

LEARNING TO READ VERSES READING TO LEARN: How the Brain Reads

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Goals

- How does one learn to read?
- Why do some children struggle with the reading process?
- What are some of the early warning signs that a child may be at risk for learning to read.
- How should one assess for a reading disability?
- How are reading deficits best remediated

What are some of the early warning signs that would place a child at risk for difficulty with reading acquisition?

What are some of the warning signs that would place a child at risk for poor reading comprehension?

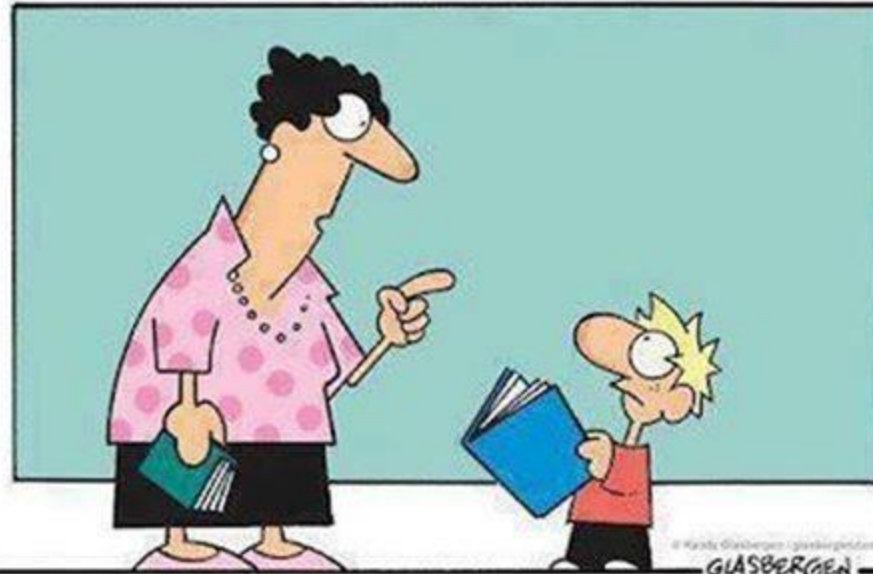
How early can you determine if a child is struggling with reading, that it is likely to be a Reading Disorder?

Reading is a learned skill which is only possible because of the brain's extraordinary ability to make new connections among its existing structures.

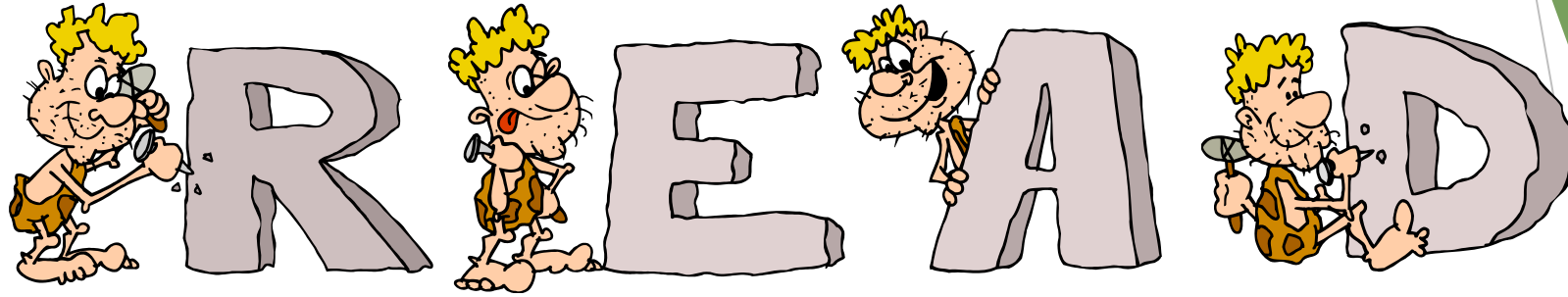
When one learns to read, his/her brain is forever changed, both physiologically and intellectually.



- Maryanne Wolf



It's called **reading**.
It's how people install new
software into their brains.



