

A Diagnostic/Prescriptive Approach to Reading, Writing, and Mathematics

MASP 2023

Michael D. Hixson, Ph.D., BCBA, Michigan Certified School Psychologist
Central Michigan University
hixso1md@cmich.edu

The Framework: A Diagnostic/Prescriptive Approach

- Two types:
 - **Ability training approach** (Aptitude by treatment): primary concern is the identification of perceptual and/or psycholinguistic abilities or processes which are presumed to cause inadequate skill development.
 - **Task analysis approach**: assessment of academic skill development and instruction tailored to move the child from where he is to where we desire him to be. The emphasis is on component skills and their integration into complex terminal behaviors (skills) rather than the training of test identified "processes" that presumably underlie (cause) skill development. [this is the approach taken in this talk]
- Ysseldyke, J. E., & Salvia, J. (1974). Diagnostic-prescriptive teaching: Two models. *Exceptional children*, 41(3), 181-185.

Good intervention requires good assessment information

	IQ SCORE	
	70	100
2 place add w/ carry		
	IQ SCORE	
	70	100
2 place add w/ carry	NP	NP
2 place add w/o carry	P	NP
Column add	P	NP
Place value	P	NP
Add facts	P	P
Counting	P	P

What is the evidence that the task analysis approach works? How do you know?

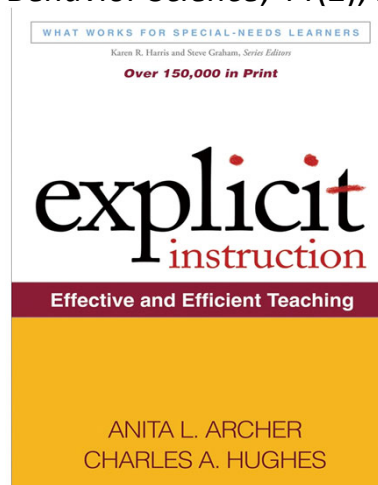
- Research on instructional hierarchy and other research on linking intervention to specific assessment information
 - Instruction linked to where a student is in the instructional hierarchy is more effective
- Research on effective instruction
 - Explicit instruction with a well-designed scope and sequence is more effective
- Research on identifying and teaching prerequisite/component skills
- Logic

Research on instructional hierarchy and other research on linking intervention to specific assessment information

- Maki, K. E., Zaslofsky, A. F., Knight, S., Ebbesmeyer, A. M., & Chelmo-Boatman, A. (2021). Intervening with multiplication fact difficulties: Examining the utility of the instructional hierarchy to target interventions. *Journal of Behavioral Education, 30*, 534-558.
- Preast, J. L., Taylor, C. N., Brann, K. L., Aguilar, L. N., Kilgus, S. P., & Burns, M. K. (2022). Differentiating Academic Behaviors from Academic Skills to Inform Interventions. *Journal of Applied School Psychology, 1-26*.
 - *half of the students were selected based on their reading screening scores (cBM-R), and half were selected based on their behavior screening scores (saeBRs). interventions were provided in a contraindicated fashion. Providing mismatched intervention did not lead to improvements, but the matched interventions increased positive outcomes.*

Research on effective instruction

- Mason, L., & Otero, M. (2021). Just How Effective is Direct Instruction?. *Perspectives on Behavior Science, 44*(2), 225-244
- Research cited in this book:



Logic

- Do we really need to do studies showing that math interventions don't help students low in reading and vice versa?

The Components of the Framework

- Instructional hierarchy
- Task Analysis
- RESA (Retention, Endurance, Stability, and Application)
- Knowledge of each behavior domain (reading, writing, mathematics, social behavior, self-management skills, problem-solving, etc.)

Instructional Hierarchy (Haring & Eaton, 1978)

- **Acquisition stage.** Movement from inaccurate to accurate responding
- **Proficiency stage.** Movement from accurate but slow responding to fast and accurate.
- **Generalization stage.** Generalization of skill to novel conditions
- **Adaptation or application stage.** Application of the skill to solve problems

- Need to think about instruction **and assessment** at each of these levels

Assessment Results of 2nd Grader (simulated but similar to a real case)

- WIAT-4 Standard Scores
 - Word reading = 69
 - Reading Comp = 87
 - Pseudoword decoding = 90 (measures accuracy of phonics skills)
 - Phonemic proficiency = 80
 - Spelling = 73
- Acadience Scores (NWF measures fluency of phonics skills)
 - NWF CLS = 25 (benchmark = 54)
 - NWF WWR = 0 (benchmark = 13)
 - PSF = 25
- Could slowly decode some VC and CVC words but not CVC beginning with a stop sound or CVCC or CCVC words

4th Grade Math Student

- KTEA Math Calculation SS = 89
- CBM digit correct per minute:
 - Addition = 50
 - Subtraction = 32
 - Multiplication = 13 (students math group average score = 35)

We need to provide educational experiences that will:

- Produce fluent performance that produces RESA
 - **Retention.** The skill is retained over time (low likelihood of forgetting). How do we assess and teach that?
 - **Endurance.** Skill is emitted over an extended period of time (what we would want in the real world). What kind of students have trouble with this? How do we assess and teach this?
 - **Stability.** Skill is emitted in the face of distractors (what we would expect in the real world), not just under ideal conditions. What kind of students have trouble with this? How do we assess and teach this? Is the can't do/won't do distinction useful here, maybe not.
 - **Application.** Can the student apply the skill? How do we assess and teach this?
- Need to think about instruction **and assessment** at each of these levels

Task Analysis

- Breaking a skill down into smaller components/prerequisite skills
- How far should you go?
- As far as it takes.
- How far can it go?
- **Far**

Specifically, we need to know:

- **Learned stimulus-response relations**
 - What the student can do when presented with various stimuli
 - E.g., Shown the letter *a*. Student can say the name, say the sound, say what words start with a, say it is the first letter of the alphabet, sing “abc” song, etc.
 - E.g., Shown the word “tiger.” Can read the word, can draw a tiger, can say where tigers live, etc.
 - E.g., Shown the problem. *Mary had 6 apples and wanted to share them fairly (equally) among her two friends and herself. How many apples do each of them get?* Student reads problem, student illustrates the problem with a drawing, student converts the words of the problem into an equation, student solves the problem.
- **Reinforcing/punishing value of stimuli**

Reinforcing/Punishing Value of Stimuli

- What topics does the student show interest in?
- What topics does the student avoid?
- Are books reinforcing or punishing?
- Are the solving of problems reinforcing?
- Are writing activities reinforcing or punishing?

- If particular academic activities are not reinforcing, can you make them more reinforcing?

- Gentilini, L. M., & Greer, R. D. (2021). The effect of the establishment of conditioned reinforcement for reading content on second-graders' reading achievement. *Behavior Analysis in Practice, 14*, 141-160.
 - *These results suggest that a [Collaborative Shared Reading] procedure with a teacher or peer should be considered as a means of increasing the reading achievement of early elementary students via increases in the reinforcement value of reading.*
- Similar results by Greer and colleagues for the development of voice sounds as conditioned reinforcers, the opportunity to engage in math or writing as a reinforcer.

Sometimes very basic discrimination skills are missing

- Choi, J., Greer, R. D., & Keohane, D. D. (2015). The effects of an auditory match-to-sample procedure on listener literacy and echoic responses. *Behavioral Development Bulletin*, 20(2), 186.
- Speckman-Collins, J., Lee Park, H. S., & Greer, R. D. (2007). Generalized selection-based auditory matching and the emergence of the listener component of naming. *Journal of Early and Intensive Behavior Intervention*, 4(2), 412.

Table 2: Auditory Stimuli Used during Instruction on Generalized Auditory Matching

Phase	Exemplars	Non-Exemplars
Sounds vs. Non-Sounds	Laugh, Siren of Fire Engine, Cow Mooing, Sound of A Grasshopper, A Dog Barking	Non-Sound
Five Different Sounds	Laugh, Siren of Fire Engine, Cow Mooing, Sound of A Grasshopper, A Dog Barking	
Five Words vs. Non-Sense Words	Make, Low, Pot, Time, and Cup	Afe and Ipe
Five Words	Make, Low, Pot, Time, and Cup	
Five Sets of Words with Similar Phonetic Structures	Cop, Late, Make, Poppy, Soon	Pop, Bait, Mate, Potty, Moon

