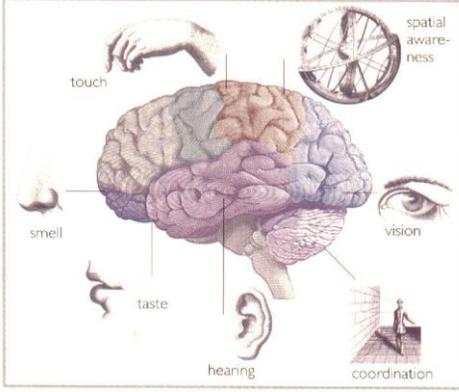
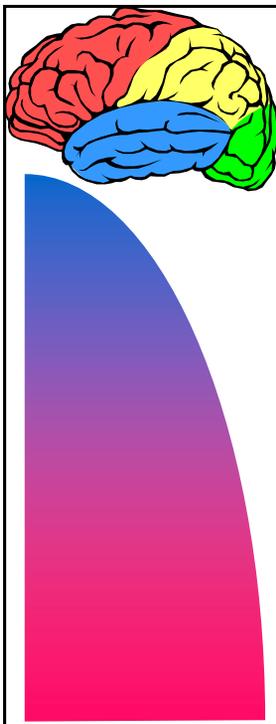


## The Neuropsychology of Reading Disorders: Diagnosis and Intervention



**Steven G. Feifer, D.Ed, NCSP, ABSNP**  
*feifer@comcast.net*

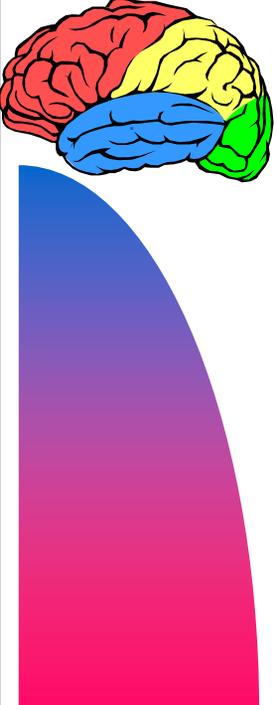
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## PRESENTATION GOALS

1. Discuss the pitfalls of relying on either an aptitude/achievement discrepancy model, or a student's **R**esponse **t**o **I**ntervention, as the sole basis for identifying reading disorders in young children.
2. Link brain functions to the reading process and introduce a *brain-based* educational model to effectively identify and classify **subtypes** of reading disorders.
3. Discuss four key brain concepts with respect to reading, and tie in appropriate remediation and educational and strategies for each reading subtype.
4. Introduce the **90 minute dyslexia** evaluation to measure eight core constructs associated with reading disorders in children.

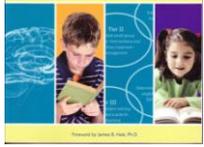
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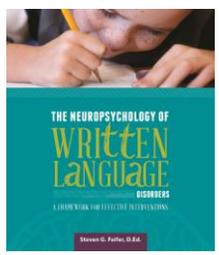
## Further Reading Materials

**Integrating RTI With  
Cognitive Neuropsychology:**  
A SCIENTIFIC APPROACH TO READING

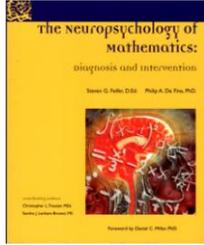
Steven G. Faller, D.Ed.    Douglas A. Della Follina, Ph.D.



Foreword by David C. Phillips, Ph.D.



**THE NEUROPSYCHOLOGY OF  
WRITTEN  
LANGUAGE**  
FROM NEURAL CIRCUITS TO DISORDERS  
Foreword by Steven G. Faller, D.Ed.



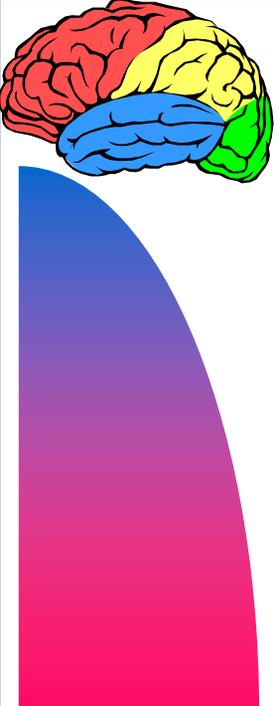
**the neuropsychology of  
mathematics:**  
diagnosis and intervention

Steven G. Faller, D.Ed.    Philip A. Du Pree, Ph.D.

Foreword by David C. Phillips, Ph.D.

[www. schoolneuropsychpress.com](http://www.schoolneuropsychpress.com)

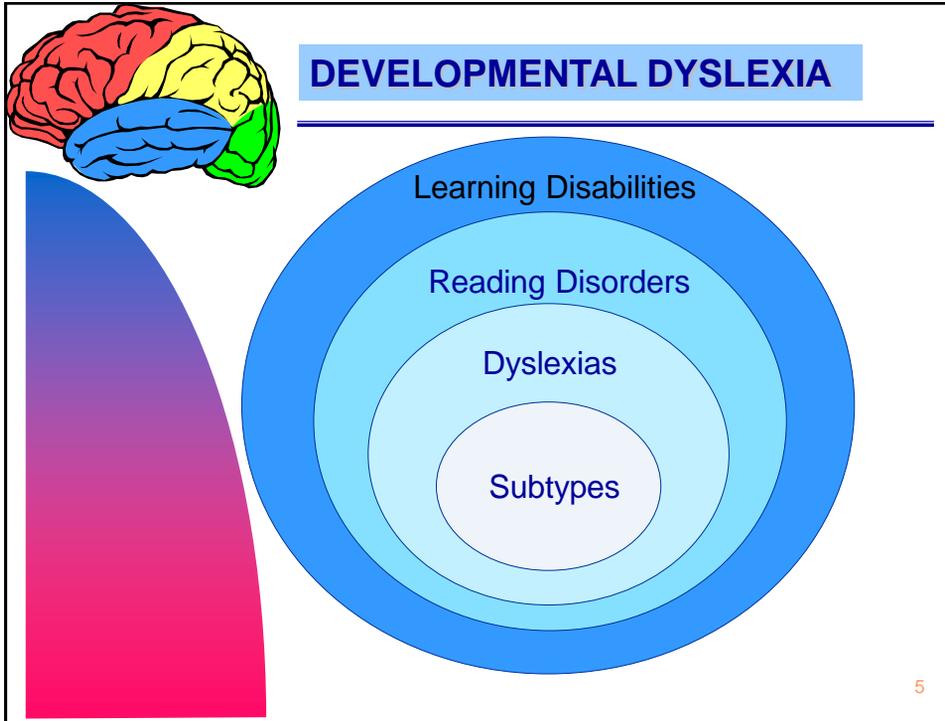
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## DEVELOPMENTAL DYSLEXIA

