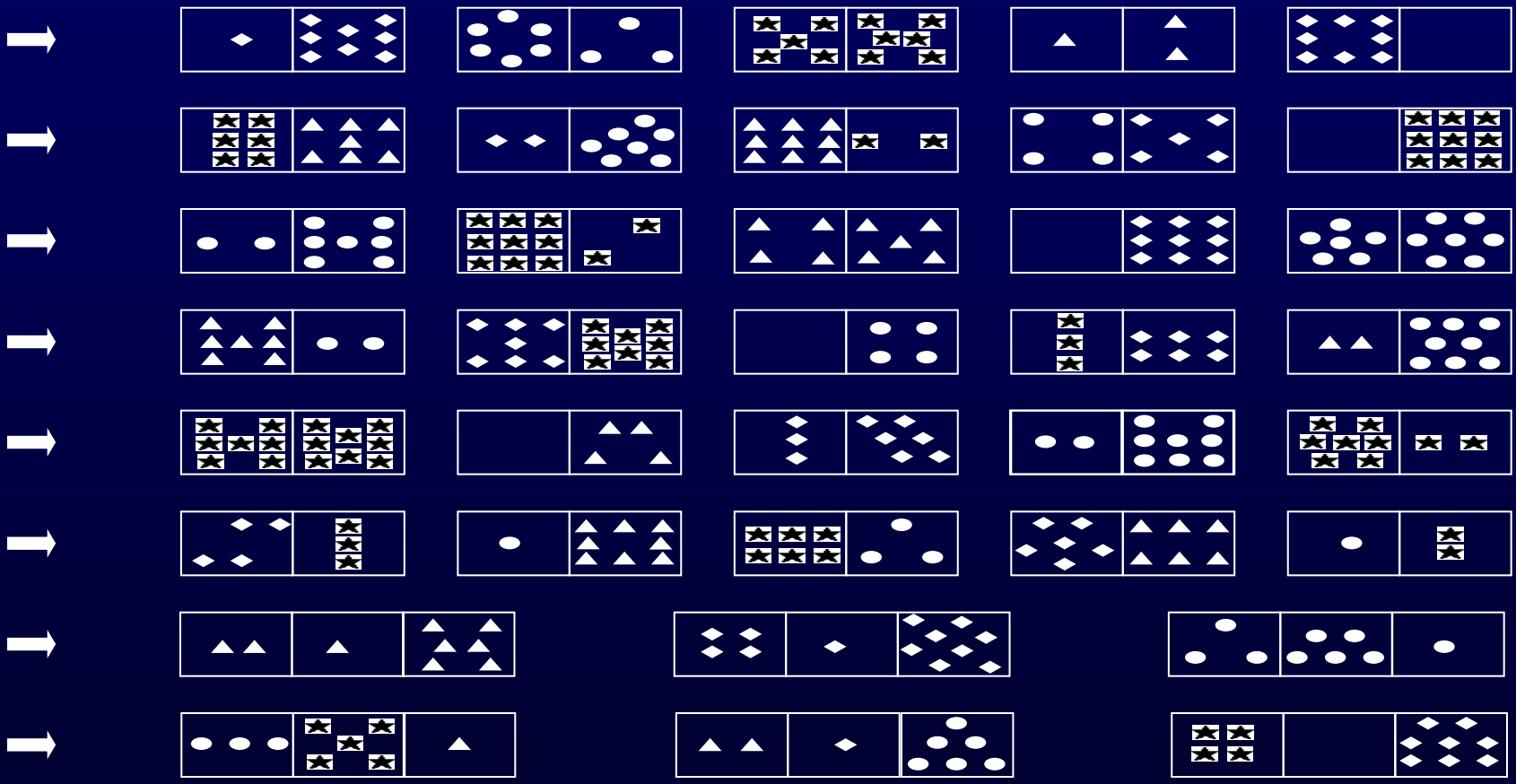
5

→	1	4	9	8	4	1	5	1	5	0
→	4			5		0		2	9	
→	3	2	2	3	7	5	1	3	2	1
→	1		0			8	4			1
→	4	8	5	5	5	0	3	2	9	2
→		2	2			5		1	2	
→	3	2	0		1	1	2		2	2	1
→	0					2					1

ID _____

Circle all of the groups that add up to 9.
Work as quickly as you can.