- Humans were not born with the ability to read.
- Man invented reading only 5000 thousand years ago.
- It is one of the single most remarkable inventions in history.

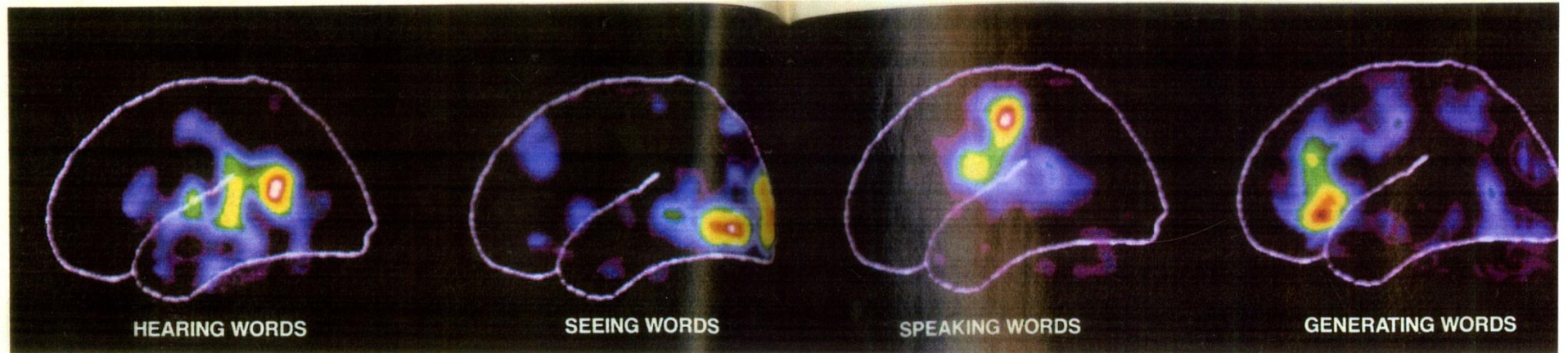
Neurological Considerations

- ▶ Not born prewired to read or write
- ▶ Reading “software” gets added to “hard-drive” of phonological processing
- ▶ Processes that sub serve reading were designed to support language acquisition
- ▶ Learning to read changes the brain organization
- ▶ Inheritability and genetic factors