- ▶ The term refers to an inability to acquire functional reading skills despite the presence of **adequate** intelligence and exposure to educational opportunities.
- ▶ This term is often synonymous with the term **“learning disabled,”** and is assumed to represent 5% to 10% of all children.
- ▶ Nearly 80% of children identified as LD have a reading disorder (Lyon, 1996).

4




**NATIONAL ASSOCIATION OF SCHOOL PSYCHOLOGISTS**

**NASP 2011 LD POSITION STATEMENT**

- ▶ Specific learning disabilities are endogenous in nature and are characterized by **neurologically** based deficits in cognitive processes.
- ▶ These deficits are specific; that is, they impact particular cognitive processes that interfere with the acquisition of academic skills.
- ▶ Specific learning disabilities are heterogeneous—there are various **types** of learning disabilities, and there is no single defining academic or cognitive deficit or characteristic common to all types of specific learning disabilities.
- ▶ It is best practice to look at multiple sources of data, including how students respond to scientifically based instruction, including environmental and instructional conditions. Relying upon an **ability–achievement discrepancy** as the sole means of identifying children with specific learning disabilities is at odds with scientific research and with best practice (Gresham & Vellutino, 2010).

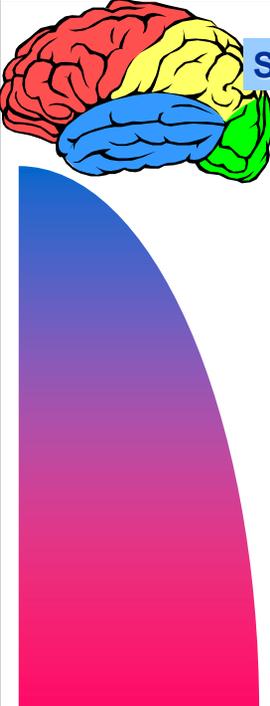


## MAIN PITFALLS OF DISCREPANCY MODEL

1. There is no universal agreement on what the discrepancy should be.
2. A discrepancy model of reading disabilities precludes early identification.
3. Intelligence is more a predictor of school success, and not necessarily a predictor of successful reading.
4. A discrepancy model promotes a *'wait and fail'* policy, forcing interventions to come after the fact.

**Side note:** Do you really think human intellectual functioning can be captured by one unitary value?

7

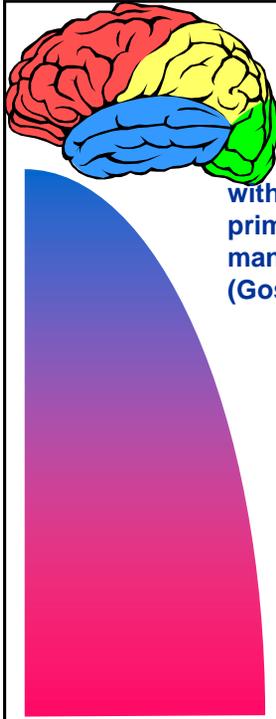


## School Neuropsychological Assessment

**Neuropsychology:** An analysis of learning and behavior which examines brain-behavior relationships. The underlying assumption is that the brain is the seat of **ALL** behavior; therefore, knowledge of cerebral organization should be the key to unlocking the mystery behind most cognitive tasks.

- ▶ Reports based upon a brain-behavioral paradigm which attempts to describe how a child learns and processes information...not label.
- ▶ More comprehensive!!
- ▶ Evidence based interventions require evidence based assessments!!

8



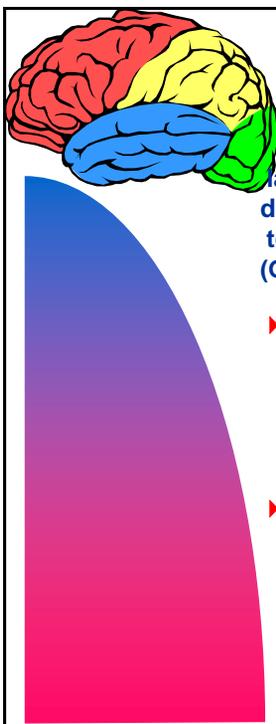
## Four Universal Truths of Reading

1. In all word languages studied to date, children with developmental reading disorders (dyslexia) primarily have difficulties in both recognizing and manipulating phonological units at all linguistic levels (Goswami, 2007).

<u>Lowest Incidence:</u>		<u>Highest Incidence:</u>	
Slovakia	1-2%	China	5-8%
Italy	1-5%	United States	5-10%
Czech Republic	2-3%	Russia	10%
Britain	4%	Israel	10%
Poland	4%	Finland	10%
Belgium	5%	Nigeria	11%
Greece	5%	Australia	16%
Japan	6%	India	20%

(Smith, Everatt, & Salter, 2004)

9



## Four Universal Truths of Reading

2. The English language *is not* a purely phonological language. In fact, one letter may map to as many as five distinct phonemes or sounds. English speaking children tend to develop phonemic processing more slowly (Goswami, 2007).