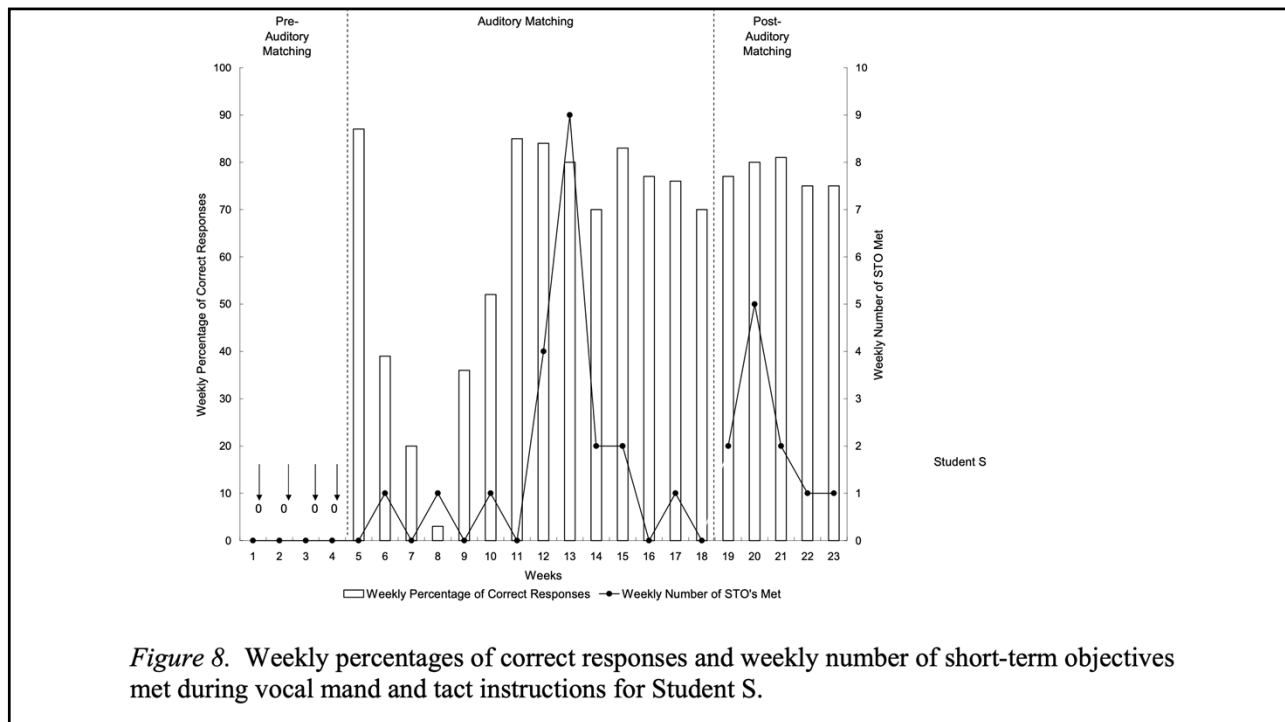
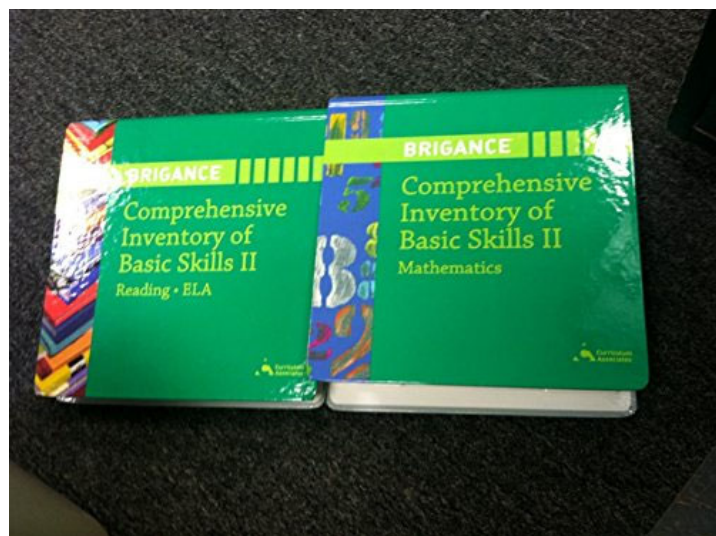
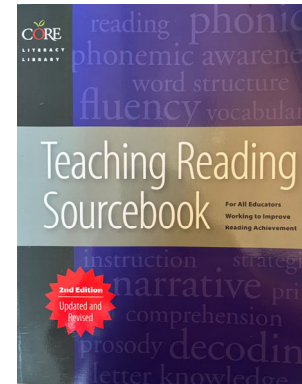
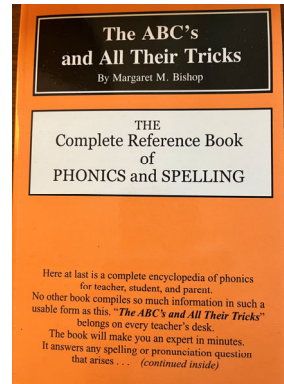
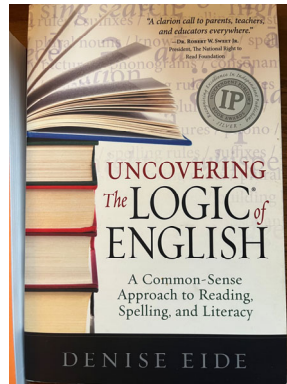
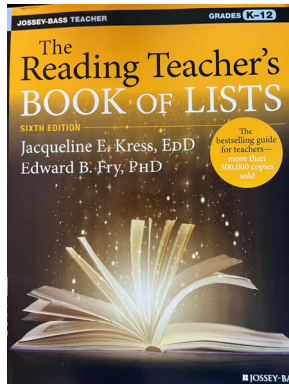


Figure 8. Weekly percentages of correct responses and weekly number of short-term objectives met during vocal mand and tact instructions for Student S.

Many options for identifying skills to teach in reading, mathematics, and writing



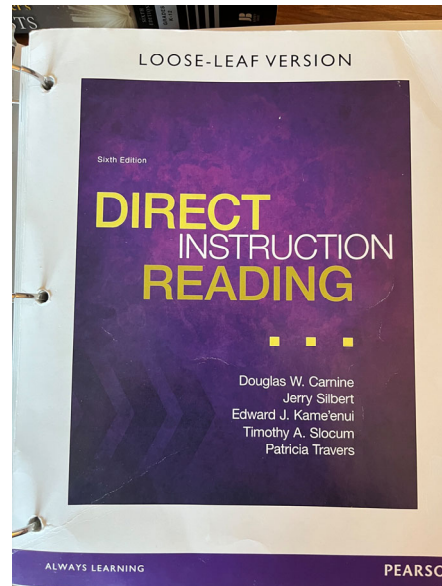
Reading



Acadience Reading Diagnostic

- <https://acadiencelearning.org/acadience-reading/diagnostic/>

I'll focus on
this



Why?

- Includes just the most basic assessments
- Includes teaching scripts and instructional techniques from phonemic awareness to critical reading and content-area reading

Phonological Awareness Skills to Assess and Teach (not in book)

- *Base instruction on individual needs and requirements of curricula. Multiple levels may be targeted at the same time (e.g., saying phonemes and blending; blending and segmenting, etc.). Different orders may be better for some learners.
1. Says individual phonemes and holds continuous sounds
 2. Blending:
 1. Blend two and three phonemes when heard elongated or individually
 2. Blend two syllables
 3. Blend four phonemes when heard elongated or individually
 4. Blend three syllables
 5. Blends five phonemes

3. Segmenting

1. Say the initial sound of a word
2. Say the last sound of a word
3. Segment two and three phoneme words (can elongate or segment)
4. Segments four phoneme words
5. Segments five phoneme words

4. Deletion

1. Deletes the first phoneme of a simple word
2. Deletes the last phoneme of a simple word
3. Deletes the first syllable of a word
4. Deletes the last syllable of a word
5. Deletes a middle phoneme

5. Substitution

1. Substitutes an initial phoneme
2. Substitutes a final phoneme
3. Substitutes a middle phoneme

If acquisition of PA skills is slow, then may need to assess and teach

- **Auditory match to sample**
 - Speckman-Collins, J., Lee Park, H. S., & Greer, R. D. (2007). Generalized selection-based auditory matching and the emergence of the listener component of naming. *Journal of Early and Intensive Behavior Intervention*, 4(2), 412.
 - Halbur, M., Kodak, T., Williams, X. A., Reidy, J., & Halbur, C. (2021). Comparison of sounds and words as sample stimuli for discrimination training. *Journal of Applied Behavior Analysis*, 54(3), 1126-1138.
- **Establish voice sounds as conditioned reinforcers**
 - Greer, R.D., Pistoljevic, N., Cahill, C. and Du, L. (2011) Effects of Conditioning Voices as Reinforcers for Listener Responses on Rate of Learning, Awareness, and Preferences for Listening to Stories in Preschoolers with Autism. *The Analysis of Verbal Behavior*, 27, 103-124.

Some other Phonological Awareness Measures

- Acadience Readig PSF. Fluency measure of phonemic awareness
- Phonological Awareness Screening Test (PAST). Accuracy and fluency. David Kilpatrick <https://thepasttest.com>
- Many general achievement tests include a measure of phonological awareness
 - E.g., WIAT. Phonemic Proficiency (fluency measure)
- Comprehensive Test of Phonological Processing
- And many others
- ***Helpful to get a comparison of child to peers and what specific PA skills student does and does not demonstrate

Phonics Skills to Assess

1. Basic phonics: e.g., letter-sound relationship of single letters
2. Different word types: CVC, CVCC, CCVC, etc.
3. Advanced phonics: Letter combinations and word parts: digraphs, diphthongs, prefixes, suffixes, etc.