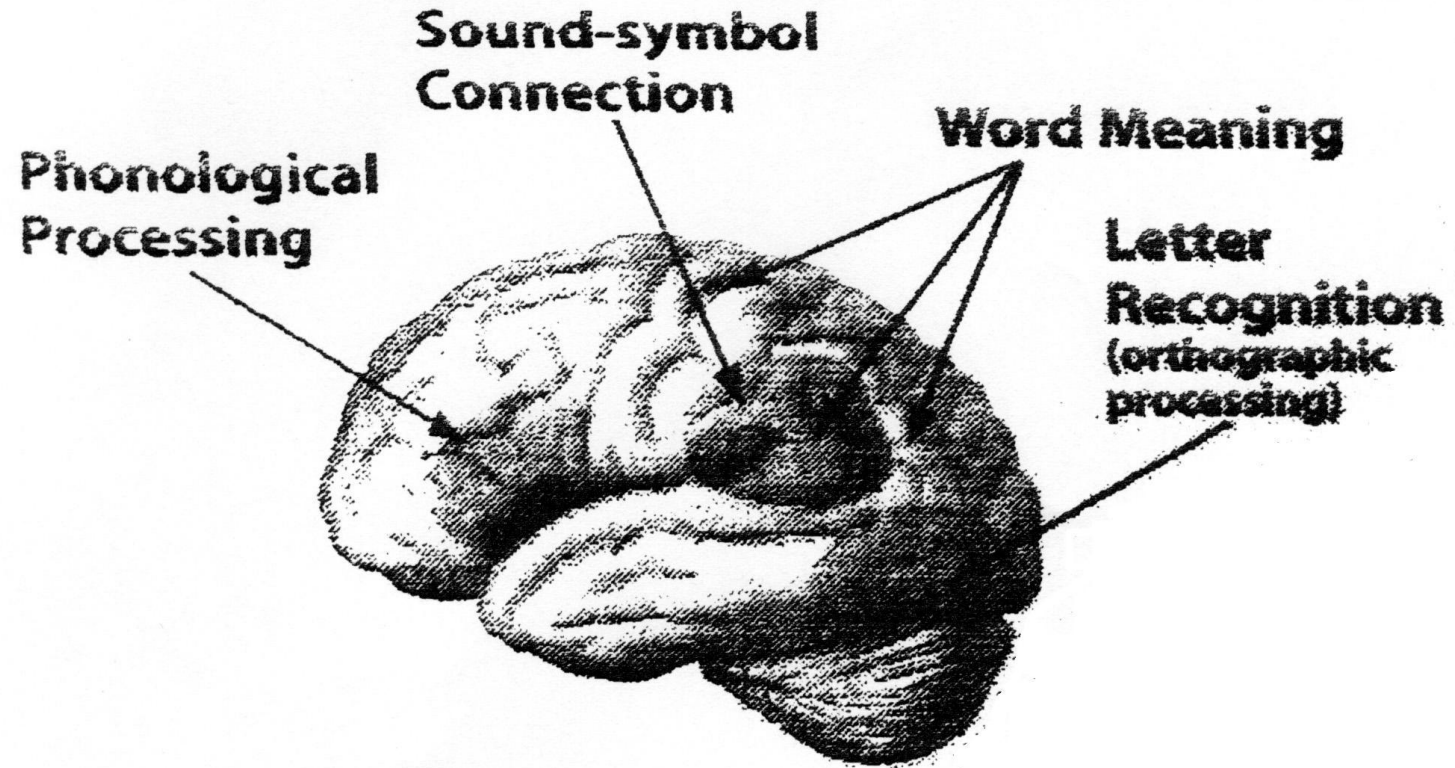
Reading

- ▶ Reading relies on brain circuits that are already wired for language, i.e., reading is an “overlaid function”
- ▶ fMRI shows 2 pathways for mapping reading:
 - 1 for beginning readers (Broca’s, parietal-temporal)
 - 1 for skilled readers (occipital- temporal)

Word Processing in the Brain



Areas of the Brain Used for Reading



Good vs. Poor Readers

- ▶ Skilled readers activate occipital temporal (back) areas and lesser amounts of frontal activation.
- ▶ Poor readers and dyslexics have under-activation of back neural pathways and more in frontal and parietal temporal.
- ▶ Overtime brain activation in dyslexics change showing more frontal region activation in adolescence.

Characteristics of a Reading Disorder vs. Dyslexia

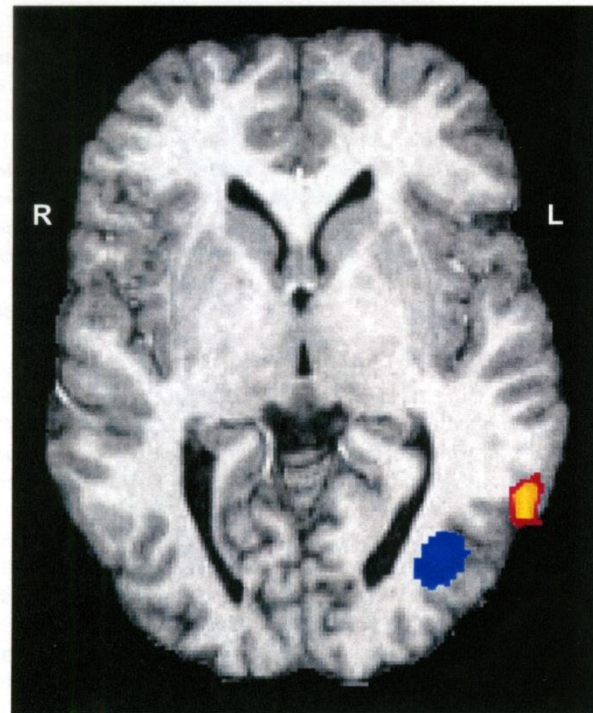
► Umbrella term:

Decoding- evident in early grades in initial acquisition of *learning to read*.