- ▶ The English language includes over 1,100 ways of representing 44 sounds (phonemes) using a series of different letter combinations (Uhry & Clark, 2005). By contrast, in Italian there is no such ambiguity as just 33 graphemes are sufficient to represent the 25 phonemes.
- ▶ Therefore, 25% of words are phonologically irregular (i.e. “debt”, “yacht”, “onion”, etc..) or have one spelling but multiple meanings (i.e. “tear”, “bass”, “wind”, etc..)
- ▶ Summary: We need to develop orthography!!

10

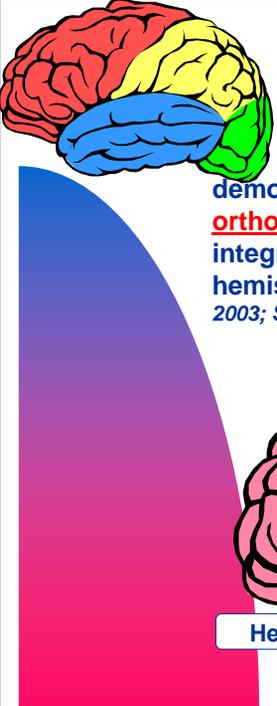


## Six Syllable Subtypes

The **six** types of syllables that compose English words must be directly taught. These syllable subtypes help to develop **orthographical** patterns in words and include:

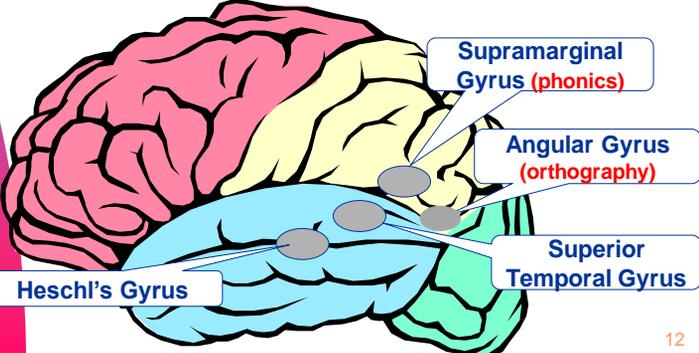
- a) Closed syllables (just one vowel... "cat")
- b) Open syllables (ends in long vowel... "baby")
- c) Vowel-Consonant **E** Syllables  
(silent **e** elongates vowel... "make")
- d) Vowel-Team Syllables (two vowels make one sound... "caution")
- e) R-Controlled Syllables (vowel followed by "r" changes sound... "hurt")
- f) Consonant-**le** Syllables (end of word ending in "le" ..... "turtle")

11

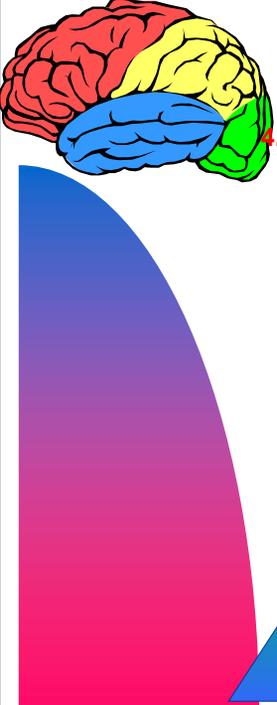


## Four Universal Truths of Reading

3. Specific neuroimaging techniques have demonstrated that **phonological** processing and **orthographic** processing is a by-product of the functional integrity of the *temporal-parietal* junctures in the left hemisphere of the brain (Pugh et al., 2000, McCandliss & Noble, 2003; Shaywitz, 2004; Sandak et al., 2004).



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## Four Universal Truths of Reading

According to the National Reading Panel (2000), and modified by Grizzle et al. (2009), the 5 big ideas of the reading process include:

**5 Big Ideas**

*COMPREHENSION*

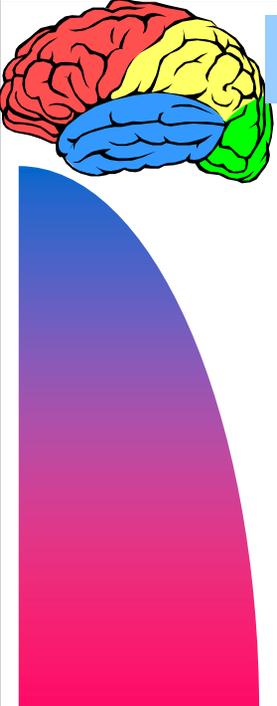
*LANGUAGE*

*FLUENCY*

*PHONICS*

*PHONEMIC AWARENESS*

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## NATIONAL READING PANEL CONCLUSIONS

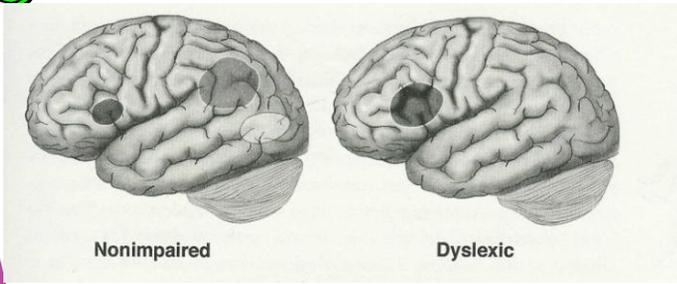
- (1) The younger the child, the better the outcome.
- (2) The “*at-risk*” child responds best to small group instruction (3:1), with **phonological awareness** training being combined with **explicit phonics**.
- (3) Highly trained teachers achieve the best results.
- (4) Frequency of instruction (4-5 days per week) was more effective than sporadic instruction (2 days per week).
- (5) For each successive year in school, more intensive phonological instruction is required.
- (6) The following characteristics were associated with poor outcome:
  - a) attention or behavior concerns
  - b) low socioeconomic status
  - c) poor verbal skills
  - d) poor rapid naming skills

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## NEURAL CIRCUITRY OF DYSLEXIA

