

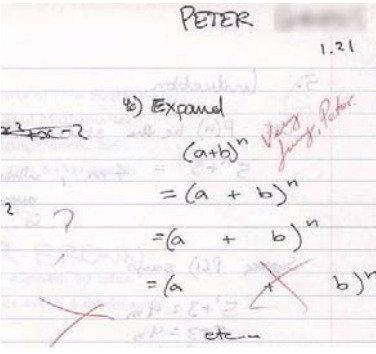
 **Response to Intervention & Research-Based Tiered Math Instruction**

www.enumeracy.com
www.scottmethe.com

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 Psychology Department
 School Psychology Program
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 **What are the potential problems that arise from poor performance in early mathematics?**

3. Find x.


Here it is X O

OH NO!!

A Bit About Me


Very Important Point!

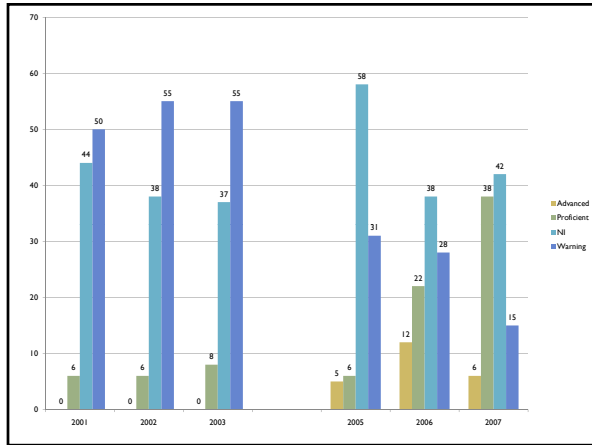
- School psychologist, a.k.a., learning mechanic
- Professor at ECU in School Psychology
- Run “School Support Division” of the CCRSP
- Maintain www.enumeracy.com
- Training at the University of Massachusetts

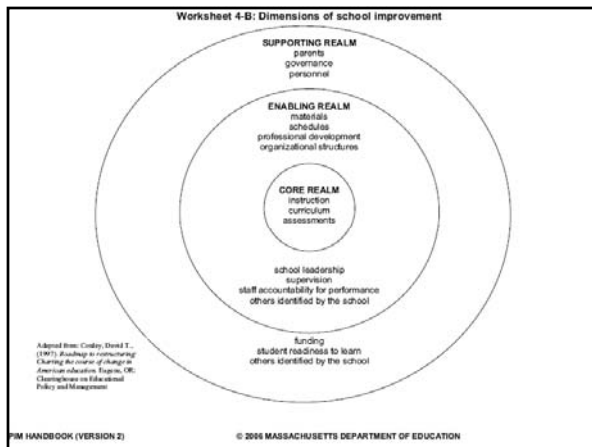



How I Got Here

- 1992 – Saw “Silence of the Lambs,” and dreamed of working for the FBI’s “Behavioral Science Unit.”
- 1999 - graduate school: told to “norm the school”
- 2002 - Began research and dissertation work on early math assessment.
- 2002 – Let go of dream of working for the FBI
- 2004 - Hired as a math and reading consultant for a school undergoing Coordinated Program Review
- 2003-2005 - Developed, delivered, and trained staff on math interventions and assessment.










What does it mean to do the
Right **T**hing?

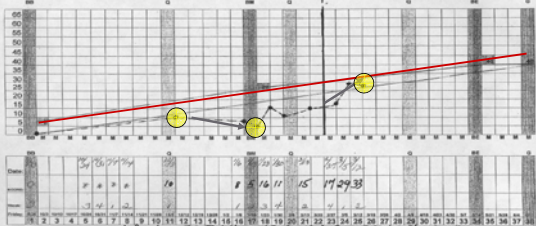


First...
Do Something!



Then...
Make Sure it Works!

Curriculum-Based Monitoring of Number Naming Fluency





What is an Intervention?