Comprehension/processing- becomes evident in third or fourth grade as complexity of print increases. Maybe good at decoding but misses intent, can't infer or predict. Compromised in *reading to learn*.

Yellow/flame: area of activation specific to letter processing

Blue: spatial location common to all tasks (color, symbol, letter) in visual cortex



What is developmental dyslexia?

- ▶ Reading and dyslexia can NOT be attributed to a single process.
- ▶ Dyslexia is a partially heritable condition that involves a complex cluster of processes or behaviors including: sensory processing (phonological processing), working memory, sensorimotor coordination.
- ▶ 5 to 20% of the population may have symptoms of dyslexia including slow or inaccurate reading, poor spelling and poor writing.
- ▶ The biological mechanisms of these “clinical” behaviors are being investigated, but are still not completely understood.

At-Risk behavioral manifestations for reading disability

- ▶ Deficits in phonological awareness
- ▶ Deficits in phonological sequencing (transpositions)
- ▶ Deficits in immediate or short term auditory memory
- ▶ Deficits in word or phoneme retrieval
- ▶ Genetic history
- ▶ Delayed onset of speech and language skills

Phonology

1. The study of the distribution and patterning of speech sounds in a language and the implied rules governing pronunciation.
2. The phonological system or the body of the phonological facts of a language.

Stumbling Blocks to Becoming a Good Reader

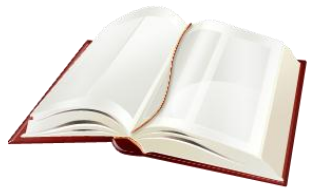
- ▶ Difficulty learning to read words accurately and fluently.
- ▶ Insufficient vocabulary, general fund of knowledge and reasoning skills to support comprehension of written language.
- ▶ Lack of motivation to read and a failure to develop a mature appreciation of the rewards of reading.

Classroom “signs” of a reading disability:

- ▶ Trouble with alphabetic learning; connecting sound to print; rhyming
- ▶ Difficulty remembering the letter names or “hearing” the sounds
- ▶ Difficulty with sound sequencing or sequencing in general (days of the week, months of the year etc.)
- ▶ Difficulty with any ideographic learning, such as number names; confuses math symbols
- ▶ Difficulty with spelling
- ▶ Difficulty with word retrieval
- ▶ Difficulty understanding what they read

“The Practice Effect”

- ▶ A 5th grade student at the 10th percentile reads about 60,000 words per year
- ▶ A 5th grade student at the 50th percentile reads about 900,000 words per year *(15 times as much practice per year)*



The Reading Process



COMPREHENSION

FLUENCY

PHONOLOGY

**ORAL
LANGUAGE**

Key to reading instruction for struggling readers

- ▶ **Explicit** instruction
- ▶ **Systematic** instruction
- ▶ **Intensive** instruction

Reading Readiness Skills

- ▶ Alphabet learning: sequencing, upper and lower case matching, sound symbol matching
- ▶ Vocabulary building
- ▶ Phonological and phonemic awareness skill development
- ▶ Story retelling and listening comprehension
- ▶ Promote sound and word play

Critical components for reading instruction

- ▶ **Fluency**- developing speed and automaticity in sound, word and text reading
- ▶ **Vocabulary expansion**- semantic and morphological knowledge including structural word analysis
- ▶ **Text comprehension**- retelling, predicting, inferring, summarizing and relating

SKILLS to ASSESS

- ▶ Achievement
- ▶ Ability (IQ)
- ▶ Memory
- ▶ Phonological awareness/ reading precursors
- ▶ Visual motor integration
- ▶ Language (vocabulary, word retrieval, processing)
- ▶ Processing Speed

Assessment tools for dyslexia

Critical reading precursors

- ▶ Short term auditory memory
- ▶ Retrievals and rapid naming
- ▶ Reading efficiency
- ▶ Phonic knowledge

Assessment tools

- ▶ TAPS-3, CTOPP Phonological memory subtests
- ▶ BNT (Boston Naming Test), CTOPP Rapid naming subtests
- ▶ TOWRE (Test of Word reading Efficiency), Reading fluency/rate: WJ-3. GORT-5
- ▶ DST (Decoding Skills Test), Word Attack- WJ3