(Shaywitz, 2003)

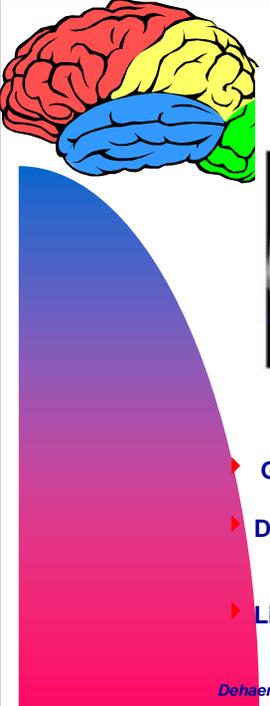




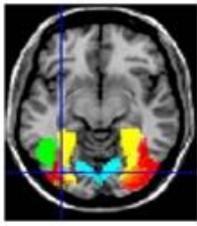
- ▶ Nonimpaired readers activate primarily posterior portions of left hemisphere.
- ▶ Impaired readers under-activate posterior regions and activate primarily frontal areas.

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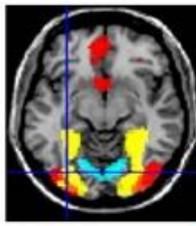
## Brain Imaging and Dyslexia



9 year-old  
good readers

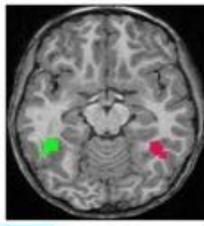


9 year-old  
dyslexics



Greater activity in good  
readers than in dyslexics

for words    for faces



Words







- ▶ Good readers show a well-developed visual word form area (shown in green).
- ▶ Dyslexics show no such specialization for written words, and also exhibit a much weaker activation to faces in the right hemisphere.
- ▶ Literacy involves a specialization of the visual word form area in the left hemisphere.

Dehaene, S. (2013) *Inside the letter box: How literacy transforms the human brain.* Cerebrum <sup>16</sup>

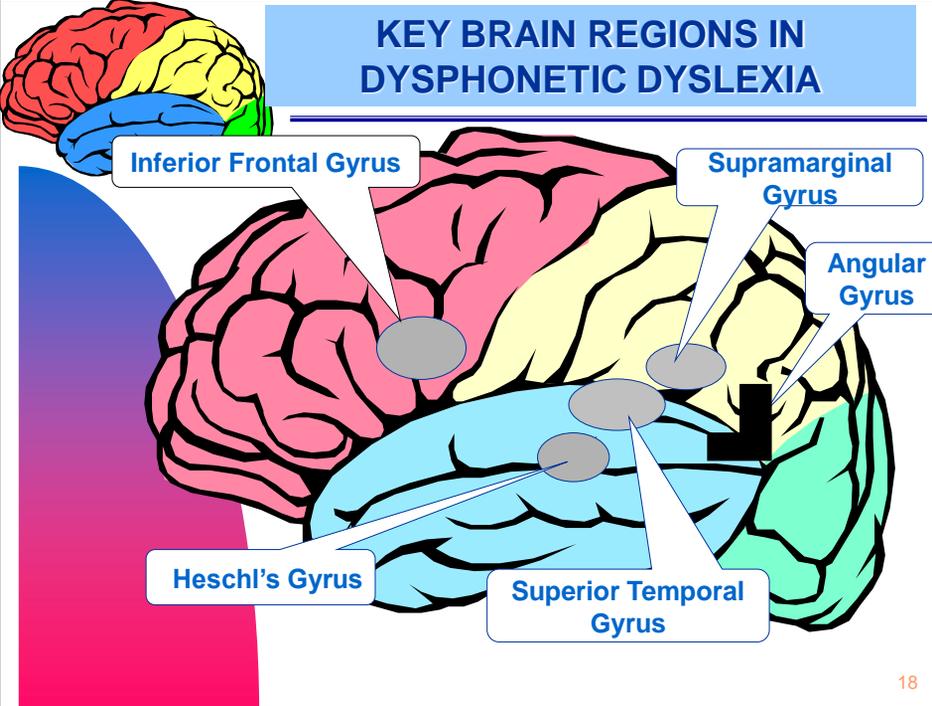


## SUBTYPES OF DYSLEXIA

1. **Dysphonetic Subtype** - great difficulty using phonological route in reading, so visual route to lexicon is used. These readers do not rely in letter to sound conversions, but rather over-rely on visual cues to determine meaning from print.

**Neuropsychological Significance:** Left temporal-parietal cortex (*supramarginal gyrus*).

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## KEY BRAIN REGIONS IN DYSPHONETIC DYSLEXIA

- Inferior Frontal Gyrus
- Supramarginal Gyrus
- Angular Gyrus
- Heschl's Gyrus
- Superior Temporal Gyrus

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## KEY BRAIN REGIONS IN DYSPHONETIC DYSLEXIA

- Heschl's Gyrus** – auditory perception and discrimination (*phonemic awareness*).
- Superior Temporal Gyrus** – modulating the 44 phonemes of the English language.
- Angular Gyrus** – cross modal association area underlying mapping symbols to sounds (*orthography*).
- Supramarginal Gyrus** – cross modal association area underlying the spatial appreciation and positioning of sounds.
- Inferior Frontal Gyrus** – end point for inner articulation region.
- Fusiform Gyrus** – automatic word recognition center of the brain.