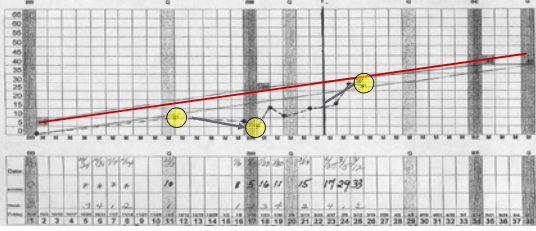
- **Something you do...**
to alter a **fixed educational trajectory**
- Two critical components:
 - Action
 - Evidence



Evidence: Use Valid Measures

- EN-CBM “General Outcome” approach
 - Tests of Early Numeracy (www.aimsweb.com)
 - Useful in screening, progress monitoring, goal setting, IEP writing, etc.
- Sub-Skill Mastery approach
 - Quicker “terminal points”
 - Should be linked directly to curricular objectives
 - Utility for diagnosing skill breakdown and monitoring progress in the short term

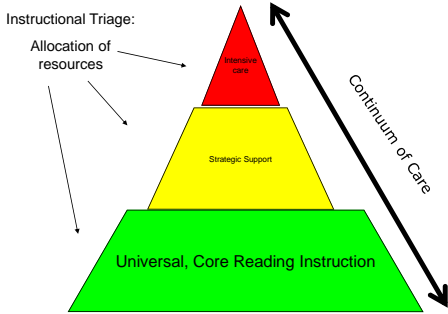
Curriculum-Based Monitoring of Number Naming Fluency

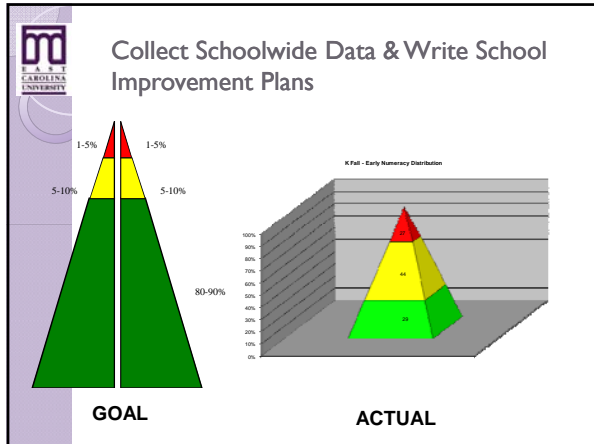


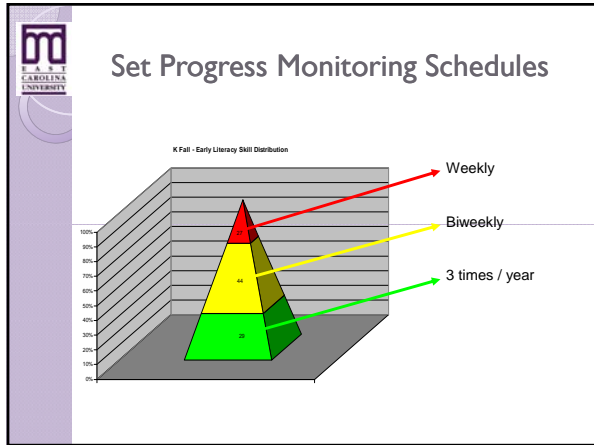


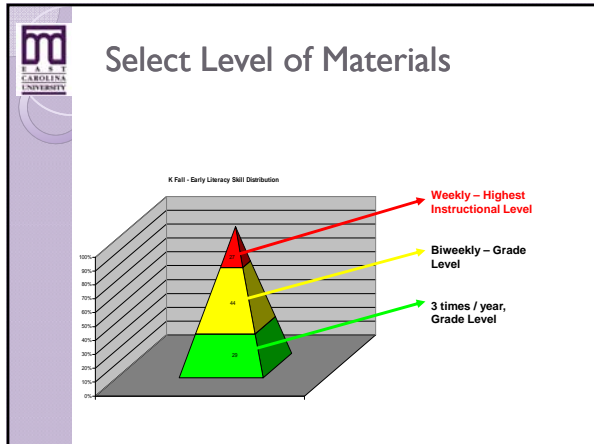
- Did a team do something? Yes.
 - Did it work? Yes.
 - Do we stop there? No.
-
- Now that we know how to do the right thing, let's look at the multiple tiers of RTI.