Assessment tools for reading

Comprehension

- ▶ Word list reading
- ▶ Reading vocabulary
- ▶ Paragraph reading
- ▶ Story retelling (oral/ listening comprehension)

Assessment tools

- ▶ Word identification- WJ 4, KTEA-3, WIAT-3
- ▶ Word knowledge- PPVT-4, KTEA-3, WJ-3 Reading Vocabulary subtest
- ▶ WJ-4, KTEA-3, GORT-5, WIAT-3 (Nelson Denny- for high school)
- ▶ WRAML-2, WJ-3 Story Recall subtest

Achievement:

Woodcock Johnson Tests of Achievement 4(WJ-4)

Kaufman Test of Educational Achievement 2(KTEA-3)

Wechsler Individual Achievement Test 2 (WIAT 2)

Nelson Denny Reading Test (for 9th- 12th)

Test of Word Reading Efficiency-2 (TOWRE)

Decoding Skills Test (to look at phonic patterns) (DST)

DIBELS (for kinder and 1st phonological awareness—group testing)

Comprehensive Test of Phonological Processing (CTOPP-2) (5 -adult)

Phonological Awareness Test (PAT) (5yrs.- elementary)

Oral Written Language Test- Written Language (OWLS-2)

Ability:

Wechsler (WPPSI; WISC 5; WAIS)

Differential Ability Scale (DAS) (for young children with language factors)

Stanford Binet; K-ABC etc.

Memory:

Wide Range Assessment of Memory and Learning 2

Test of Auditory Perceptual Skills -R

Phonological Awareness:

DIBELS (for kinder and 1st phonological awareness—group testing)

Comprehensive Test of Phonological Processing (5 yrs.-adult)

Andre 5.1 yrs. Montessori kindergarten

Referred by the teacher and parents to look comprehensively at his learning profile of strengths and weaknesses, in light of disproportionate struggle with learning the alphabetic code in the context of an otherwise clearly “intelligent” little boy. **There is a significant genetic history of Dyslexia paternally.**

SUMMARY AND RECOMMENDATIONS: In addition to a **genetic history of dyslexia**, Andre presents with a cluster of behaviors that make him at even greater risk for expressing a dyslexic profile, including: **compromised immediate rote auditory memory skills ; difficulty with sequencing; poor rapid automatized naming; and difficulty with producing and discriminating rhyming patterns.** *There is a developmental range within which children acquire reading, and there is no direct correlation between intelligence and early reading,* however Andre’s weak rote auditory memory skills and his significant struggle with learning the alphabet code appears to be more pronounced than one would see as a result of developmental maturation.

The benefits of early intervention, as a prevention for reading failure is well documented.

1. It is recommended that reading instruction be approached aggressively in terms of the systematic nature of the program used, the intensity of the service delivery, and the explicit nature of the type of program. A multi sensory **methodology (Orton Gillingham)** should be used, but in the context of a structured and explicit **reading program**, such as the **Lindamood Bell programs (LIPPS, SEEING STARS), Phonographics, the P.A.T. Spell Read Program, or the Wilson Reading System, FUNDATIONS**, or similar type programs.
2. Reading instruction should be incorporated into Andre's day at school. Summer tutorial should be intensive targeting 8 - 10 hours a week of **systematic, explicit and intensive** reading instruction.
3. Andre will need repetition and practice in these early years, in order to develop critical phonological awareness skills, master the alphabetic code, with expectation that he will learn these pre-requisite skills to become a competent reader.
4. Programs such as **“Reading Wonders, DreamBox, Star Fall, Earobics Level I” and “Leapfrog”** can help to develop his phonological awareness skills, a critical ~~reading's parents~~ should continue to read to him, incorporating books of verse that will help to reinforce phonological awareness development.