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## REMEDATION STRATEGIES FOR DYSPHONETIC DYSLEXIA

<p><b><u>Over Age 12:</u></b></p> <p>(Top-Down)</p> <p><b><u>Ages 7 - 12:</u></b></p> <p>(Bottom-Up)</p> <p><b><u>Under Age 7:</u></b></p>	<ul style="list-style-type: none"> <li>Wilson Reading System</li> <li>SRA Corrective Reading &amp; REACH System</li> <li>Read 180</li> <li>HOSTS</li> <li>Kaplan Spell/Read</li> </ul> <ul style="list-style-type: none"> <li>Alphabetic Phonics (Orton-Gillingham)</li> <li>Recipe for Reading</li> <li>SRA Corrective Reading</li> <li>Earobics II</li> <li>SIPPS</li> <li>Lindamood Seeing Stars Program</li> <li>LEXIA</li> <li>Horizons</li> <li>Read Well</li> <li>DISTAR (<i>Reading Mastery</i>)</li> </ul> <ul style="list-style-type: none"> <li>Fast Forward II(Tallal)</li> <li>Earobics I</li> <li>Phono-Graphix</li> <li>Saxon Phonics Program</li> <li>Success for All</li> <li>Ladders to Literacy</li> <li>Foundations</li> <li>Road to the Code</li> <li>Scott Foresman Early Intervention Reading</li> </ul>
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20



## Alphabetic Phonics

- ▶ Orton-Gillingham multi-sensory program
- ▶ Synthetic..bottom-up approach...

**11 activities:**

1) Language building	7) Handwriting
2) Alphabet recognition	8) Spelling
3) Reading Decks	9) Verbal Expression
4) Spelling Decks	10) Reviews
5) New Learning	11) Reading Comp
6) Reading Practice	

- ▶ Highly scripted
- ▶ Up to 3yrs to complete
- ▶ Fast paced activities emphasizing automaticity

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## SRA Corrective Reading

- ▶ Designed for students grades 4-12
- ▶ Recommended 4-5 days per week...45 min per day.
- ▶ Emphasis is on decoding and comprehension, but most research only examined decoding portion of program.
- ▶ Program is aligned with “Scientifically Based Reading Research” (SBRR) because it covers 5 pillars of reading as outlined by the National Reading Panel.
- ▶ The teacher models phonemic awareness using auditory activities which are then applied to decodable text. Vocabulary instruction is taught using morphological rules.
- ▶ Recommended for SPED kids reading one or more years behind. Scaffolded nature imposes structure to assist students with executive dysfunction as well.

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## HORIZONS FAST TRACK A-B

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- \* 150 Lessons – 50 minutes per lesson
- \* Highly scripted....designed for Grades 2 and above
- \* Letter sounds taught in two families:
  - 1) **F,L,M,N,R,S,X,Y** - last part of sound makes letter.
  - 2) **B,D,J,K,P,T,V,Z** - initial sound is the letter.
- \* After consonants are learned, orthographic prompts color code blends. For instance, the blue letter makes no sound and the black letter says its name:
 

**ay**

**ea**
- \* Word attack activities emphasizing decoding and critical vocabulary prepare students for upcoming stories

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## The Morphological Connection (“Top-Down”) (Senechal & Kearnan, 2007)

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**Morpheme**- the smallest meaningful component of a word that still conveys meaning. Examples include:

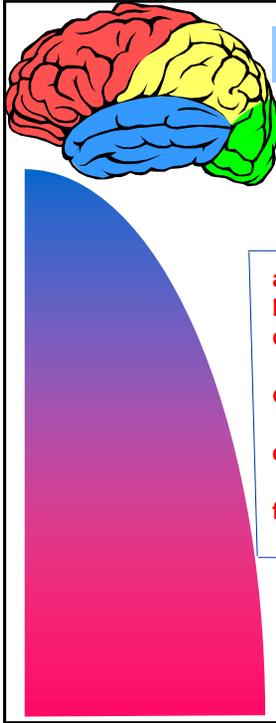
**Prefixes:** *ante, extra, mis, para, pre, retro, super*

**Suffixes:** *able, tion, ment, ness, ship, tude, ward, ible*

**Latin Roots:** *cent, extra, hemi, meta, therm, ultra*

- ▶ Research suggests that children learn to **anticipate** words through a combination of phonological, orthographic, and morphological strategies.
- ▶ Knowledge about morphological awareness contributes to individual differences in reading and spelling that cannot be entirely attributed to orthographic and phonological processing.

24



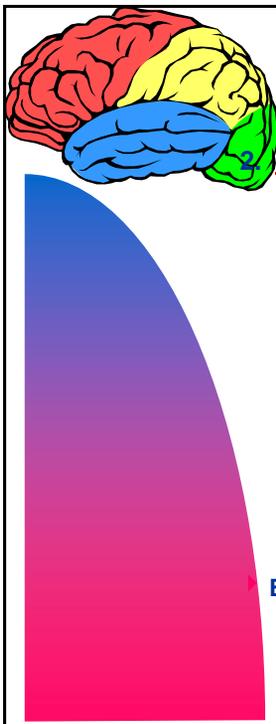
## Wilson Reading System

- ▶ Designed specifically for adolescents and adults with dyslexia. Also, very appropriate for ELL students.
- ▶ Recommended 4-5 days per week...45 -90 min per day.
- ▶ Emphasis is on **six syllable subtypes**:

- a) Closed syllables (just one vowel..."cat")
- b) Open syllables (ends in long vowel..."baby")
- c) Vowel-Consonant **E** Syllables (silent **e** elongates vowel..."make")
- d) Vowel-Team Syllables (two vowels make one sound..."caution")
- e) R-Controlled Syllables (vowel followed by "r" changes sound..."hurt")
- f) Consonant-**le** Syllables (end of word ending in "le"....."turtle")

- ▶ Students create their own diacritical markers.
- ▶ Students rely upon finger tapping to learn syllable boundaries.
- ▶ Comprehension component does not rely upon metacognitive strategies, but rather **visualization**.

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## SUBTYPES OF DYSLEXIA

**Surface dyslexia** - an over-reliance on sound symbol relationships as the process of reading never becomes automatic. These children break every word down to its phonetic base, and read slowly due to poor **orthographic processing**.