Basic Phonics

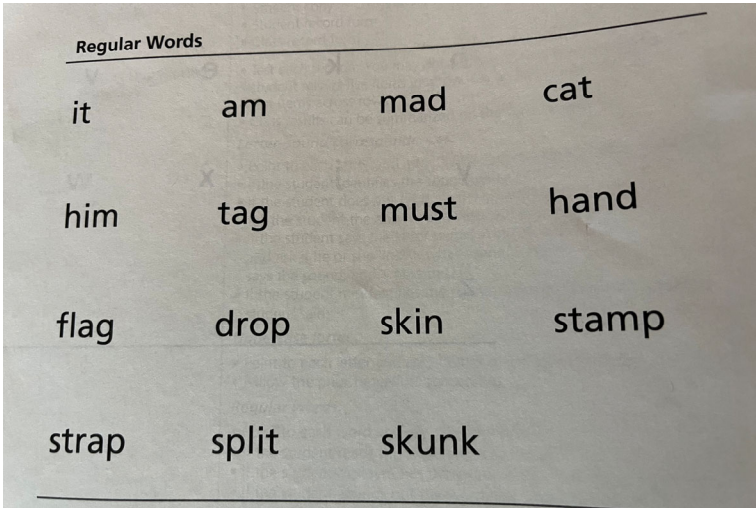
- Direct Instruction Reading's Basic Phonics Assessment

Student Name: _____

Examiner Name: _____

**Beginning Phonics Assessment
Student Record Form**

Sounds ("What sound?")			Up
#	Item	Response	#
1	a		27
2	m		28
3	t		29
4	s		30
5	i		31
6	f		32
7	d		33



Includes word type assessment

I made my own basic phonics and word type assessment that assesses a little more

Beginning with Continuous Sounds

Word Type	VC Beginning with a continuous sound					CVC Beginning with a continuous sound					VCC Beginning with a continuous sound					CVCC Beginning with a continuous sound				
Words	it	am	on	up	if	fun	lad	set	win	mop	ask	odd	ink	end	act	lamp	must	wind	felt	rows
Student																				

Beginning with short sounds, blends, and longer words

Word Type	CVC Beginning with a stop sound					CVCC Beginning with a stop sound					CCVC Beginning with a consonant blend					CCVCC, CCCVC, and CCCVCC Longer words				
Words	cup	tin	hot	bet	pan	dust	hand	cent	dish	golf	crib	blow	snap	flat	frog	clamp	spent	scrap	scrimp	drink
Student																				

Basic Phonics. Also include

- Acadience Reading NWF CLS and WWR
- Or similar measures that assess fluency of basic phonics

Student Name: _____ Date: _____
 Examiner Name: _____ Grade: _____

**Primary Phonics Assessment
Student Record Form**

#	Item	Response	#	Item
1	th—bath		29	ew—stew
2	er—hunter		30	ph—graph
3	ing—testing		31	wr—wrap
4	sh—shop		32	au—haunt
5a	ed—handed		33	aw—hawk
5b	ed—licked		34	con—confuse
5c	ed—missed		35	ment—payment
6	wh—when		36	de—demand
7	qu—quiz		37	al—sandal
			38	ful—handful

More
advanced
phonics:
Letter
Combinations

An expanded assessment of advanced phonics I created and can email to you

**Word-Attack Skills Test
Examiner Protocol**

Instructions: Have the student read the list of word from the student booklet... Indicate if the student read the corresponding sound in each word correctly by placing a checkmark ✓ next to the word... Note that scoring is done by correct target sound and not correct word... Under the Score column, indicate how many words out of three the student read the corresponding sound correctly (3/3).

Score		Sound	Word 1	Word 2	Word 3
1. ¹	Digraph	(th)	bath	the	with
2.	Digraph	(wh)	when	whip	white
3.	Suffix	(ing)	handing	cutting	digging
4.	R controlled	(er)	matter	speller	bigger
5.	Digraph	(sh)	shop	fish	wish
6.	L controlled	(ol)	fold	bolt	toll
7.	Digraph	(oa)	loan	coat	soap
8.	Digraph	(ea)	neat	bead	east
9.	Digraph	(oo)	toot	cool	hoop

80.	Prefix	(pre)	prepare	preschool	predict
81.	Prefix	(ex)	expect	explain	exit
82.	Prefix	(for)	forward	forever	forbid
83.	Suffix	(ize)	realize	memorize	idolize
84.	Digraph	(ure)	adventure	creature	future
85.	Prefix	(inter)	interfere	intersect	interrupt
86.	Suffix	(ism)	realism	prism	racism
87.	Suffix	(tive)	motive	creative	native
88.	Suffix	(sive)	expensive	abusive	massive
89. ⁵	Suffix	(ly)	safely	lonely	ally
90.	Suffix	(ary)	military	library	imaginary
91.	Suffix	(ity)	city	gravity	entity
92.	Suffix	(ant)	distant	infant	servant
93.	Suffix	(ent)	accident	investment	confident
94.	Suffix	(cious)	vicious	delicious	precious
95.	Suffix	(ture)	stature	future	picture
96.	Suffix	(cial)	facial	crucial	special
97.	Suffix	(tious)	cautious	ambitious	nutritious

Also think about including

- Test of Word Reading Efficiency (TOWRE)
- Or similar measure of accuracy and fluency of reading more complex words

REWARDS

- A program to teach fluent reading of multisyllabic words
- But also useful for assessment



Vowel Letter	Sound	Key Word	Name	Key Word
a	a	cat	a	labor
i	i	sit	i	pilot
e	e	get	e	female
o	o	hot	o	locate
u	u	cup	u	human

Vowel Combinations

Vowel Combination	Key Word	Vowel Combination	Key Word
ay	say	oa	foam
ai	rain	ou	loud
au	sauce	ow	low, down
er	her	oo	moon, book
ir	bird	ea	meat, thread
ur	turn	a-e	make
ar	farm	o-e	hope
oi	void	i-e	side
oy	boy	e-e	Pete
or	torn	u-e	use
ee	deep		

Word Parts and Vowel Combinations

	Word Part	Key Word	Word Part	Key Word	Word Part	Key Word
Word Parts at the Beginning of Words	dis	discover	com	compare	con	continue
	mis	mistaken	be	belong	per	permit
	ab	abdomen	pre	prevent	un	uncover
	ad	advertise	de	depart	a	above
	in	insert	re	return	ex	example
	im	immediate	pro	protect	en	entail
Word Parts at the End of Words	s	birds	er	farmer	ment	argument
	ing	running	al	final	ance	disturbance
	ed	landed	tion	action	ence	essence
	ness	kindness	sion	mission	ous	nervous
	less	useless	ion	million	cious	precious
	ic	frantic	tive	attentive	tious	cautious
	ate	regulate	sive	expensive	cial	special
	ish	selfish	y	industry	tial	partial
	ist	artist	ly	safely	age	courage
	ism	realism	ary	military	ture	picture
	est	biggest	ity	oddity	able	disposable
	ful	careful	ant	dormant	ible	reversible
	or	tailor	ent	consistent	le	cradle
	Vowel Combinations	ay	say	a—e	make	or
ai		rain	o—e	hope	ee	deep
au		sauce	i—e	side	oa	foam
er		her	e—e	Pete	ou	loud
ir		bird	u—e	use	ow	low, down
ur		turn	oi	void	oo	moon, book
ar		farm	oy	boy	ea	meat, thread

Reading Fluency

- Reading Fluency
 - ORF measures (e.g., Acadience Reading ORF)
 - Word Reading Fluency Measures
 - TOWRE

- Reading with Expression
 - Associated with comprehension and...
 - Study on listening to reading with and without expression found better comprehension when passage read with expression
 - Tenenbaum, H.A., Wolking, W.D. Effects of oral reading rate and inflection on intraverbal responding. *Analysis Verbal Behav* 7, 83–89 (1989). <https://doi.org/10.1007/BF03392839>
 - Could assess by rating yes/no on ORF whether or not the student read with expression

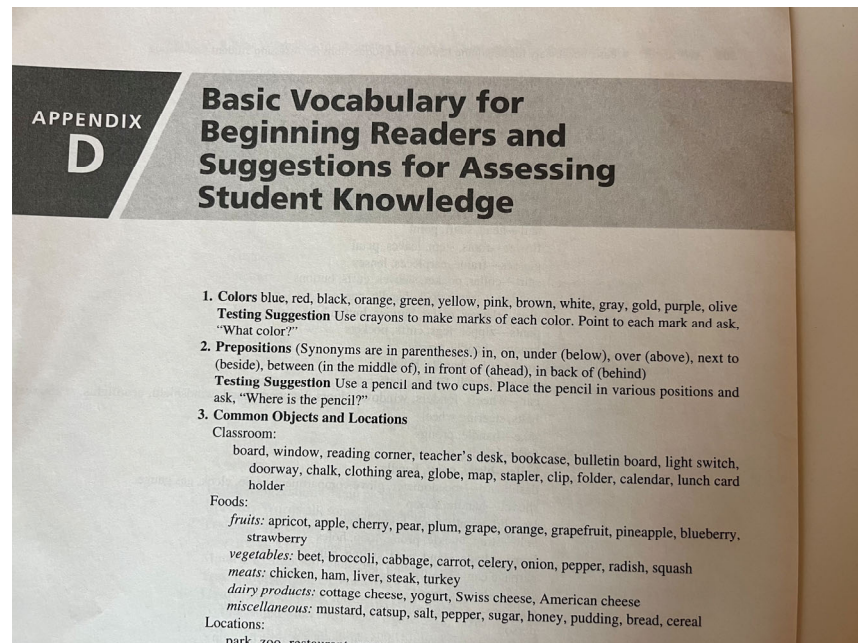
Reading Vocabulary

- Critical for reading comprehension
- Vocab associated with overall school success—may be the best single predictor of high school performance. High school seniors near the top of their class knew about four times as many words as their lower-performing classmates (Graves & Slater, 1987).
- After the primary grades, the “achievement gap” between socioeconomic groups is a language gap (Hirsch, 2002).
- Starting around 3rd grade the primary way new vocabulary is learned is through reading.