Structured Service Model





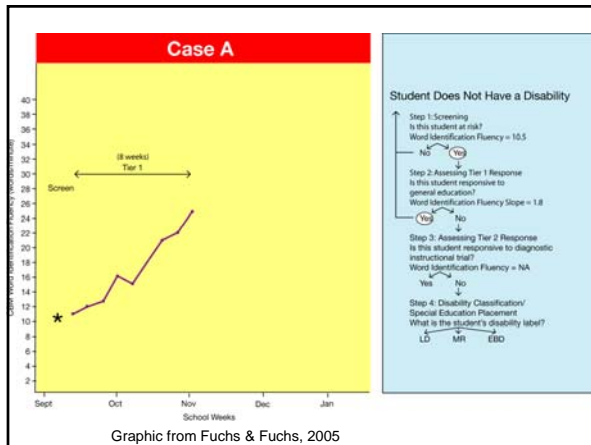


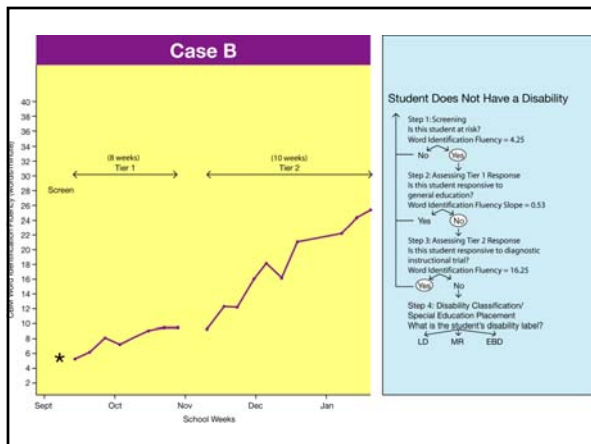


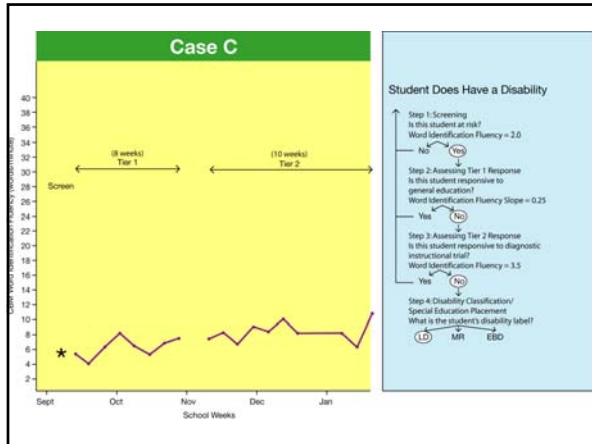


Now, Begin to Focus on Individuals

- Let's look at three kids
- All three begin the year with identifiable problems, and below performance standards.







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If this is RTI, there are a few things we need to do it right...

- Check our own ideas about **learning & goals of schooling**
 - Whatever happened to the "elements" or "grammar?"
- Understand the **"amino acids"** of math ability
- Adopt a **valid and multipurpose assessment system**
 - Measures have demonstrated reliability, validity, developmental and instructional sensitivity
 - Measures used for screening, progress monitoring, and instructional planning.
- Identify and select **research-based multi-tiered intervention**
 - No matter how good, progress monitoring schedules are critical.

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How Do Human Organisms Learn? (a philosophical and perhaps rhetorical question)

How Do We Know When Humans are Learning? (a practical question)




The Learning Equation

$$OTR + ICF = L$$



Why do Children Fail to Learn?


- Children who show up already knowledgeable and skillful rarely struggle.
- Prior knowledge & skills are key
- The #1 Rule of the Effective Instructor:
 - Children only fail to learn when I fail to instruct



Why Do Children Fail to Learn?


1. They do not want to do it.
2. They have not had enough practice doing it.
3. They have not had enough help learning it.
4. They have not seen it done that way before.
5. It is too difficult.

from Daly, Martens, Witt, & Dool, 1997



What are keys to instruction for children who struggle?

1. Knowledge of the BIG THREE
2. Knowledge of how to stack the odds in your favor: the FOURTH!




Learning Hierarchy

Generalization

Maintenance


Fluency

Acquisition




	Entry Level	Acquisition Initial Advanced	Proficiency	Maintenance	Generalization	Adaption
Low-to-high rates of progress	No or low frequency	0 to 25%	High rate and accuracy	High rate and accuracy	Transfer to new settings	Capitalize on knowledge
		65% to 80%				
AIM		Accuracy (90-100%)	Fluency (desired rate)	Retention	Expansion	Extension

Adapted from Teaching the Learning Disabled, 6th Edy D. D. Smith, 1981, Englewood Cliffs, NJ: Prentice Hall.




Generalization: The Big Goal

- What does it really mean to generalize?
 - Across settings, prompts, similar tasks
- Consider a basic teaching task:
 - [Linking numbers with dots](#)
 - Does this automatically translate to “give me [show number 4] tokens?”