WORD	→	READ AS
island	→	izland
grind	→	grinned
listen	→	liston
begin	→	beggin
lace	→	lake

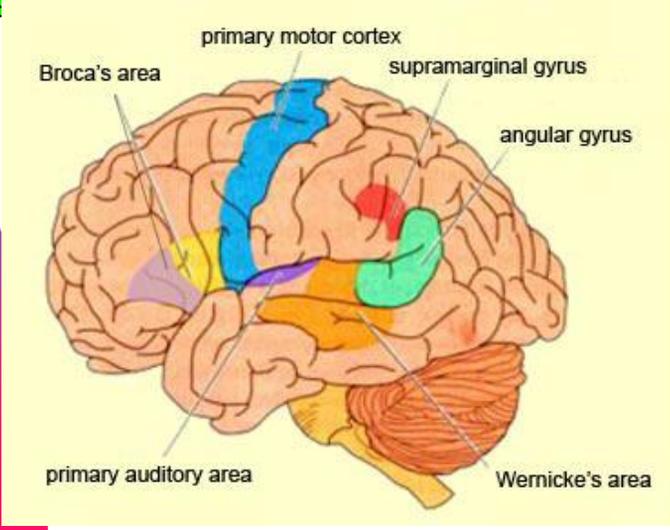
▶ Extreme difficulty reading words where phonemes and graphemes are not in 1 to 1 correspondence: yacht  
debt

26



## KEY BRAIN REGIONS IN SURFACE DYSLEXIA

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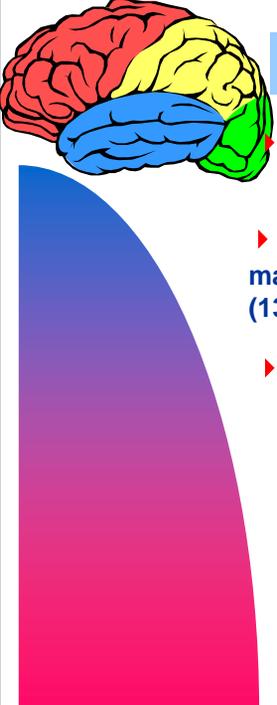


## REMEDATION OF SURFACE DYSLEXIA

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<u>Over Age 12:</u>	Academy of Reading Wilson Reading System Laubauch Reading Series Read 180
<u>Ages 7 - 12:</u>	Read Naturally Great Leaps Reading Quick Read RAVE-O Fast Track Reading
<u>Under Age 7:</u>	Destination Reading Reading Recovery Early Success Fluency Formula

28

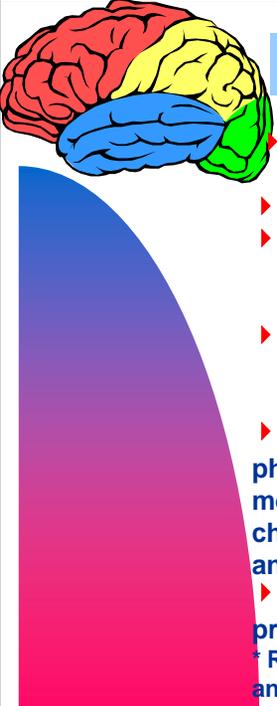


## Read Naturally

A fluency based program designed to develop speed, accuracy, and proper expression.

- ▶ Designed to be used 3 times per week...30 minutes, mainly for students between 2<sup>nd</sup> (51wpm) though 8<sup>th</sup> (133 wpm) grades.
- ▶ Each level of the program has 24 non-fiction stories.
  - a) Student placed in level and goal is set.
  - b) Cold read for one minute graphing wpm and identifying difficult words.
  - c) Read with tape three times consecutively.
  - d) Hot read is attempted.
  - e) Comprehension questions involve main idea, details, vocabulary, inferences, and short answers.

29

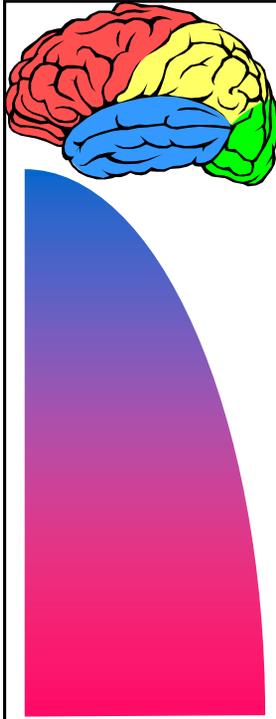


## RAVE-O (Maryann Wolf, 2006)

Reading fluency program released in 2006 after 10 years of extensive research.

- ▶ Grades 1-5 and ELL students...45 min/day..16weeks
- ▶ **R**eading, **A**utomaticity, **V**ocabulary, **E**ngagement, & **O**rthography.
- ▶ Main focus is to determine 80 percent accuracy on material, then focus upon speed and fluency.
- ▶ Each week, the student learns core words at the phonemic, orthographic, semantic, syntactic, and morphological levels. The premise is that the more the child knows about the word, the quicker it is retrieved and comprehended.
- ▶ Speed Wizard computer program assists with progress monitoring.
- ▶ Researched based (Morris et al., 2007) to improve fluency and comprehension.

30



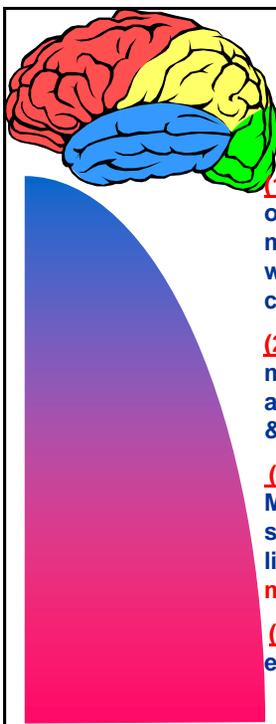
## SUBTYPES OF DYSLEXIA

3. **Mixed Dyslexia** - severely impaired readers with characteristics of both **phonological** deficits, as well as **orthographical** deficits. These readers have no usable key to the reading and spelling code. Very bizarre error patterns observed.