Reading and Vocabulary

- “Haltingly, and with many pauses while she attempted to control her crying, Leanne told Professor McGonagall how Katie had gone to the bathroom in the Three Broomsticks and returned holding the unmarked package, how Katie had seemed a little odd, and how they had argued about the advisability of agreeing to deliver unknown objects, the argument culminating in the tussle over the parcel, which tore open.”
- Excerpt From: J.K. Rowling. “Harry Potter and the Half-Blood Prince (Enhanced Edition).” Pottermore Publishing, 2015. Apple Books.
<https://books.apple.com/us/book/harry-potter-and-the-half-blood-prince-enhanced-edition/id1037196935>

Reading Vocabulary (DI Reading book)



6. Characteristics (Adjectives)

long—short	few—many	dark—light
big—little	same—different	deep—shallow
hot—cold	old—new	raw—cooked
full—empty	skinny—fat	stale—fresh
wet—dry	clean—dirty	ripe—spoiled
straight—crooked	fast—slow	early—late
rough—smooth	young—old	happy—sad
wide—narrow	tiny—huge	sick—well
quiet—noisy	mild—stormy	easy—difficult
safe—dangerous	ugly—beautiful	careful—careless
sharp—dull	open—closed	tight—loose
whole—part	shiny—dull	
wild—tame	cool—warm	

Testing Suggestion Obtain pictures of objects or actual objects that contain a characteristic. Ask either "Is this _____?" or "Which one is _____?"

Oral Language (DI Reading Book)

APPENDIX E

Oral Language Screening Test and Record Form

RECORD FORM FOR ORAL LANGUAGE SCREENING TEST

.....

circle 1: yellow circle 2: brown

Directions—Color circle 1 yellow. Color circle 2 brown.

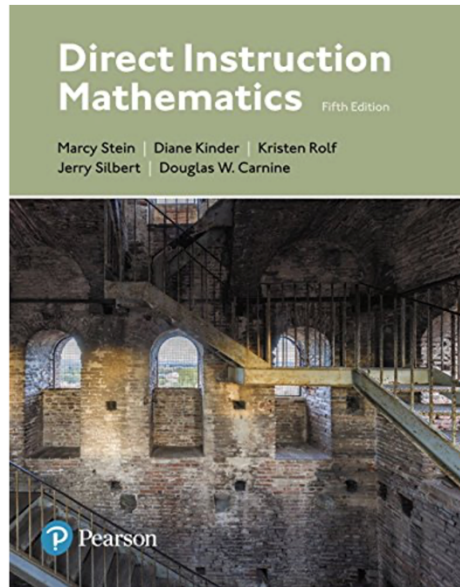
1. (Point to circle one and ask) "What color is this?"
2. (Point to circle two and ask) "What color is this?"
3. "I'll say sentences. Say them just the way I say them. Listen." (pause) "A big boy sat on a dirty bench." (Repeat the sentence once if the student did not say it verbatim. If the student says it correctly verbatim on the first or second trial, score the item correct.)
4. "Listen." (pause) "Mary was baby-sitting for her little sister last night. Say that." (Repeat the sentence once if the student did not say it verbatim. If the student says it correctly verbatim on the first or second trial, score the item correct.)
5. "I'm going to say a sentence, then ask you some questions. Listen carefully. A little cat slept in the park yesterday. Listen again. A little cat slept in the park yesterday." "Where did the cat sleep?" (In the park.)
6. "When did the cat sleep in the park?" (Yes(ter)day)
7. "How are a mouse and a cow different?" (Accept reasonable answers.)
8. "Listen. Monday, Tuesday, Wednesday, Thursday, Friday. Say that." (Repeat the days once if the student did not say them correctly. If the student says them correctly on the first or second trial, score the item correct.)
9. "What is a person who fixes your teeth called?"
10. "What is a pencil usually made of?"

Reading Comprehension

- **Literal**
 - Does the student follow a strategy for these questions?
- **Inferential**
 - Main idea
 - Inferential questions where the relationship can be induced (running and heart rate example)
 - Inferential questions where you must already know the relationship (e.g., feelings questions, cactus example)
- **Pronouns**
- **Sentence structures**
 - E.g., Active vs passive sentence constructions
- **Story Grammars**
- DI Reading Book has instructional recommendations for most of these that could be converted into assessments.

Reading Assessment/Intervention Materials You Want to Recommend

Math



CBM ORF—no clear parallel in math. CBM computation is probably the closest

CBM Math

- *This study supports the reliability of mastery measurement in math CBM and as a precise tool to be used in the screening process.*
- Solomon, B. G., VanDerHeyden, A. M., Solomon, E. C., Korzeniewski, E. R., Payne, L. L., Campaña, K. V., & Dillon, C. R. (2022). Mastery measurement in mathematics and the goldilocks effect. *School Psychology*.

Math Mastery Measurement Examples Across Grades

As a concrete example, [Table 12.1](#) displays the skills assessed by SpringMath (Education Research & Consulting, 2013; www.springmath.org) in grades K–8.

TABLE 12.1. Screening Measures in Mathematics

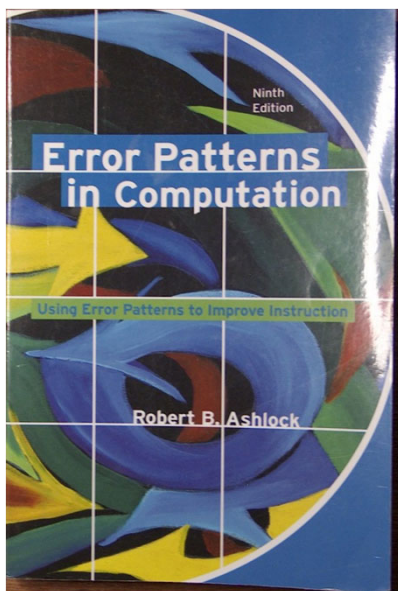
Grade	Screening fall	Screening winter	Screening spring
Kinder- garten	<ul style="list-style-type: none"> • Counting Objects to 10, Circle Answer • Identify Number, Draw Circles to 10 • Quantity Comparison with Dots to 10 	<ul style="list-style-type: none"> • Count Objects, Write Number to 20 • Identify Number, Draw Circles • Quantity Comparison with Dots to 20 • Missing Number 0–20 	<ul style="list-style-type: none"> • Change Quantity with Dots to 10 • Missing Number 0–20 • Sums to 5 Kindergarten • Subtraction 0–5 Kindergarten

First grade	<ul style="list-style-type: none"> • Sums to 6 • Subtraction 0–5 • Quantity Comparison 20–99 	<ul style="list-style-type: none"> • Sums to 12 • Subtraction 0–5 • Fact Families Addition and Subtraction 0–5 • Quantity Comparison 101–999 	<ul style="list-style-type: none"> • Sums to 20 • Subtraction 0–20 • Fact Families Addition and Subtraction 0–9
Second grade	<ul style="list-style-type: none"> • Sums to 20 • Subtraction 0–20 • Fact Families Addition and Subtraction 0–20 • Quantity Comparison 1,001–9,999 	<ul style="list-style-type: none"> • Two-Digit Addition without Regrouping • Two-Digit Subtraction without Regrouping • Quantity Comparison Sums/ Differences to 20 	<ul style="list-style-type: none"> • Two-Digit Addition with Regrouping • Two-Digit Subtraction with Regrouping • Create Equivalence Using Place Value and Decomposition • Create Equivalence Using Associative Property and Near Easy

Acadience Math

			Concepts and Applications																				
			Computation																				
			Missing Number Fluency																				
			Advanced Quantity Discrimination																				
Next Number Fluency																							
Number Identification Fluency																							
Beginning Quantity Discrimination																							
Begin	Mid	End	Begin	Mid	End	Begin	Mid	End	Begin	Mid	End	Begin	Mid	End	Begin	Mid	End	Begin	Mid	End	Begin	Mid	End
Kindergarten			First Grade			Second Grade			Third Grade			Fourth Grade			Fifth Grade			Sixth Grade					