ANDRE 6.3

<u>Test</u>	<u>Standard Score</u>	
OWLS, Written Language	99	
WJ 3 Basic Reading Skills	114	(99)
Word Attack	122	(100)
Spelling	113	(98)
Letter Word Identification	100	

DECODING SKILLS TEST (DST)

Basal Vocabulary: 100% pre-primer (1.2 G.E.), 70% primer (1.5), 30% first reader

Phonic Patterns: 100% CVC , 60% CVCe & CCVCC

Instructional methods for teaching and reinforcing phonology skills

- **Phonological awareness**

- Onset
- Rime
- Words in sentences
- Syllables
- Rhyming



•Phonemic awareness (sounds)

- Segmentation
- Blending
- Isolation
- Manipulation
- Deletion
- Substitution
- Reversal



A total reading program includes systematic phonics instruction integrated with other reading instruction in phonemic awareness, fluency, and comprehension strategies

Tim is a 15 year, 5 month old left-handed male currently in the 9th grade.

It was reported that Tim showed clear signs of difficulty with reading acquisition by 3rd grade, and has been tutored regularly through 6th grade, completing the Spell Read Program reportedly with good benefit. Historically, Tim was diagnosed with an Auditory Processing Disorder. He has continued to struggle with processing speed.

BEHAVIORAL OBSERVATIONS: Tim is a verbally engaging and charming young man who was highly cooperative and participatory. He is, however, quick to give up, especially as tasks become more challenging, and he is limited in his mental persistence. He approached math tasks with greater ease and speed, and in contrast was likely to “wear out” more quickly with reading tasks. For this assessment, he demonstrated good sustained attention with no evidence of impulsivity or overt distractibility

ACADEMIC PERFORMANCE: The Woodcock-Johnson-3, Tests of Achievement, the Wechsler Individual Achievement Test-2, the Nelson Denny, Form G, Reading Comprehension and Reading Rate Subtest, the Comprehensive Test of Phonological Processing (CTOPP), and the Test of Word Reading Efficiency(TOWRE) were administered to evaluate Tim’s academic skills in reading, arithmetic, spelling, written language and critical reading precursors, *as compared with chronological age peers in the population at large*. Overall, **he presents with a “classic” dyslexic profile, as he struggles significantly not only with reading speed but with reading mechanics in terms of decoding**. However, with short passages and under extended time conditions he is able to adequately gain meaning from print. He demonstrates strengths in his quantitative reasoning, though math fact automaticity again reflects an across the board compromise to his production speed. Written language too is characteristic of the Dyslexic profile, with less well developed spelling in context, limited vocabulary (and probably likely in an effort to compensate for poorer spelling), and less well developed or extended expository writing. He is able to gain meaning from print, despite his poor efficiency and competence with decoding. For short passages, as assessed by the Passage Comprehension Subtest of the WJ-3, he achieves a standard score of 103, though his reading comprehension rate drops off dramatically with demands for lengthier, more integrated reading that taps as well into working memory. Thus, even under extended time conditions on the Nelson Denny, Form G, Reading Comprehension Subtest, he performs only at the 9th percentile (HE DID NOT FINISH EVEN WITH EXTENDED TIME), and at the 7th percentile under timed conditions.

SUMMARY AND RECOMMENDATIONS: Tim is cognitively capable, but with a pattern of weaknesses on measures of decoding, critical reading precursors, such as rapid automatized naming, that is consistent with a **moderate Dyslexia** and concomitant **Written Language Disability**. In many ways Tim is the prototypical “**recovered dyslexic**” as he has had benefit from longstanding tutoring and the intensity and explicit nature of the Spell Read Program, but remains a slow reader, inefficient in decoding and encoding, yet age appropriate in terms of his ability to gain meaning from print. However, he **cannot sustain reading**, and his reading comprehension deteriorates as the demand for lengthy and sustained reading increases. Tim will continue to compensate. He will benefit from his strong verbal skills, intellect and motivation. As though he is equally likely to limit his strong verbal skills and will benefit from his well developed verbal abilities, good listening comprehension and his **executive function skills** continue to develop he will become more aware and adept at using strategies and compensatory skills.

What executive function skills will support his learning and reading?