<u>WORD</u>	<u>READ AS:</u>
Advice	Exvices
Correct	Corex
Violin	Vilen
Museum	Musune
Possession	Persessive
Material	Mitear

▶ Multiple breakdowns along many pathways modulating the entire reading process.

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## 4 REMEDIATION STRATEGIES FOR MIXED DYSLEXIA

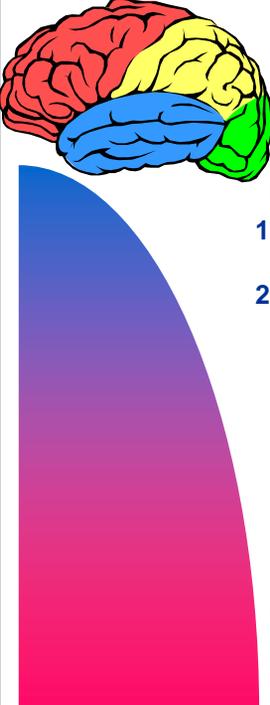
(1) **Balanced Literacy** - An eclectic and approach capitalizing on the particular strengths of the child. Consider using a multi-sensory type of Orton-Gillingham program, coupled with a fluency model such as Read Naturally, and the computerized models of Read 180.

(2) **Top Down Strategies** - Often atypical development mapping individual sounds to the visual word form association areas (Temple, 2002; Shaywitz, et al, 2003; Noble & McCandliss, 2005).

(3) **Socioeconomic Status** - According to Noble and McCandliss (2005), socioeconomic status (SES) is a very strong predictor of reading skills due primarily to the home literacy environment. Therefore, schools need to provide **more reading opportunities**.

(4) **Motivation and Confidence** -Great Leaps, Read Naturally, etc. tend to give immediate feedback.

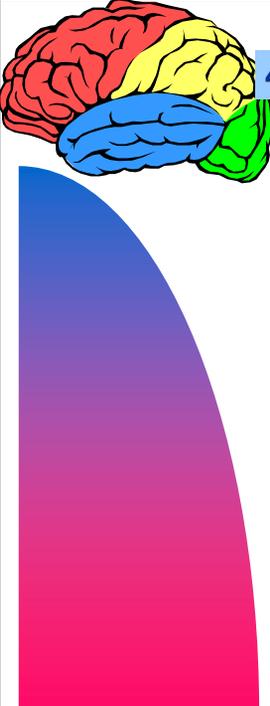
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## Read 180 (Dr. Ted Hasselburg)

- ▶ A 90 minute per day balanced literacy program.
- ▶ Designed for grades 4<sup>th</sup> – 12<sup>th</sup>.
- 1) 20 minute whole group instruction where teachers model fluent reading skills.
- 2) Students then move to three-20 min stations.
  - a) **Teacher Station** – small group differentiated instruction to reinforce previous concepts.
  - b) **Computer Station:**
    - *Reading Zone (phonics, fluency, vocab)*
    - *Word Zone (automaticity of decoding)*
    - *Spelling Zone*
    - *Success Zone (comprehension strategies)*
  - c) **Library Station** – read silently and written language activities.
- ▶ Software adapts level of instruction to learner.
- ▶ Expensive, but research based...recommended for most struggling readers.

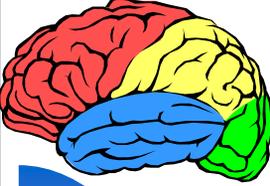
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## 4 Components of Reading Comprehension

1. **Content Affinity** - attitude and interest toward specific material.
2. **Working Memory** - the ability to temporarily suspend information while simultaneously learning new information. The amount of memory needed to execute a cognitive task.
3. **Executive Functioning** - the ability to self-monitor performance and organize information on a given problem solving task.
4. **Language Foundation** – most children enter kindergarten with 3000 – 5000 words, though graduate from high school with 60,000 words (Pinker, 1994).

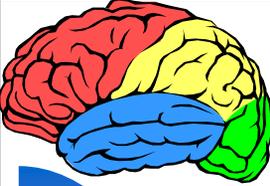
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## Reading Comprehension Interventions

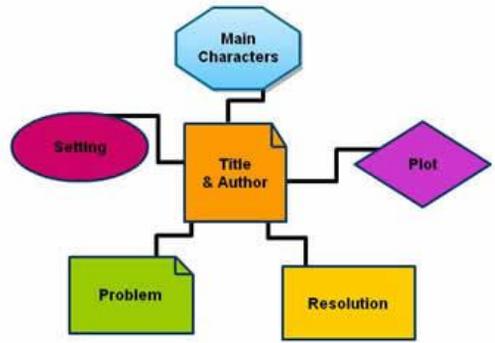
- 1. Stop & Start Technique** – student reads a passage out loud and every 30 seconds “stop” to ask questions.
- 2. Directional Questions** – ask questions at the beginning of the text instead of the end.
- 3. Read Aloud** – reading out loud allows student to hear their own voices and facilitates working memory.
- 4. Story Maps** – pre-reading activity where graphic organizers are used to outline and organize the information.

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## Story Mapping Technique

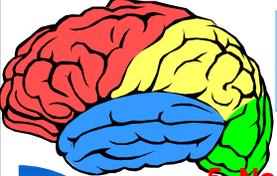
### Story Map



```

graph TD
    MC[Main Characters] --- TA[Title & Author]
    S((Setting)) --- TA
    P{Plot} --- TA
    TA --- PR[Problem]
    TA --- R[Resolution]
  
```

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## Reading Comprehension Interventions

- 5. Narrative Retelling** – have the child retell the story after reading aloud in their own words.
- 6. Multiple Exposures**– encourage students to skim the material prior to reading, with emphasis on chapter and text headings.
- 7. Active Participation** – encourage active, not passive reading, by having children take notes or putting an asterisk next to important information. Also, multiple colors for highlighting.
- 8. Reduce Anxiety** – anxiety inhibits working memory and leads to ineffective recall. Be wary of having children read out loud in class.
- 9. Practice Terminology**– review vocabulary terms and concepts prior to reading the text.