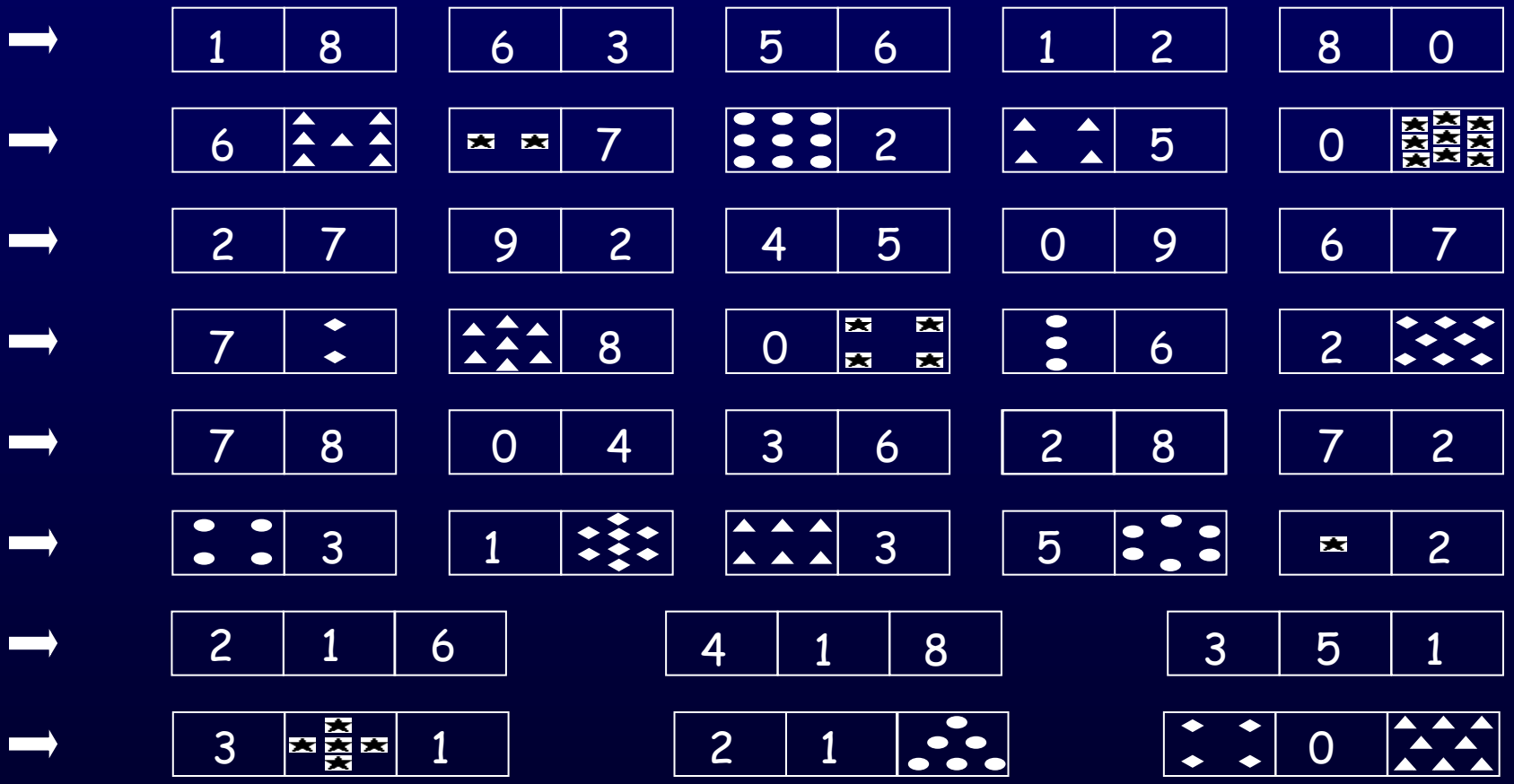
9



ID _____

Circle all of the groups that add up to 9.
Work as quickly as you can.