The Amino Acids of Early Mathematics

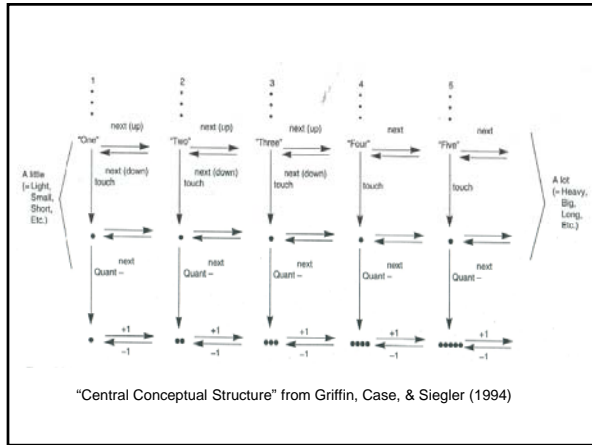


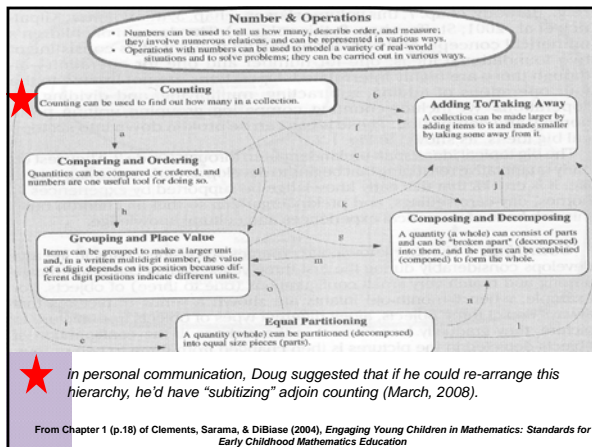
Early Math = Numeracy

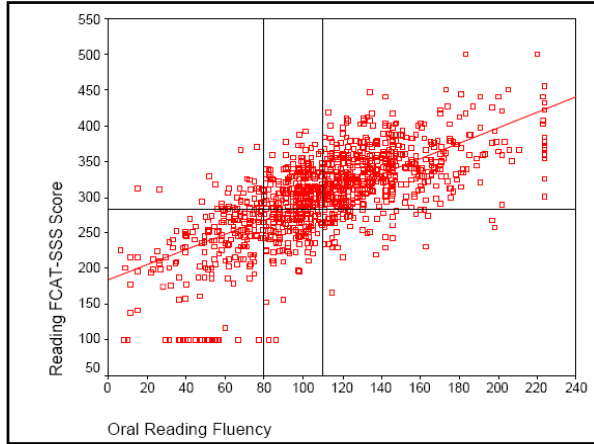
- Be a Mesopotamian Shepherd (Gazale, 2000)
- Number Sense (NCTM, 2006)
- Awareness of what a numeral represents
- $5 + 7 =$ $14 + 8 =$ $9 + 12 =$
- $26 + 16 =$ $38 + 17 =$

Big Ideas:
<http://reading.uoregon.edu>










Available Early Math Measures
(measures in bold show potential for Tier III diagnosis)

- www.aimsweb.com
 - Oral Counting
 - Number Identification (unsure if measures math ability)
 - **Quantity Discrimination**
 - Missing Number
 - Addition and Subtraction Basic Facts (excellent early GOM)
- www.enumeracy.com
 - **Ordinal Position Fluency**
- www.interventioncentral.org
- www.progressmonitoring.net
 - **Quantity array**
- rgfloyd@memphis.edu
 - **One-to-one correspondence counting fluency**

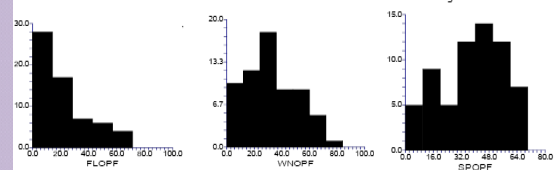
Ordinal Position Fluency


Stimulus Sheet →


Task Measures: Rapid, automatic recognition and production of ordinal sequence
Assumes: Development of counting schema (cardinality, ordinality)

 **Ordinal Position Fluency Results**

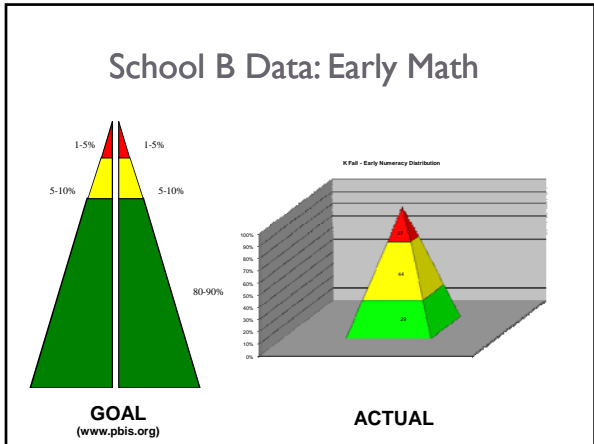
- Reliability above .88
- Validity above .77
- Indices of discrimination above .80
- Sensitive to development