Figure 1.1 Acadience Math Benchmark Administration Timeline



Errors and a KTEA Math Calculation subtest I gave a long time ago

Error Analysis

- The most common error pattern

$$\begin{array}{r} 32 \\ -17 \\ \hline 25 \end{array}$$

Mikey's worksheet

$$\begin{array}{r} 74 \\ +56 \\ \hline 1210 \end{array}$$

$$\begin{array}{r} 35 \\ +92 \\ \hline 127 \end{array}$$

$$\begin{array}{r} 67 \\ +18 \\ \hline 715 \end{array}$$

Carol's Worksheet

$$\begin{array}{r} 46 \\ +3 \\ \hline 13 \end{array}$$

$$\begin{array}{r} 18 \\ +30 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 8 \\ +16 \\ \hline 15 \end{array}$$

Error Analysis

- Jimmy given the story problem: There are 7 cookies on the plate and mother puts on 8 more. How many cookies are on the plate now? Jimmy says 14. Here are his answers on a worksheet:
- $7 + 6 = 12$ $8 + 6 = 13$
-
- $8 + 5 = 12$

Counting Chapter

Instructional Sequence and Assessment Chart

Grade Level	Problem Type	Performance Indicator
K-1	Counting by 1s beginning at 1; counting through 20	Verbal test: teacher asks students to
K-1	Counting a group of objects	Teacher writes four lines, asks how with seven lines, five lines.
K-1	Counting two groups of objects	Teacher writes and asks together?
K-1	Counting by 1s, beginning at 1, counting through 30	Verbal test: teacher asks students to
K-1	Ordinal counting first through tenth	Verbal test: teacher draws 10 lines students to touch third line and sev
K-1	Skip counting by 10s 10-100	Verbal test: teacher asks students to
K-1	Counting backward from 10 to zero	Verbal test: teacher asks students to from 10 to zero.
K-1	Counting by 1s from 1 through 100	Written test: write the number that 26, _____, _____, 29, _____ 46, _____, _____, 49, _____

Symbol ID and Place Value Chapter

Instructional Sequence and Assessment Chart

Grade Level	Problem Type	Performance Indicator
K-1	Reading numerals zero through 10	Read these numerals: 4 8 5 9 10
K-1	Writing numerals zero through 10	Write these numerals: 4 8 5 9 10
K-1	Writing a numeral to represent members of a set	<input type="text" value="4"/> <input type="text" value="6"/>
K-1	Writing members of set (lines) to represent a numeral	<input type="text" value="4"/> <input type="text" value="6"/> _____
1a	Reading teen numbers	Read these numerals: 15 19 14 16 18
1b	Writing teen numbers	Write these numerals: 15 19 14 16 18
c	Reading numbers from 20 to 99	Read these numerals: 64
d	Writing numbers from 20 to 99	Write these numerals: 47
e	Column alignment	85 + 3 = _____
	Rewriting horizontal addition and subtraction problems	4 + 25 = _____
	Expanded notation	37 - 2 = _____
		63 = _____ + _____

Addition

		35	64	
1a	Begin fact memorization			See Chapter 6
1b	Adding a two-digit and a one- or two-digit number; no renaming	$\begin{array}{r} 35 \\ +21 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ +23 \\ \hline \end{array}$	
2a	Adding three single-digit numbers	$\begin{array}{r} 1 \\ 3 \\ +2 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ 4 \\ +3 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 3 \\ +5 \\ \hline \end{array}$
2b	Adding two three-digit numbers; no renaming	$\begin{array}{r} 325 \\ +132 \\ \hline \end{array}$	$\begin{array}{r} 463 \\ +124 \\ \hline \end{array}$	
2c	Adding a three-digit and a one- or two-digit number; no renaming	$\begin{array}{r} 326 \\ + 21 \\ \hline \end{array}$	$\begin{array}{r} 423 \\ + 5 \\ \hline \end{array}$	
2d	Adding one-, two-, and three-digit numbers; no renaming	$\begin{array}{r} 4 \\ 21 \\ + 2 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ 71 \\ + 10 \\ \hline \end{array}$	
2e	Adding two two-digit numbers; renaming from ones to tens	$\begin{array}{r} 37 \\ +46 \\ \hline \end{array}$	$\begin{array}{r} 48 \\ +14 \\ \hline \end{array}$	
2f	Adding a three-digit and a one-, two-, or three-digit number; renaming from ones to tens	$\begin{array}{r} 247 \\ +315 \\ \hline \end{array}$	$\begin{array}{r} 258 \\ + 13 \\ \hline \end{array}$	
3a	Complex facts; adding a single-digit number to a teen number—sum below 20.			Test students individually; tea
3b	Adding two two- or three-digit numbers; renaming from tens to hundreds	$\begin{array}{r} 374 \\ +261 \\ \hline \end{array}$	$\begin{array}{r} 83 \\ +43 \\ \hline \end{array}$	$\begin{array}{r} 187 \\ + 81 \\ \hline \end{array}$
3c	Adding two three-digit numbers; renaming from ones to tens and tens to hundreds	$\begin{array}{r} 376 \\ +185 \\ \hline \end{array}$	$\begin{array}{r} 248 \\ +164 \\ \hline \end{array}$	$\begin{array}{r} 437 \\ +275 \\ \hline \end{array}$

Subtraction

1a	Conceptual introduction			
1b	Subtracting a one- or two-digit number from a two-digit number; no renaming	$\begin{array}{r} 57 \\ -20 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ - 3 \\ \hline \end{array}$	
2a	Subtracting a one- or two-digit number from a two-digit number; renaming required	$\begin{array}{r} 54 \\ -18 \\ \hline \end{array}$	$\begin{array}{r} 46 \\ - 9 \\ \hline \end{array}$	
2b	Subtracting a one-, two-, or three-digit number from a three-digit number; renaming tens to ones	$\begin{array}{r} 382 \\ - 37 \\ \hline \end{array}$	$\begin{array}{r} 393 \\ -174 \\ \hline \end{array}$	
3a	Subtracting a two- or three-digit number from a three-digit number; renaming from hundreds to tens	$\begin{array}{r} 423 \\ -171 \\ \hline \end{array}$	$\begin{array}{r} 418 \\ - 83 \\ \hline \end{array}$	
3b	Subtracting a two- or three-digit number from a three-digit number; renaming from tens to ones and hundreds to tens	$\begin{array}{r} 352 \\ -187 \\ \hline \end{array}$	$\begin{array}{r} 724 \\ -578 \\ \hline \end{array}$	
3c	Tens minus 1 facts	$70 - 1 = \square$ $40 - 1 = \square$ $80 - 1 = \square$		
3d	Subtracting a two- or three-digit number from a three-digit number, zero in tens column; renaming from tens to ones and hundreds to tens	$\begin{array}{r} 503 \\ - 87 \\ \hline \end{array}$	$\begin{array}{r} 504 \\ - 21 \\ \hline \end{array}$	$\begin{array}{r} 700 \\ - 86 \\ \hline \end{array}$
3e	Subtracting a three- or four-digit number from a four-digit number; renaming from thousands to hundreds	$\begin{array}{r} 4689 \\ -1832 \\ \hline \end{array}$	$\begin{array}{r} 5284 \\ -4631 \\ \hline \end{array}$	
3f	Subtracting a one-, two-, three-, or four-digit number from a four-digit number; renaming required in several columns	$\begin{array}{r} 5342 \\ - 68 \\ \hline \end{array}$	$\begin{array}{r} 6143 \\ - 217 \\ \hline \end{array}$	

Other Chapters

- Multiplication
- Division
- Problem Solving (identify what types of math story problems students have trouble with)
- Fractions
- Decimals
- Measurement, Time, and Money
- Percent, Ratio, and Probability
- Data Analysis

STUDENT

SUR IOH

- Age: 12
- Grade: 6
- Gender: Female
- History: Learning disability in math
- Intervention Setting: Clinic
- Intervention Duration:
 - 2.25 hours/day
 - 4 days/week
 - 6 weeks

STUDENT

GI#P dkw#JHVX QWV#0DGG IWIR Q =

ADDITION PROBLEM TYPE	PRE-TEST	POST-TEST
+ two-digit and one- or two- digit number; no renaming	Yes	Yes
+ three single-digit numbers	Yes	Yes
+ two three-digit numbers; no renaming	Yes	Yes
+ a three-digit and a one or two-digit number; no renaming	Yes	Yes
+ a one-, two-, and three-digit number; no renaming	Yes	Yes
+ two two-digit numbers; renaming	Yes	Yes
+ three-digit and one, two, or three-digit number; renaming	Yes	Yes
complex facts, adding single digit number to a teen number	Yes	Yes
+ two two or three-digit numbers, renaming	Yes	Yes
+ two three-digit numbers, renaming	Yes	Yes
+ three two-digit numbers, renaming	Yes	Yes
+ three or four numbers; renaming	Marginal	Yes
+ a single number as a teen number	No	Yes
+ three two-digit numbers	Yes	Yes
+ three, four, or five multi-digit numbers; renaming	No	Yes