9



CBM-Based Products and Other Products with Promising Technical Features

- www.RTI4Success.org

TOOLS	AREA	Reliability of the Performance Level Score	Reliability of the Slope	Validity of the Performance Level Score	Predictive Validity of the Slope of Improvement	Alternate Forms	Sensitive to Student Improvement	End-of-Year Benchmarks	Rates of Improvement Specified	Norms Disaggregated for Diverse Populations	Disaggregated Reliability and Validity Data
AIMSweb	Math	●	●	●	●	◐	◐	●	●	No	●
	Oral Reading	●	●	●	●	●	◐	●	●	No	●
	Test of Early Literacy - Letter Naming Fluency	●	●	●	●	●	◐	●	●	No	●
	Test of Early Literacy - Letter Sound Fluency	●	●	●	●	●	◐	●	●	No	●
	Test of Early Literacy - Nonsense Word Fluency	●	●	●	●	●	◐	●	●	No	●
	Test of Early Literacy - Phonemic Segmentation Fluency	●	●	●	●	●	◐	●	●	No	●

Presentation Outline

1. RTI: A Multi-Level Prevention System
2. Primary Prevention: Creating Routines to Differentiate Instruction
3. Secondary Prevention: Standard Protocols for Small-Group Tutoring
4. Assessment: An Essential Component of Primary and Secondary Prevention and at the Core of Tertiary Prevention
5. Tertiary Prevention: Experimental Teaching to Individualize Instruction

Tertiary Prevention Versus Secondary Prevention

- Ambitious, instructional-level goals
- Because student has demonstrated insufficient response to standard forms of instruction at primary and secondary, tertiary prevention is individualized (i.e., nonstandard).
- Requires a highly skilled, knowledgeable teacher. In some RTI schools, this is the special educator.

Tertiary Prevention

- Set ambitious goals
- Begin tertiary prevention with a validated program, but implement more frequently, with longer sessions, with smaller group size.
- Collect progress-monitoring data (CBM) weekly to systematically experiment with instructional components that individually tailor the tutoring protocol to match the student's needs and ensure its effectiveness for that student.
- Use flexible exit/re-entry decisions, based on student progress
  - Rely on tertiary prevention as needed
  - Maximize time in primary/secondary prevention as possible.

Roberto's Case Study

- Roberto developed sizeable math deficits in 1st and 2nd grades despite strong primary and secondary prevention. In November of 3rd grade, he entered tertiary prevention.

- His special education teacher, Mrs. Hayes, set his goal as competent 2nd-grade performance at the end of 3rd grade.
  - Rationale: The 2nd-grade curriculum is transparently connected to the 3rd-grade mathematics curriculum, but includes easier problem types that create the platform for learning the harder, third-grade problems.

Roberto's Case Study: CBM

- Mrs. Hayes used CBM to monitor Roberto's response to tertiary intervention.
- Each CBM test systematically samples the 2nd-grade math curriculum in the same way.
  - Computation: 3 minutes to complete as many problems as he can.
  - Concepts/applications: 6 minutes to complete as many problems as he can.
- Each weekly CBM test is of equivalent difficulty.
- The score on each week's CBM test is an indicator of mathematics competence at 2nd grade.

Computation 2 - Test 1

Name: _____ Date: _____

A 30 + 7	B 8 + 7	C 12 - 3	D 15 - 5	E 5 4 + 2
F 10 - 7	G 35 - 6	H 11 - 6	I 55 - 33	J 32 41 + 23
K 14 + 9	L 64 + 16	M 16 - 8	N 9 + 7	O 7 + 7
P 50 - 5	Q 83 - 67	R 254 - 20	S 5 + 3	T 15 - 7
U 30 + 32	V 6 - 5	W 4 + 6	X 12 - 6	Y 8 + 9

Name _____ Date _____ Test 1 Page 1

Column A

Applications 2

Column B

(1)

Counting by 2's, fill in the blanks.