TEST SCORES: TIM

WISC IV Verbal Comprehension Index- SS =108

CTOPP Phonological Awareness = 73

Phonological Memory = 94

Rapid naming = 58

TOWRE Sight Word Efficiency = 74

Phonemic Word reading Efficiency = 73

WJ3 BROAD READING =84

READING COMPREHENSION = 106

WORD ATTACK = 84

WORD IDENTIFICATION = 84

NELSON DENNY READING COMPREHNSION

(ET) =9th %ile

What would you recommend for Tim??

- ▶ Remediation
- ▶ Accommodations
- ▶ Modifications
- ▶ Strategies

Recommendations (Tim)

Accommodations

- ▶ Recorded text (www.learningally.org)
- ▶ Reader for standardized tests
- ▶ Extended time
- ▶ Laptop; spell check
- ▶ No penalty for spelling errors
- ▶ Text to speech software (Kurzweil, SmartPen)
- ▶ Speech to text software
- ▶ Teacher prepared outline or syllabus

Remedial

- ▶ Practice at listening to recorded material and software programs
- ▶ Sustained reading for 30 min daily; use hi interest material
- ▶ Tutorial in written language
- ▶ Brainstorm writing projects with an adult “scribe”
- ▶ Teach spelling recognition
- ▶ Master the 1000 most commonly used words in writing and 100 most common misspelled words

Recommendations (Tim)

Strategies

- ▶ Preview test and literature (teach techniques)
- ▶ Use abridged notes
- ▶ Watch movies or video when available
- ▶ Work in study groups

Modifications

- ▶ Foreign language exemption
- ▶ Limit/ adjust course load
- ▶ 5 year college plan

Reading comprehension

- ▶ Text comprehension is important because it is the reason for reading
- ▶ Text comprehension must be purposeful and active
- ▶ Text comprehension can be developed by teaching comprehension strategies
- ▶ Strategies can be taught through explicit instruction, cooperative learning, and with **technology support**

Critical components for reading comprehension instruction

- ▶ Previewing strategies
- ▶ Identification of relevant and irrelevant details
- ▶ Identification of main ideas, characters, setting, plot etc.
- ▶ Identify and underline key phrases or words
- ▶ Make summary notes
- ▶ Stop and check understanding (**active reading**)

Strategies

- ❑ Semantics- Word Learning:
 - ❑ teach new words in the context of something familiar
 - ❑ use a word multiple times in many ways
 - ❑ use a word in different grammatical context
- ❑ Grammatical Learning:
 - ❑ highlight endings and root words, emphasize superlative and comparative
 - ❑ find words within words
 - ❑ play with the grammar
- ❑ Phonological Learning:
 - ❑ segmenting sentences and words
 - ❑ discriminating and producing rhyming patterns
 - ❑ deleting and blending sounds

Who, What and When?

- ▶ Remediation
- ▶ Modifications
- ▶ Accommodations
- ▶ Strategies
- ▶ Student
- ▶ Teacher
- ▶ Tutor
- ▶ Parent
- ▶ Special program