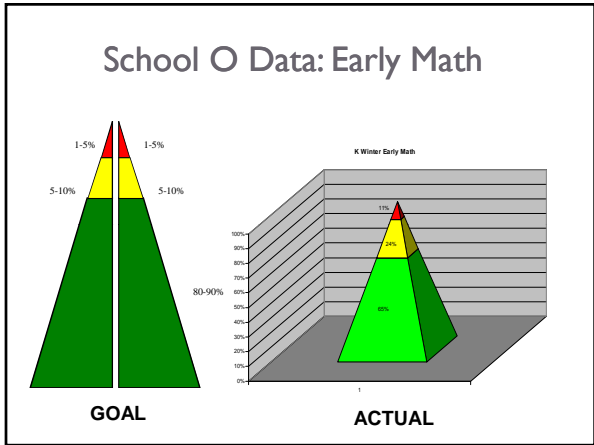



 **Video of Early Numeracy Assessment**

 **Screening**

- Broad, general look at groups and individuals.
- Purpose: identify risk status
- Method: Choose measures and compare student performance to norm









Toward Systematic Treatment:

Progress Monitoring




Writing Objectives: 4 Key Points

- **Broad Goal: Enhance early math skills**
- **PLEP**
 - When administered a test of quantity discrimination fluency, Phil is able to produce 16 correct units with 5 median errors with 3 alternate forms.
- **Objective**
 - In 12 weeks, when administered QDF, Phil will produce 29 correct units with less than 3 errors over a period of 3 separate assessment sessions on different days.



Choosing Comparison Points

1. **Established benchmarks**
 - Performance standards
 - National samples
2. **Local normative data**
 - Based on large screening sample from your schools
 - General target: 50th percentile
3. **Growth rates**
 - Useful when beginning later in year



Local Normative Data

- Most useful and recommended approach
- Using percentile ranks for grade level:
 - Liberal recommendations (more children identified):
 - Low risk – at or above 25th
 - Some risk – between 16th and 34th
 - High risk – between 0 and 15th
 - Conservative recommendations (less children id'd):
 - Low risk – at or above 25th
 - Some risk – between 11th and 24th
 - High risk – between 0 and 10th



Growth Rates

- Available at www.aimsweb.com
- For all members of the sample, typical improvement gains from week to week.
- Will differ by educational designation (e.g. regular v. special ed).

Grade	UCPM per week	
	Aimsweb	Average*
1	1.2	2.10
2	1.1	1.46
3	0.9	1.08
4	0.8	.84
5	0.8	.49
6	0.7	.32

*(Adapted from Fuchs, Fuchs, Hamlett, Walz, and Germann, 1993 p. 34)



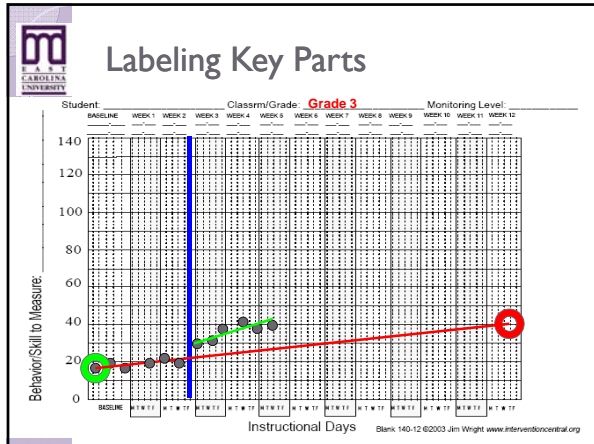
Completing a Graph

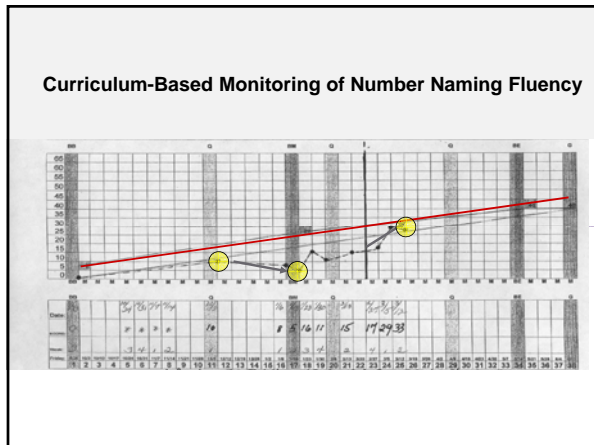
- Make one.
- The most critical part of school improvement
- Standardize the graph across the school, district.