32, 34, 36, _____, _____

(2)

Write a number in each blank.

Of these numbers,

346 332 798

_____ is the smallest.
_____ is the largest.

(3)

Look at this group of numbers.

1 2 3 4 5 6 7

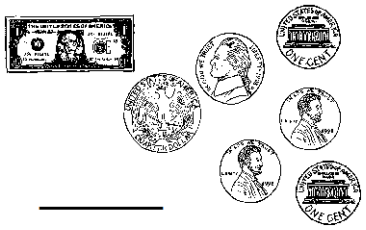
8 9 10 11 12 13 14

15 16 17 18 19 20

Write the sixteenth number. _____
Write the eleventh number. _____
Write the eighteenth number. _____

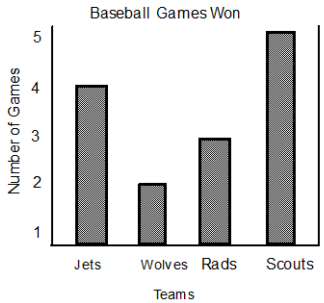
(4)

How much money?



_____

(5)



Write a number in each blank.

How many games did the Jets win? ____

How many more games did the Jets win than the Rads? ____

How many fewer games did the Wolves win than the Scouts? ____

(6)

Write the number in the blank.

5 + 11 = _____ + 5

Name _____ Date _____ Test 1 Page 2

Column C — Applications 2 — Column D

(7)

Counting by 3's, fill in the blanks.

60, 63, 66, _____, _____

(8)

Number of Hours Bill Watches T.V. on School Days.

Monday	D D D
Tuesday	D
Wednesday	D
Thursday	D D

Each D means 2 hours

Write the number in each blank.

How many hours does Bill watch T.V. on Tuesday? _____

How many more hours does Bill watch T.V. on Thursday than on Tuesday? _____

How many hours does Bill watch T.V. on Tuesday and Wednesday together? _____

(9)

Write **+** or **-** in the blank.

4 ____ 5 = 9

(10)

Write the number in the blank.

____ + 3 = 3 + 7

(11)

Write the letter of the matching fraction in each blank.

____ 

____ 

____ 

(A) 1/3

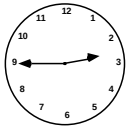
(B) 1/10

(C) 1/5

(D) 1/4

(12)

Write the time.



___ : ___

Name _____ Date _____ Test 1 Page 3

Column E — Applications 2 — Column F

(13)

Write the answer in the blank.

Norris biked to the candy store and spent 67¢ on candy. Lynn walked to the store and spent 98¢. How much more did Lynn spend on candy than Norris?

_____

(14)

December

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Christmas Play

Write the letter in the blank.

The Christmas play falls on which day of the week?

(A) Monday
(B) Friday
(C) Wednesday

_____

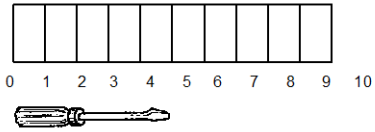
(15)

Write + or - in the blank.

8 ____ 4 = 4

(16)

How long is the screwdriver?



_____ units

(17)

Write the answer in the blank.

Jim found 6 empty coke cans in the park. Sally found 11 empty coke cans. How many empty coke cans did Jim and Sally find?

_____

(18)

Fill in the blanks.