STUDENT

GI#P dkw#JHVX QWV#0VXE WUDFWIR Q =

PROBLEM TYPE	PRE-TEST	POST-TEST
- a one or two-digit number from a two-digit number; no renaming	Yes	Yes
- a one or two-digit number from a two-digit number; renaming	Marginal	Yes
- a one, two, or three-digit number from a three-digit number; renaming tens to ones	Marginal	Yes
- a two or three-digit number from a three-digit number; renaming from hundreds to tens	Yes	Yes
- a two or three-digit number from a three-digit number; renaming from tens to ones and hundreds to tens	Marginal	Marginal
tens minus 1 facts	Yes	No
- a two or three-digit number from a three-digit number; zero in tens column; renaming from tens to ones and hundreds to tens	No	Yes
- a three or four-digit number from a four-digit number; renaming from thousands to hundreds	Yes	Yes
- a one, two, three, or four-digit number from a four-digit number; renaming	Marginal	Yes

STUDENT

GI#P dwk#JHVXQWV#0P XOWIS OIFDWIR Q =

PROBLEM-TYPE	PRE-TEST	POST-TEST
Skip counting by tens to 100, twos to 20, and fives to 60	Yes	Yes
Skip counting by nines to 90	No	Yes
One digit times one digit	Yes	Yes
Missing factor multiplication	No	Yes
One-digit factor times two-digit factor; no carrying	No	Yes

STUDENT

GI#P dwk#JHVXQWV#0SUREOHP #VROYIQJ =

PROBLEM TYPE	PRE-TEST	POST-TEST
+/- simple action problems with key words	No	Yes
+/- temporal sequence problems	No	Yes
+/- comparison problems	Yes	Yes
+/- classification problems	Yes	Yes
Multistep problems: + three numbers	No	Yes
+/- problems with larger numbers	No	Marginal
+/- problems with distracters	Marginal	No
Multistep problems: three numbers; the sum of two numbers is subtracted from the third number	No	Yes

STUDENT		
GI# dwk#SRVWQ WHUYHQWIRQ #JHVXOWV#XP P DU\=		
SKILL AREA	PRE-TEST	POST-TEST
Addition	12/15	15/15
Subtraction	4/9	7/9
Multiplication	2/5	5/5
Problem Solving	2/8	6/8

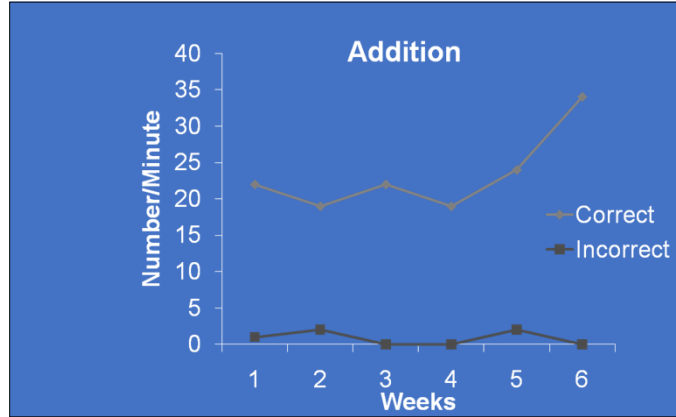
Intervention mostly targeted addition, subtraction, and multiplication with fluency instruction on addition and multiplication only

STUDENT			
F P DW#SRVWQ WHUYHQWIRQ #JHVXOWV=			
SCALE	GRADE EQUIVALENT		GAIN
	PRE-TEST	POST-TEST	
Addition	3.7	5.7	+2.0
Subtraction	6.2	6.2	0
Multiplication	2.7	6.2	+3.5
Division	2.2	4.4	+2.2
Problem Solving	2.7	4.0	+1.3
Charts, Tables, & Graphs	2.7	4.7	+2.0

STUDENT

PRACTICEMILL

Instruction included addition math fact practice to build fluency.



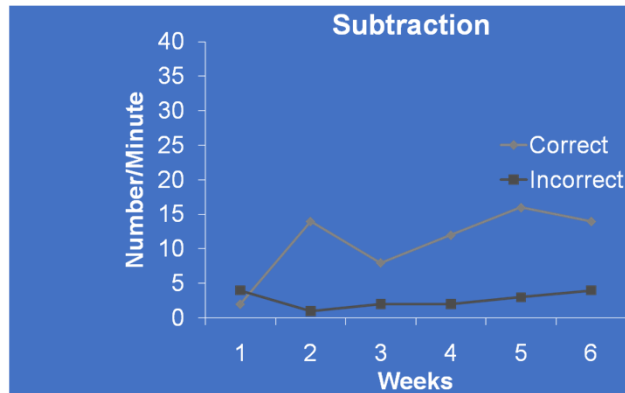
Accuracy: 96% to 100%

Fluency: +12/minute

STUDENT

PRACTICEMILL

Instruction included subtraction algorithms but no practice in subtraction fluency

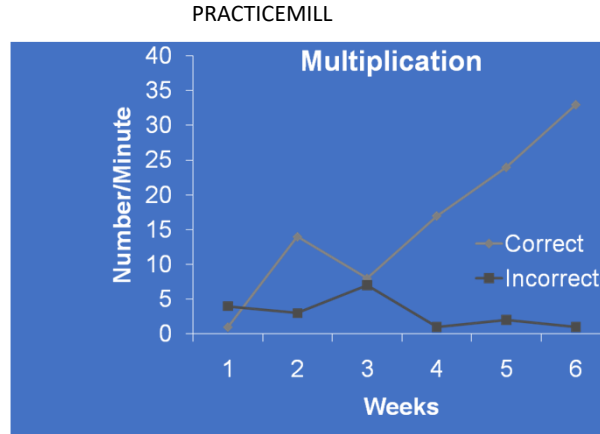


Accuracy: 33% to 78 %

Fluency: +12/minute

STUDENT

Instruction included multiplication algorithms and multiplication fact fluency



Accuracy: 20% to 97%

Fluency: +32/minute

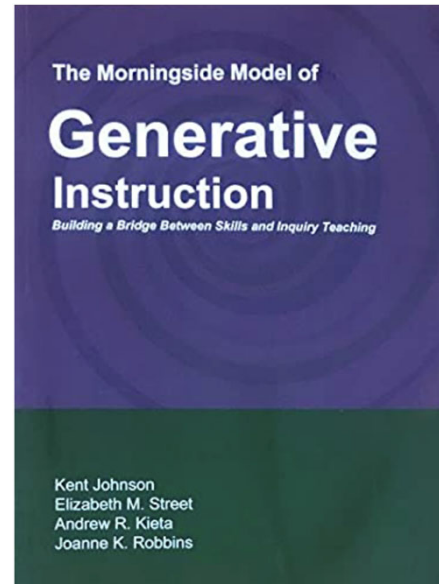
Good instruction and teaching specific missing skills can also move kids from average to superior

Another student

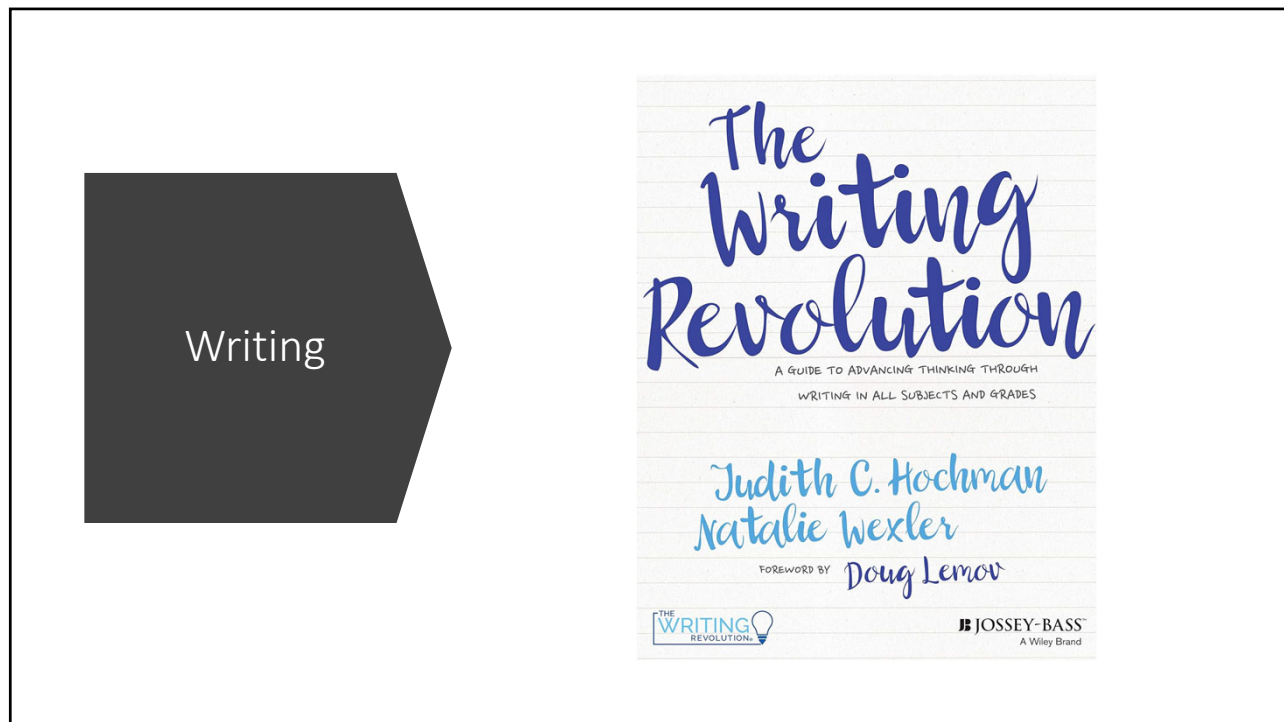
- Math (CMC E), Practicemill multiplication & division, & DI Math book (focused on math calculation)
- CMAT
- Basic cal 98 130
- Math reas 100 115
- Gen math 99 126