Graph is Not Complete Without:

- Screening point
- Baseline
- Target / Goal
- Aimline
- Trendline
- Phaseline

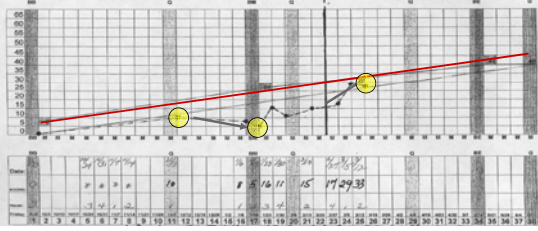





Treatment

- Not treatment unless accompanied by **progress measures**
- Treatment is also “something you do” but typically implies content-focused time in acquisition then fluency with key skills

Curriculum-Based Monitoring of Number Naming Fluency





Step I: Program Planning

Director and Lead Teacher Reviewed & Aligned

- NC Standard Course of Study
- Numberworlds Program
- Research-Based Recommendations

Director and School Principal Selected Students

- Each month, teachers asked to turn in list of names for concerns in math or reading
- Randomly selected 18
- Mix of supplementary (tier II) and intensive (tier III)

East Carolina University & The Department of Psychology - Number Sense Unit Overview - Kindergarten Intervention Program

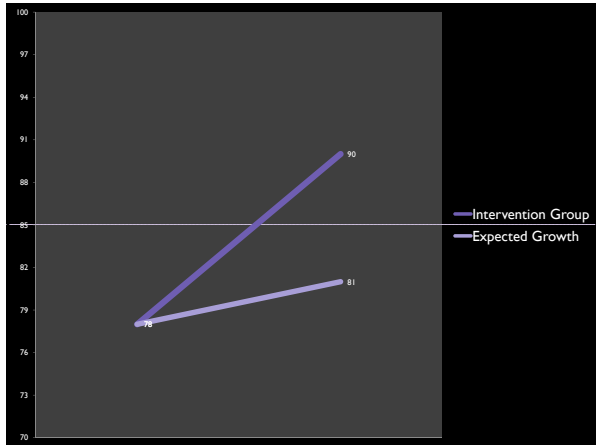
Section	Objectives*	Warm-Up**	Activity** <small>(Discussion of activity to students follows)</small>	Skill Area***
#1-#14	1.01 Develop number sense for whole numbers through 10 (a-g)			
#1	a. A concrete model, number word (orally), and number using a variety of representations	Object Lead 1 - Count Up Purpose: helps students learn number	Object Lead 1 - Watch Listen and Count Purpose: helps students learn that each number is associated with an object, list number and identifies a set	Counting
#2	a. A concrete model, number word (orally), and number using a variety of representations	Object Lead 2 - Blanket Purpose: give opportunities to practice counting backward, lays foundation for subtraction	Object Lead 4 - Matching Colors and Quantities Purpose: helps extend students' knowledge of number concepts from concrete objects to 2-D images (dot - sets)	Counting
#3	b. Count objects in a set	Lead Lead 6 - Count Up Purpose: helps students learn order of numbers associate with moving forward	Object Lead 14 - Tappet and Chopping Purpose: gives concrete example of set size by performing and action sequence that corresponds to the size of the set/ explore dot-set patterns and set size	Counting
#4	b. Count objects in a set	Picture Lead 4 - Blanket Purpose: teaches that counting backward by one unit and subtraction use object from a set yield equivalent results	Picture Lead 16 - Dig and Blow Purpose: helps children make transition from counting objects to counting set representations of familiar objects	Counting
#5	c. Read and write numerals	Picture Lead 5 - Name That Numeral Purpose: builds numeral recognition skills	Picture Lead 19 - Beroo Purpose: helps students to compare numerals	Counting