618 =

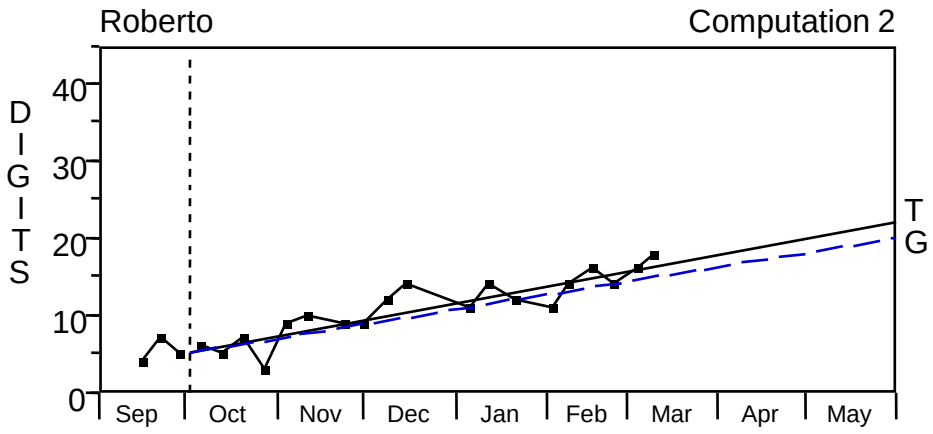
_____hundreds _____tens _____ ones

Roberto's Case Study: The Initial Program

- When Mrs. Hayes assumed responsibility for Roberto's math tertiary intervention, she decided to use the validated protocol Pirate Math, but more intensively: 45-minute sessions 5 days per week.

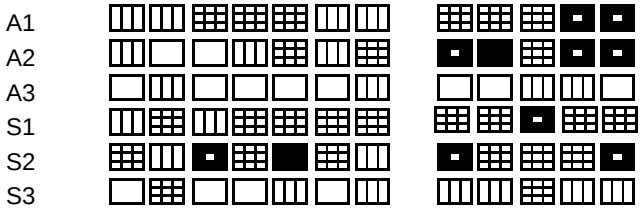
Roberto's Case Study: IEP Goal Setting

- After 3 initial CBM testings, Mrs. Hayes calculated baseline.
- She decided that her year-end goal for Roberto would require a weekly increase of .5 digits for computation and .6 points for concepts/applications (CBM norms).
- Year-end goals (25 weeks later):
  - 18 digits correct on CBM computation
  - 18 points correct on concepts/applications.
- She drew these goals onto Roberto's graphs.
- She connected Roberto's baseline scores with the year-end goals to show the goal lines (desired weekly rates of improvement).



OK!! Raise the goal.

The 4 most recent scores are above the goal line.

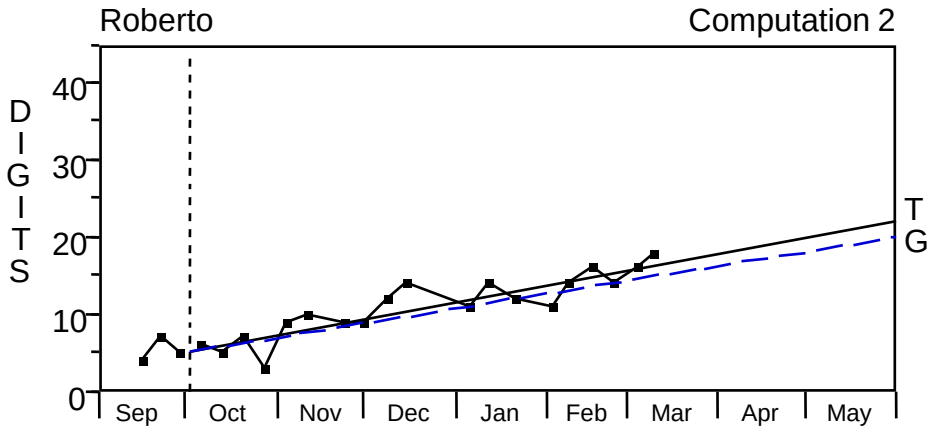


Roberto's Case Study: How Did Roberto Do?

- Ten weeks later, Mrs. Hayes drew lines of best fit through Roberto's actual CBM scores and compared these trend lines to the goal lines.