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## SOAR to SUCCESS

- ▶ A comprehension program for grades 3-6.
- ▶ 30-35 minute lessons...18 weeks.
- ▶ **4 Key Strategies:**
  - a) Summarize
  - b) Clarify
  - c) Question
  - d) Predict
- \* **5 Key Aspects of Program.**
  - 1) **Revisiting** – re-read previous story with a partner.
  - 2) **Reviewing** – graphic organizer used to summarize.
  - 3) **Rehearsing** – preview text and make predictions of book to be read that day.
  - 4) **Read and Reciprocal Teaching** – silent reading and practicing strategies.
  - 5) **Reflecting** – discussing story.

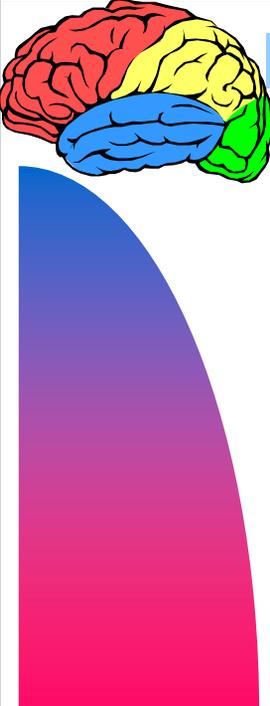
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## Lindamood Visualization and Verbalization for Language Comprehension and Thinking

- ▶ Created by Nanci Bell
- ▶ Recommended 3-5 times per week for 60 minutes.
- ▶ 12 week program- whole class or individual.
- ▶ Based upon 12 structure words (*i.e. what, size, color, shape, etc.*) used to provide a framework to create visual images. The student begins with picture imaging, word imaging, sentence imaging, multiple sentence imaging, and paragraph imaging.
- ▶ Pacing is determined by student progress.
- ▶ Researched based (Johnson-Glenberg, 2000; Sadoski & Wilson, 2006).
- ▶ Consideration for students with Autism, Hyperlexia, ELL, and students with lower verbal abilities.

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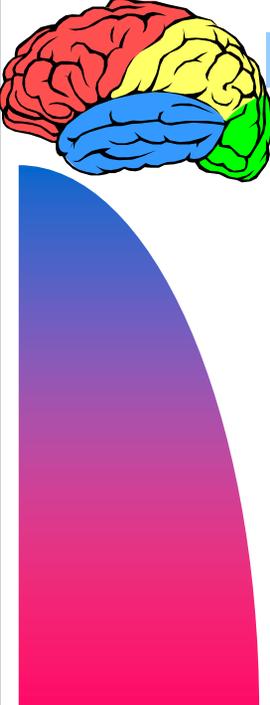


## 90 Minute Dyslexia Evaluation

- ▶ Intelligence tests (Gc)
- ▶ Phonemic/Phonological Awareness (Ga)
- ▶ Rapid Naming (Glr)
- ▶ Verbal Memory Tests (Gsm)
- ▶ Reading Fluency (Gs)
- ▶ Orthographic Skills (Gv)
- ▶ Attention (Gs)
- ▶ Executive Functioning (Gf)

**\* INTEGRITY NOT DISCREPANCY**

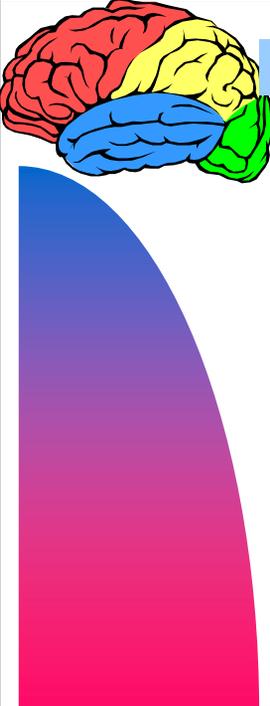
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## 90 Minute Dyslexia Evaluation

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- ▶ **Phonemic/Phonological Awareness :**  
*NEPSY II: Phonological Processing  
 PAL II: Phonological Coding  
 WIAT III: Pseudoword Decoding, Early Reading  
 CTOPP  
 KTEA II*
- ▶ **Rapid Naming:**  
*PAL II: RAN, NEPSY II: Speeded Naming, CTOPP,  
 KTEA II*
- ▶ **Verbal Memory Tests:**  
*CVLT-C, NEPSYII: List Memory,  
 PAL II Verbal Working Memory*
- ▶ **Reading Fluency:**  
*GORT 5, CBM, WIAT III ORF,  
 WIAT III Word Reading*
- ▶ **Orthographic Skills:** *PAL II Receptive Coding,  
 Orthographic Spelling, TOC*
- ▶ **Attention:** *NEPSY II Auditory Attn, Connors 3, TEACH*
- ▶ **Executive Functioning:** *BRIEF, NEPSY II Inhibition, WIAT III  
 Reading Comp (Inferential vs. literal), DKEFS*



## School Neuropsychological Model

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1. **Dysphonetic Dyslexia:**
  - ▶ *Phonemic Awareness Deficits*
  - ▶ *Phonological Processing Deficits*
  - ▶ *Poor reading accuracy*
  - ▶ *Tendency to “guess” on words*
2. **Surface Dyslexia:**
  - ▶ *Orthographic Processing Deficits*
  - ▶ *Slower Rapid Naming Skills*
  - ▶ *Poor Reading Fluency*
  - ▶ *Inaccurate Reading of “Irregular Words”*





## School Neuropsychological Model

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**3. Mixed Dyslexia:**

- ▶ Phonological and Orthographical Deficits
- ▶ Poor Working Memory
- ▶ Slower Processing Speed
- ▶ Significantly Below Grade Level
- ▶ Failure to Respond to Interventions

**4. Comprehension Deficits:**

- ▶ Poor Attention
- ▶ Poor Executive Functioning
- ▶ Limited Verbal Working Memory
- ▶ Lower Vocabulary Skills
- ▶ Slower Reading Speed