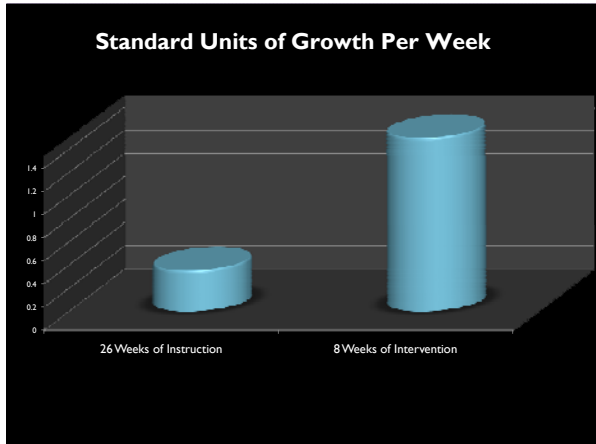
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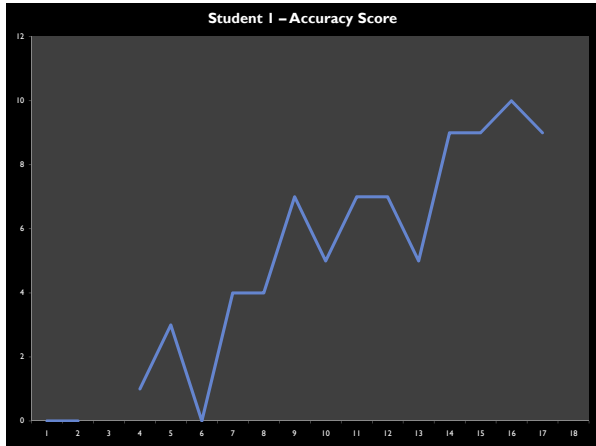
#6	c. Read and write numerals	Picture Lead 5 - Name That Numeral Purpose: helps children learn to recognize numerals	Picture Lead 17 - Concentration Purpose: helps students connect their knowledge of counting and patterns with numerals	Counting
#7	d. Compare and order sets and numbers	Circle Lead 11 - Count Up Purpose: shows children that numbers can be used for measurement and counting	Object Lead 3 - Using the Sorting Mats Purpose: helps students practice comparing sets of object to identify which sets have more, less, or the same amount	Comparing and Ordering
#8	d. Compare and order sets and numbers	Sky Lead 10 - Bear Cuts Purpose: helps children develop a foundation for subtraction	Object Lead 13 - 2 - D Count and Compare Purpose: allows students to understand how to make comparisons between sets of different sizes	Comparing and Ordering
#9	e. Use ordinals (1 st - 10 th)	Lead Lead 8 - Count Up Purpose: reinforces association between moving forward on a number line and counting up	Picture Lead 20 - Sequencing Purpose: helps students build an understanding of the position of each animal in the number sequence	Comparing and Ordering
#10	e. Use ordinals (1 st - 10 th)	Sky Lead 10 - Blanket Purpose: helps students learn applications for the reverse counting sequence	Lead Lead 23 - Position on the Number Line Purpose: helps children learn the position of each number	Comparing and Ordering
#11	f. Estimate quantities fewer than or equal to 10	Lead Lead 8 - Line Up Purpose: helps students identify or compare set size	Object Lead 12 - Mouse in the Cookie Jar Purpose: helps children to strengthen ability to count a set of objects and compare amounts	Comparing and Ordering
#12	f. Estimate quantities fewer than or equal to 10	Lead Lead 9 - Count Up Purpose: reinforce students' knowledge of the counting sequence	Object Lead 10 - Count and Compare Purpose: challenges students to identify the number of objects in a set	Comparing and Ordering