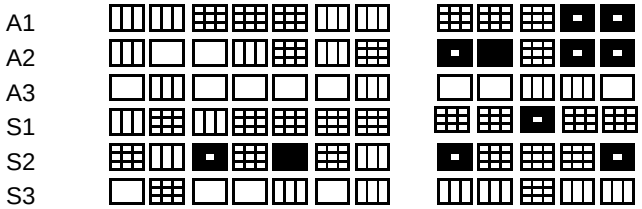
- The CBM data showed that Pirate Math was producing strong computation growth for Roberto.

- Roberto's actual rate of improvement was steeper than the goal line. She increased the computation goal and continued weekly progress monitoring.



OK!! Raise the goal.

The 4 most recent scores are above the goal line.



Roberto's Case Study: How Did Roberto Do?

- By contrast, Roberto's progress on concepts/applications was inadequate.

- His actual rate of improvement was dramatically less steep than the goal line, indicating he was growing slower than hoped and was unlikely to achieve his year-end goal.

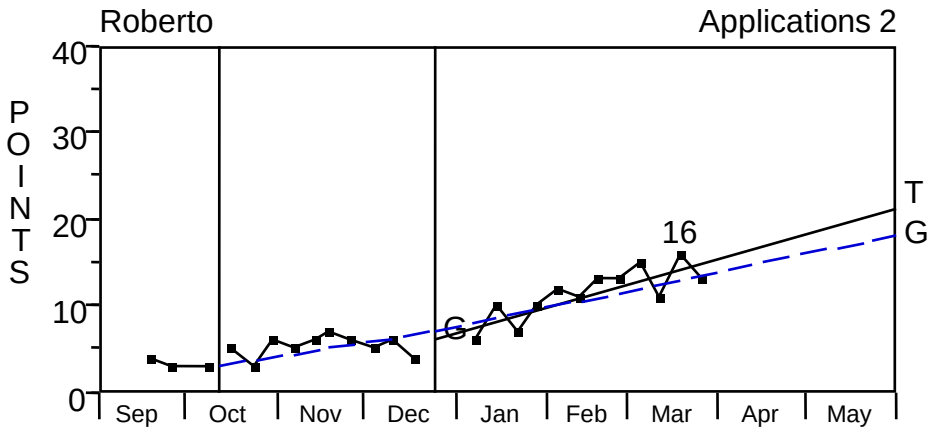
Roberto's Case Study: Individualizing the Program

- Mrs. Hayes modified Pirate Math.
- She considered Roberto's performance during tutoring and reviewed his performance on the CBM concepts/applications word problems.
- She determined Roberto was having difficulty differentiating problem types when irrelevant information occurred in problems.

Roberto's Case Study: Individualizing the Program

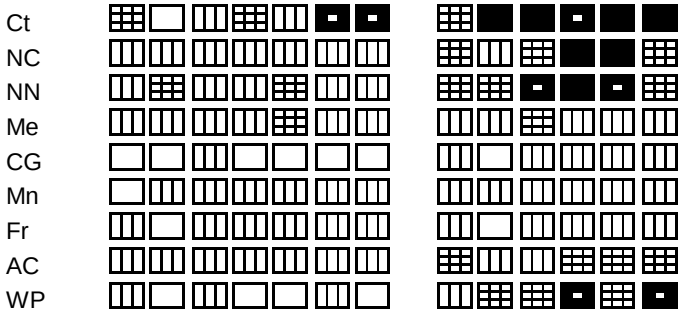
- Mrs. Hayes revised Pirate Math by
  - Adding instruction on mixed problem types
  - Lengthening the problem-type sorting activity
  - Adding instructional time on irrelevant information

- This revision in the intervention is signified on Roberto's CBM concepts/applications graph with the solid vertical line.



OK!! Raise the goal.