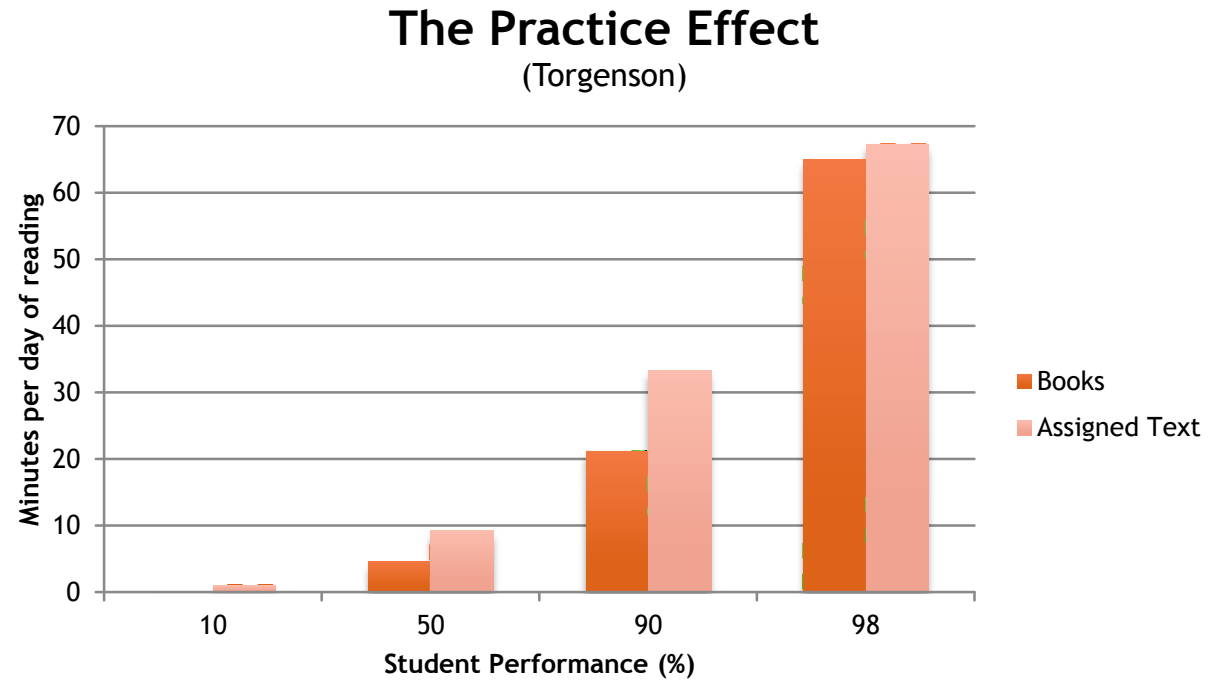
Lo-tech Hi-tech strategies for reading comprehension

- ▶ PRACTICE (independent reading)- below instructional level
- ▶ Shared reading- at instructional level
- ▶ Recorded books or reader-above instructional level
- ▶ Systematic instruction in comprehension strategies
- ▶ Teach previewing strategies
- ▶ Inspiration
- ▶ Kidspiration
- ▶ Stories and More
- ▶ PowerPoint
- ▶ Dragon
- ▶ Idioms
- ▶ Kurzweil
- ▶ SmartPen

The longer a child remains a poor reader the harder it is to catch up

- ▶ Lack of reading practice
- ▶ Lack of varied reading
- ▶ Limited reading of classroom material and learning
- ▶ Loss of interest in reading and learning
- ▶ Compromises fluency
- ▶ Compromises growth of vocabulary and general knowledge
- ▶ Compromises growth of essential information
- ▶ Compromises school success

The Practice Effect



Written Language



- Written language (learning to read and write) is segmented.
- It is made up of individual sounds in words and sentences.

*In order to read or write **cat**, the child needs to be aware that this single unit of sound is actually made up of three letters, each having an individual sound. (phonemic awareness)*

•No one program is more powerful than another. There is no “magic bullet.”
-G. Reid Lyon

•Programs which systematically and explicitly teach phoneme awareness and sound-symbol relationships (grapheme-phoneme) are far more successful in dealing with reading disabilities than other programs. -Torgesen and Wagner (Florida State University)

•It is essential that teachers have strong knowledge about reading development, reading difficulties and research-based instruction.
-Louisa Moats

•“Teachers teach students, not programs. A good teacher can use a Sears catalogue to teach a child to read.”
-Dr. Gerald Tirozzi

IDA Approved Programs (International Dyslexia Association)



Orton Gillingham (OG) Approach

Project Read Programs

Wilson Language training

Lindamood-Bell Learning
Processes

Neuhaus

Sounds and Letters
for Readers and Spellers

Family History

- ▶ 40%- 50% genetic factor; thought to be sex linked to males
- ▶ 2. Parental history of low reading and poor spelling/writing skills
- ▶ 3. Early childhood history of delayed speech language onset

RISK FACTORS IN YOUNG CHILDREN:

- ▶ Delay in onset of speech and language
- ▶ Familial history
- ▶ Word finding difficulties
- ▶ Short term memory difficult (remembering color names, shape names etc.)
- ▶ Sequencing difficulties
- ▶ Syllable transpositions

Summary

- Reading (and writing) is a process
- There is no “magic bullet”—one size does not fit all
- Program flexibility is critical