More info on
this approach
to academic
intervention:



Math Assessment/Intervention Materials You
Want to Recommend



The Writing Revolution

- A book with online supplemental materials to teach writing across all grade levels and content areas.
- It teaches many writing skills: writing sentences, paragraphs, note taking, planning, revising, etc.
- *The importance of spending plenty of instructional time working with sentences can't be stressed enough. P. 24*

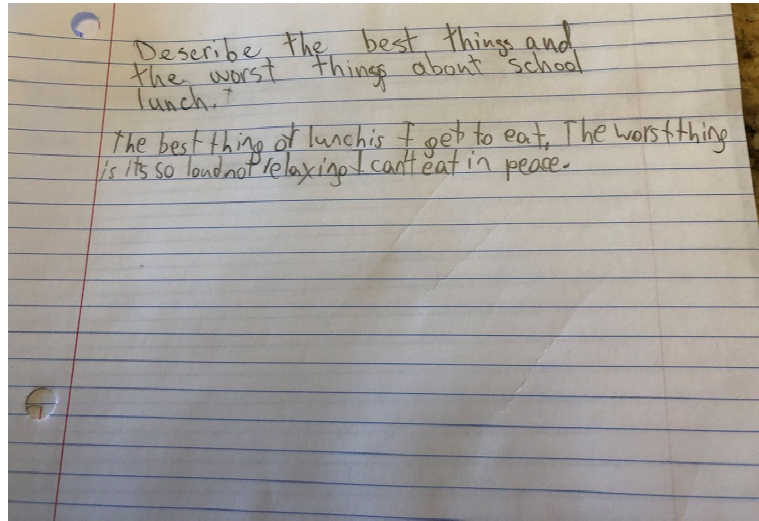
Writing Assessment

- Legibility
- Fluency
- Conventions (spelling, punctuation, capitalization)
- Sentence writing. Syntactic maturity
- Semantic maturity
- Paragraph writing
- Content (organization, conventions of style, cohesion)
- Writing process (plan, write, revise)

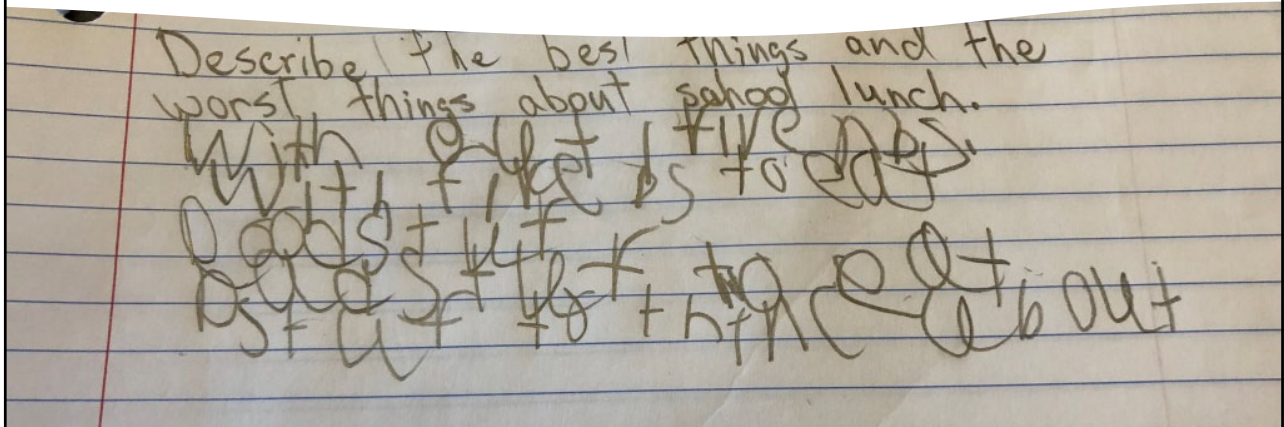
How?

- Teacher interview
- Curriculum-based measurement Written Expression (CBM-WE) (score TWW, WSC, CWS).
- Untimed writing sample. Legibility, spelling conventions, grammar, semantic maturity, content and organization
- Letter writing accuracy and fluency assessment (next slides)
- TWR Diagnostic Assessments
 - Discriminating sentences from fragments
 - Writing sentences from scrambled words
 - Sentence types: statement, question, exclamation, command; Because, but, so
 - Sentence combining
 - Expanding kernel sentences
 - Improving a paragraph
 - Identifying topic sentence
 - Making a single paragraph outline

Step 1. Total words written,
Words Spelled Correctly,
Correct Written Sequence



Step 1. Total words written, Words Spelled Correctly,
Correct Written Sequence



Handwriting (Transcription)

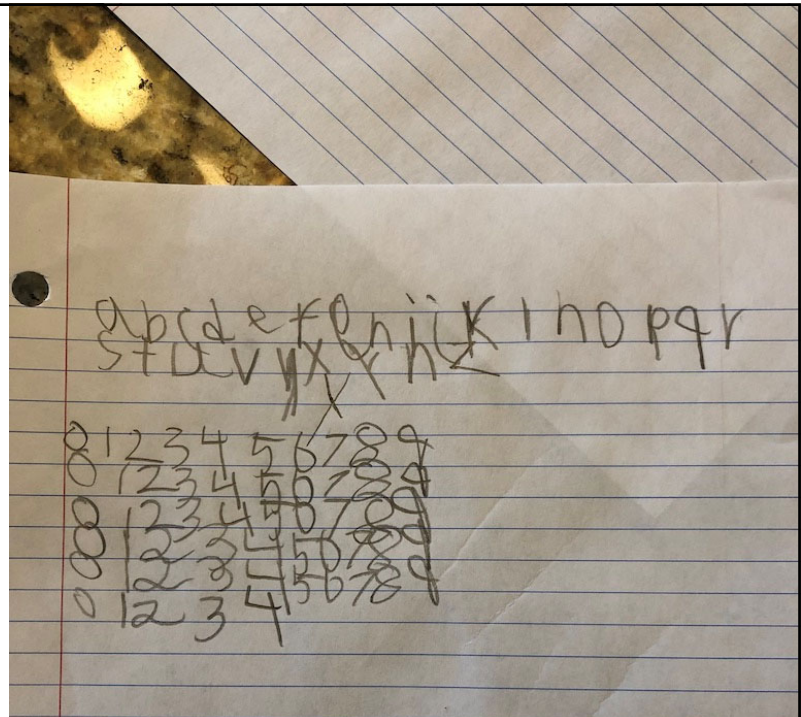
- Foundational skill
- Often insufficient explicit instruction and practice on this important skill
- About 10-30% of school-aged children struggle with handwriting (Rosenblum, Chevion, & Weiss, 2006)
- Goal of handwriting is to teach students to develop their own handwriting, but have it closely match the model sample (Danna, Enderli, Athenes, & Zanone, 2012; Stefansson & Karsdottir, 2003).
- Needs to be accurate (legible) and fluent (automatic)
- Need to assess accuracy, fluency (rate), and endurance (the new WIAT has a measure of letter writing fluency)
- Without accuracy, fluency, or endurance in handwriting, writing will be aversive to student and interfere with writing development (Limpo & Graham, 2019)

Legibility

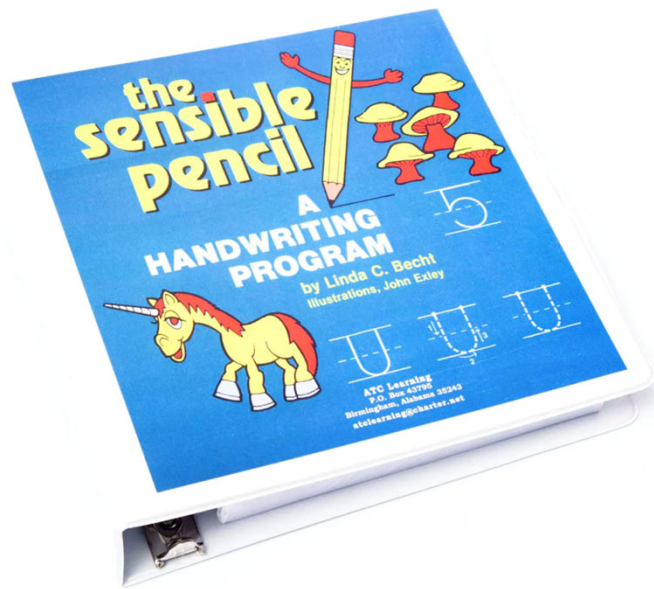
- **Handwriting:** Assess handwriting using work samples, anagrams (you can find many on the internet), writing of alphabet, *Sensible Pencil* assessment, etc.
- Learn how your schools teach handwriting and what style, for example: block, d'Nealian, cursive, cursive italic, etc.
- Here is a system for assessing legibility that Tasha Nacarato ended up using for her thesis (next slide).