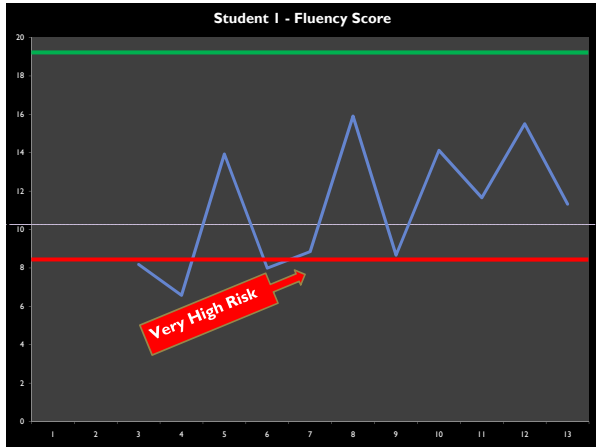
Step 2: Program Implementation

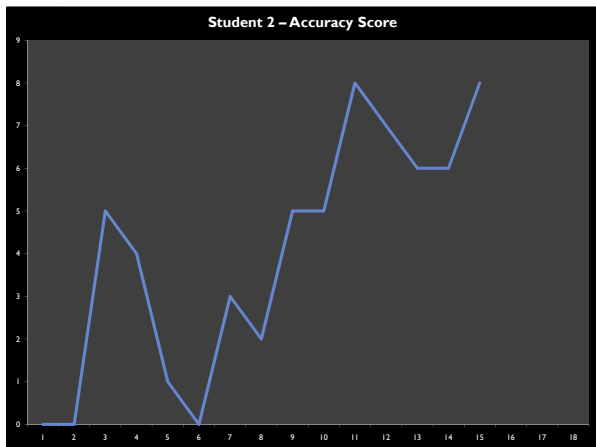
- Settled on "less is more" approach
- Selected 3 groups, 3x per week, 25 minutes per group.
- RESULTS
 - All students demonstrated growth not due to chance or development
 - 5 of 8 students went from below average to average
 - 3 students significantly reduced risk status, going from "impoverished" to just below average.
 - 1 student jumped 2 standard deviations from very poor to average (70 to 94 SS units).

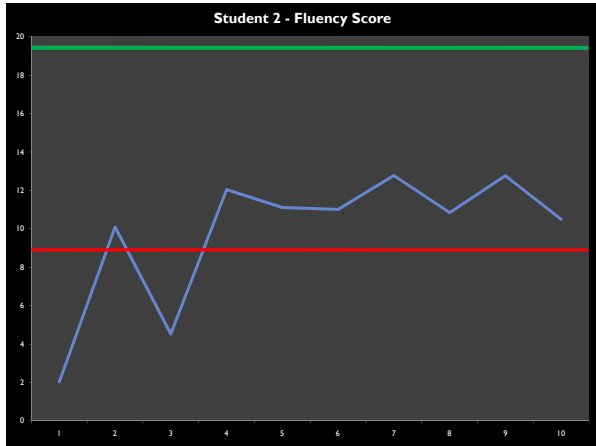


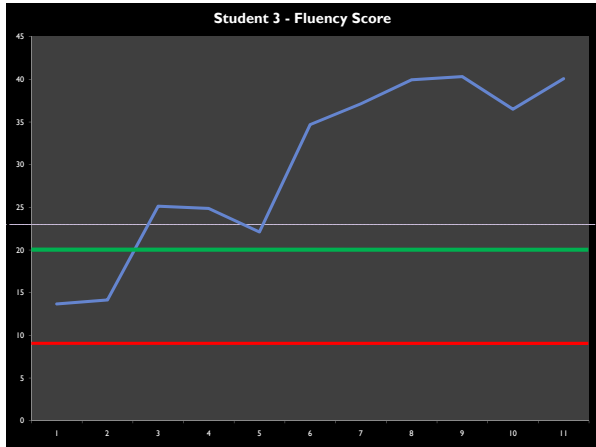


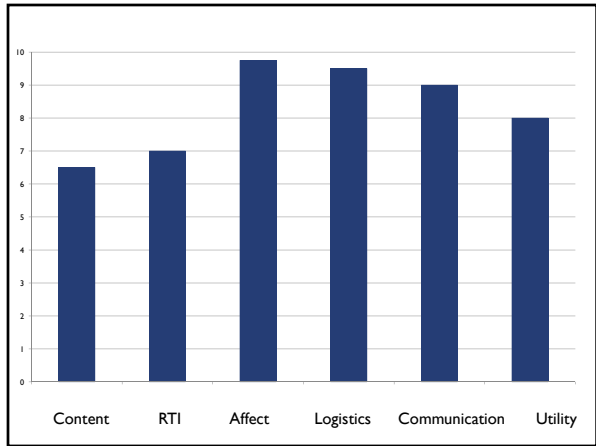















Program Highlights

- Highest Rated Content Items:
 - Improved counting skills
 - Improved automatic naming of small sets
 - Improved knowledge of order and relative size
 - Improved ability to compare quantities
 - Improved numeral recognition
- Highest Rated RTI and Program Effectiveness Items
 - Effective use of student's time
 - Improved accuracy in select skill areas
 - Clearly effective for the student
 - *More agreement on "Noticed a Difference" than on "More Responsive to Classroom Instruction" – however, both rated above 6.5



Resources

- www.ncsip.org
- www.enumeracy.com
- www.interventioncentral.com
- www.gse.buffalo.edu/org/buildingblocks
- www.sranumberworlds.com
- www.studentprogress.org
- www.schoolhousetech.org
- www.progressmonitor.net