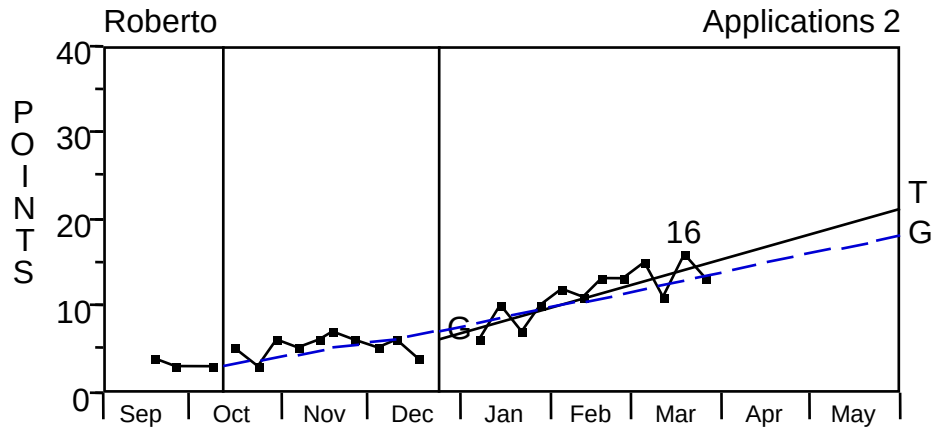
Student's rate of progress exceeds the goal line



Roberto's Case Study: Individualizing the Program

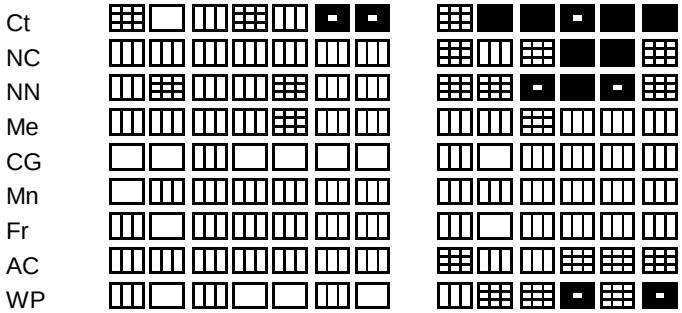
- As she implemented this revision, Mrs. Hayes continued to monitor Roberto's responsiveness using weekly CBM concepts/applications tests.
- Roberto's learning, as shown in the new trend line improved and was now steeper than the goal line. Mrs. Hayes then increased Roberto's concepts/applications goal.

Teachers use CBM in this formative, inductive way to design individualized instructional programs to improve outcomes for individual students.



OK!! Raise the goal.

Student's rate of progress exceeds the goal line



Exiting Tertiary Prevention (with ongoing PM)

- CBM is also used to quantify response.
- On the basis of level and slope, decisions are made about when to exit tertiary prevention.
- Goal is to return students to primary or secondary prevention as soon as possible, but weekly CBM continues so that students return to tertiary prevention as frequently and for as long as needed to ensure strong outcomes.

Tertiary Prevention: Determining Response in Math

Grade	Computation		Concepts and Applications	
	> Slope	**> End level**	**> Slope**	**> End level**
Grade 1	> 0.50	> 20 digits	> 0.40	> 20 points
Grade 2	> 0.40	> 20 digits	> 0.40	> 20 points
Grade 3	> 0.40	> 20 digits	> 0.70	> 20 points
Grade 4	> 0.70	> 20 digits	> 0.70	> 20 points
Grade 5	> 0.70	> 20 digits	> 0.70	> 20 points
Grade 6	> 0.70	> 20 digits	> 0.70	> 20 points

Note: These figures may change pending additional RTI research.

In Sum …,

- RTI is a promising framework for preventing the serious negative consequences associated with exiting school without the skills need to succeed in life.
- Assessment, usually in the form of CBM, is a critical component of RTI.
- Intervention occurs within the context of a multi-level prevention system. Schools classify their interventions as primary, secondary, and tertiary.
- Each level is distinctive in terms of intensity.
- A common RTI framework, with clearly distinguishable levels of intensity, fosters better communication among practitioners as they build and implement their RTI systems.

Assessment and Intervention Resources

www.rti4success.org

- Screening Tools Chart
- Progress Monitoring Tools Chart
- Tiered Intervention Tools Chart (coming soon)

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