- **Total Correct Letters/Numbers**
- All letters were scored for total correctness. So, if a letter met requirements for alignment, letter height, slant, and reversal then it was scored totally correct.
- **Alignment**
- A letter was marked correct if each letter rested along the baseline. A letter was incorrect if the letter sat above or below the baseline.
- **Letter Height**
- Lower case letters within two millimeters of the midline and capital letters within two millimeters of the top line were marked correct. If a lower case letter was more than two millimeters above or below the midline, or if a capital letter was more than two millimeters above or below the top line then it was marked incorrect.
- **Letter Slant**
- If a letter deviated less than 20 degrees from the 90-degree mark then the letter was marked correct. A letter that deviated more than 20 degrees from the 90-degree mark was incorrect.
- **Reversals**
- A letter was correct if no part or whole letter was reversed. However, a letter was incorrect if a part or whole letter was reversed.
- **Added Strokes**
- The frequency of added strokes on lowercase letters were recorded.
- **Missing Strokes**
- Missing strokes were documented for frequency when looking at each letter.
- **Missing Letters**
- Missing letters were also calculated by recording each time a letter or number was missing.

Eric 2019



<https://difflearn.com/>



Fingers _____

Left-Handed

Pencil rests in the curvature near the large knuckle of the index finger.

Pencil is parallel to the left arm.

Holds pencil between bent thumb and middle finger.

Index finger rests on top of the pencil.

Student holds the pencil 1-1/2" from the point.

PENCIL

FINGERS

Right-Handed

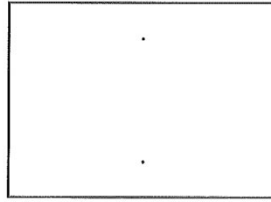
Pencil rests in the curvature near the large knuckle of the index finger.

Pencil is parallel to the right arm.

Holds pencil between bent thumb and middle finger.

Index finger rests on top of the pencil.

Student holds the pencil 3/4" to 1" from the point.

**5. TURN THE PAGE:**

SA2, page 104

POINT To page 1 of the SA. Demonstrate turning to page 2.

SAY "Let's turn to the next page."

6. CONNECTING DOTS: (Be sure the SA page is positioned horizontally in front of the student.)

POINT To the dot on the top of the page.

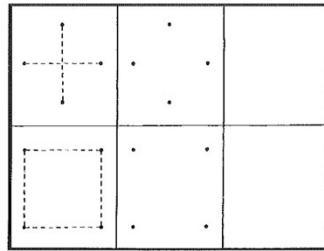
SAY "Put your pencil on this dot." (student performs)

POINT To the dot at the bottom of the page.

SAY "Draw a line to this dot." (student performs)

7. PENCIL PRESSURE

OBSERVE: The student's pencil pressure on the paper.

**2. SKILLS ASSESSMENT: CROSS AND SQUARE**

SA7, page 109

CROSS:  Trace

POINT To the cross to trace.

SAY "This is a cross. Let's trace it."

POINT To the top dot. Trace along the dotted line with your finger, and stop at the bottom dot.

SAY "Put your pencil on the dot, and make a line that goes DOWN. (student performs) Now, LIFT your pencil."

POINT To the left dot. Trace along the horizontal line with your finger, and stop at the right dot.

SAY "Put your pencil on the dot, and make a line that goes OVER."

Spelling

- Like handwriting, spelling is a foundational skill
- Needs to be automatic
- There are many poor spellers
- Overlooked content area
- Decoding (see-say) and spelling (encoding or hear-write) are reciprocal
- Spelling instruction improves spelling (of course), phonological awareness, and reading (Graham & Santangelo, 2014)

And poor spelling
can be deadly!

Operator: 911, what's your emergency?

Man: A guy just got hit by a car, I need an ambulance.

Operator: What's your location?

Man: I'm on Eucalyptus street.

Operator: Can you spell that for me?

Man: (long awkward pause)

Operator: Sir? Are you there?

Man: I'm gonna drag him over to Pine street and call right back.

Spelling

- *Words Their Way* spelling inventory:
- https://mypearsontraining.com/assets/files/documents/WTW6e_Inventory_1507909154.pdf
- You know all of the phonemic awareness, phonics, and word reading skills we talked about assessing?
 - Assess those same skills in spelling
 - Change see-say (visual to auditory) phonics and word reading assessments to hear-write (auditory to visual) spelling assessments
 - Some reading curricula, such as *Sound Partners*, combine related phonemic awareness, phonics, and spelling instruction.

Descriptive Paragraph (from Anita Archer)

0 = not present

1 = adequate

2 = good

Show paragraph on overhead, model going through each question. Provide examples and nonexamples.

0 1 2	1. Does the first sentence tell what is being described? (topic sentence)
0 1 2	2. Do the other sentences tell more about what is being described?
0 1 2	3. Are descriptive words used?
0 1 2	4. Are sentences in logical order?
0 1 2	5. Does the paragraph paint a clear and accurate picture of what is being described?
0 1 2	6. Is the description easy for the reader to understand?

Story Grammar Rating Scale

- Main Character (Who)

0. No main character was presented

1. A main character is presented with or without a name but no details are given (e.g., personality traits, physical attributes)

2. The main character is presented with at least one detail (e.g., personality traits, physical attributes)

•

- Locale (Where)

0. No location or place is mentioned

1. A location or place is mentioned but with no detail (e.g., in the woods)

2. A location or place is mentioned with a least one detail (e.g., in the woods near my grandparent's house)

•

- Time (When) ...

<https://www.readingrockets.org/sites/default/files/migrated/pdfs/Story%20Grammar%20Elements.pdf>

The Writing Revolution (TWR) Diagnostic Tests

- Are used to monitor the mastery of skills taught in TWR but we can use parts of them for assessment. These are available online:
 - <https://www.thewritingrevolution.org/resources/book-resources/assessment-tools/>
- Students read a story and then complete the writing activities. This is nice because the reading gives them the content to write about, so you don't have to worry about brainstorming, although that is another skill that needs to be assessed and taught.
 - Self-regulated Strategy Development teaches the writing process including brainstorming. Here is a reference to a similar intervention:
 - Hough, T. M., Hixson, M. D., Decker, D., & Bradley-Johnson, S. (2012). The effectiveness of an explicit instruction writing program for second graders. *Journal of Behavioral Education, 21*, 163-174.

Diagnostic Fast Food Test.

Students read the story and then do the activities

- What it assesses (7 of the 10 assess sentence writing)
 - Discriminating sentences from fragments (page 1)
 - Rearranging words into a sentence (p. 1)
 - Writing different sentence types (statement, question, exclamation, command) (p. 2)
 - Writing different sentences using the conjunctions *because, but, so*. (p. 2)
 - [*Because, but, so* are useful instructional tools to teach across content areas.]
 - Subordinating conjunctions (p. 3)
 - Sentence combining (p. 3)
 - Expanding sentences (p. 4)
 - Making sentences that fit together (p. 4)
 - Identify the topic sentence (p. 7)
 - Make a single paragraph outline (p. 8)

Because, but, so for something you have learned

- Phonics needs to be taught *because...*
- Phonics needs to be taught *but...*
- Phonics needs to be taught *so...*

Appositive

- A second noun or noun phrase placed beside another noun to explain it more fully.
- Can you find the appositive in this sentence?:
 - *In April 1865, the Union Army, a well-trained and well-equipped force, won a decisive battle against the Confederates at the Battle of Appomattox Court House*

Sentence Expansion Using

- Who
- What
- When
- Where
- Why
- How
- All of these won't be relevant in every case
- *The Union Army won.*
- *In April 1865, the Union Army, a well-trained and well-equipped force, won a decisive battle against the Confederates at the Battle of Appomattox Court House.*

Expand this sentence: *Transcription skills are important*

- Who
- What
- When
- Where
- Why
- How

Writing Assessment/Intervention Materials
You Want to Recommend

Teacher Interview To Assess

- Instruction
- Curriculum
- Environment
- Learner

Thank you...

- for your attention
- and, especially, for the work you do to support students, teachers, caregivers, and schools
- The skills you bring to schools are really needed

Mike Hixson

- hixso1md@cmich.edu