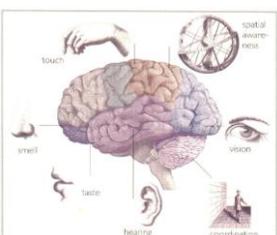




The Neuropsychology of Reading Disorders: Diagnosis and Intervention



Steven G. Feifer, D.Ed, NCSP, ABSNP
feifer@comcast.net
www.schoolneuropsychpress.com

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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 to **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 universal truths with respect to reading in order to provide a foundation for linking each reading subtype with specific interventions.
4. Introduce the **90 minute dyslexia** evaluation to measure specific cognitive processes associated with reading disorders, and introduce the **FAR**.

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Further Reading Materials



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Basic Literacy Facts National Literacy Council (2008)

The educational careers of 25 to 40 percent of American children are imperiled because they don't read well enough, quickly enough, or easily enough.

- ▶ SLD are twice as likely to suffer from mental health issues specifically related to their disability. This contributes to elevated dropout rates, poorer graduation rates, and meager employment options (National Center for Learning Disabilities, 2011).
- ▶ The graduation rate of students with SLD is just **64%**, well below that of non SLD students.
- ▶ It is estimated that more than \$2 billion is spent each year on students who repeat a grade because they have reading problems.
- ▶ Children who have not developed some basic literacy skills by the time they enter school are 3 - 4 times more likely to drop out in later years.

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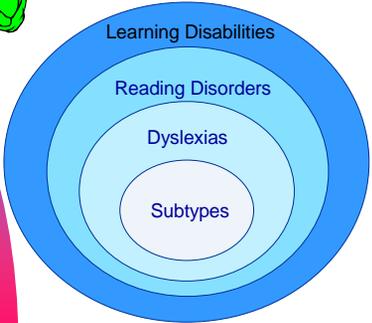
DEVELOPMENTAL DYSLEXIA

- ▶ 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).

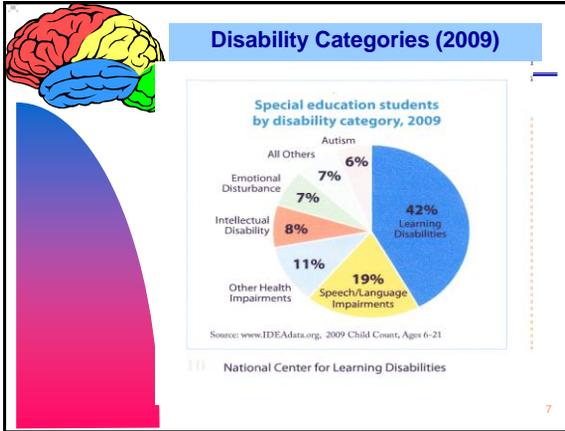
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DEVELOPMENTAL DYSLEXIA



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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?



Summary of RtI Delivery Model

RtI strengths:

- ▶ allows for earlier intervention.
- ▶ non-categorical.
- ▶ excellent for progress monitoring.
- ▶ utilizes data to make decisions.
- ▶ systemic deployment of interventions.

RtI weaknesses: *not sufficient to identify a learning disability!*
(National Joint Commission on Learning Disabilities, June 2005)

- ▶ Run the risk of delaying assessment and denying a student eligibility for services (OSEP memo, 2010).
- ▶ RtI is incapable of differential diagnosis and offers little in identifying other emotional conditions or attention factors hindering learning (Reynolds, 2008).
- ▶ RtI models often promote standard protocol interventions and assumes a "one size fits all" approach to remediation (Feifer & Della Toffalo, 2007).¹⁰



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.
- ▶ Forms the basis for a processing model of LD based upon cognitive strengths and weaknesses.
- ▶ **Evidence based interventions require evidence based assessments!!**

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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).

Lowest Incidence:		Highest Incidence:	
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)

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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!

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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:

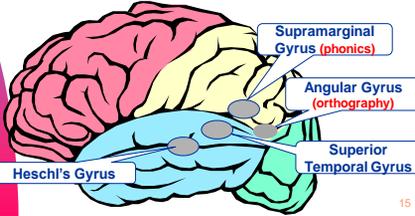
- Closed syllables (just one vowel..."cat")
- Open syllables (ends in long vowel..."baby")
- Vowel-Consonant **E** Syllables (silent **e** elongates vowel..."make")
- Vowel-Team Syllables (two vowels make one sound..."caution")
- R-Controlled Syllables (vowel followed by "r" changes sound..."hurt")
-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

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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).



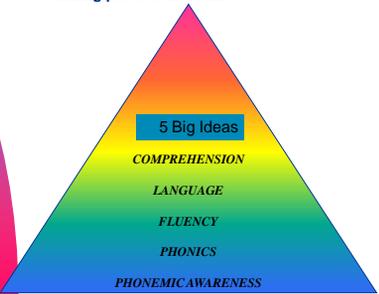
- Supramarginal Gyrus (phonics)
- Angular Gyrus (orthography)
- Superior Temporal Gyrus
- Heschl's Gyrus

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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:



The pyramid is divided into five horizontal layers, from top to bottom:

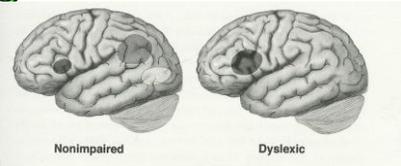
- COMPREHENSION
- LANGUAGE
- FLUENCY
- PHONICS
- PHONEMIC AWARENESS

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NEURAL CIRCUITRY OF DYSLEXIA

(Shaywitz, 2003)



Nonimpaired Dyslexic

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

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KEY BRAIN REGIONS IN 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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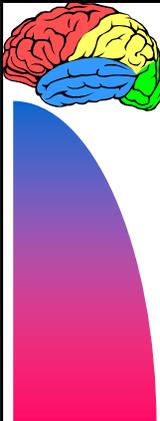


SUBTYPES OF DYSLEXIA

- 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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REMIEDIATION STRATEGIES FOR DYSPHONETIC DYSLEXIA

<p>Over Age 12:</p> <p>(Top-Down)</p> <p>Ages 7 - 12:</p> <p>(Bottom-Up)</p> <p>Under Age 7:</p>	<p>Wilson Reading System SRA Corrective Reading & REACH System Read 180 HOSTS Kaplan Spell/Read</p> <p>Alphabetic Phonics (Orton-Gillingham) Recipe for Reading SRA Corrective Reading Earobics II SIPPS Lindamood Seeing Stars Program LEXIA Horizons Read Well DISTAR (<i>Reading Mastery</i>)</p> <p>Fast Forward II (Tallal) Earobics I Phono-Graphix Saxon Phonics Program Success for All Ladders to Literacy Foundations Road to the Code Scott Foresman Early Intervention Reading</p>
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HORIZONS FAST TRACK A-B

150 Lessons – 50 minutes per lesson

- * Highly scripted....designed for Grades 2 and above
- * Letter sounds taught in two families:
 - 1) **F,L,M,I,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)

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.

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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**.

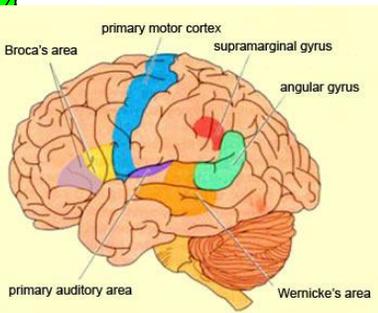
WORD	READ AS
island	izland
grind	grinned
listen	liston
begin	beggin
lace	lake

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

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KEY BRAIN REGIONS IN SURFACE DYSLEXIA



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Skilled Readers Dominant Pathway

- ▶ According to a research at an English university, it doesn't matter in what order the letters in a word are, the only important thing is that first and last letter is at the right place. The rest can be a total mess and you can still read it without problem. This is because we do not read every letter by itself but the word as a whole.
- ▶ <http://www.spritzinc.com>

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REMEDICATION OF SURFACE DYSLEXIA

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

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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 2nd (51 wpm) through 8th (133 wpm) grades.
- ▶ Each level of the program has 24 non-fiction stories
 - Student placed in level and goal is set.
 - Cold read for one minute graphing wpm and identifying difficult words.
 - Read with tape three times consecutively.
 - Hot read is attempted.
 - Comprehension questions involve main idea, details, vocabulary, inferences, and short answers.

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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 4th – 12th.

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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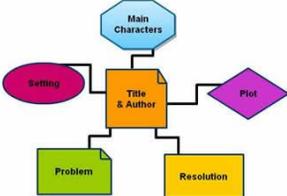
Reading Comprehension Interventions

- 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



```

graph TD
    Title[Title & Author] --- Main[Main Characters]
    Title --- Setting[Setting]
    Title --- Plot[Plot]
    Title --- Problem[Problem]
    Problem --- Resolution[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.

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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

- ▶ **Phonemic/Phonological Awareness:**
*NEPSY II: Phonological Processing
 PAL II: Phonological Coding
 WIAT III: Pseudoword Decoding, Early Reading
 CTOPP-2
 KTEA II
 WJ IV*
- ▶ **Rapid Naming:**
*PAL II: RAN, NEPSY II: Speeded Naming, CTOPP-2
 KTEA II, WJIV*
- ▶ **Verbal Memory Tests:**
*CVLT-C, NEPSY II: List Memory,
 PAL II Verbal Working Memory, PAL II, WJ IV*
- ▶ **Reading Fluency:**
*GORT 5, CBM, WIAT III ORF, WJIV
 WIAT III Word Reading*
- ▶ **Orthographic Skills:** *PAL II Receptive Coding,
 Orthographic Spelling, TOC*
- ▶ **Attention:** *NEPSY II Auditory Attn, Connors 3, TEACH, CAS-2*
- ▶ **Executive Functioning:** *BRIEF, NEPSY II Inhibition, WIAT III
 Reading Comp (Inferential vs. literal), DKEFS, CEFI*

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Steven G. Feifer, D.Ed., ABSNP

- A neurodevelopmental assessment of reading
- Pre-K to College (Ages 4-21)
- 15 subtests in complete battery
- Diagnoses 4 subtypes of reading disorders
- Includes the FAR-S dyslexia screening battery
- Total Far index score and 4 Reading index scores





PHONOLOGICAL INDEX

- Phonemic Awareness (blending, segmenting, sequencing, and manipulation of sounds)
- Positioning Sounds
- Nonsense Word Decoding
- Isolated Word Fluency
- Oral Reading Fluency (accuracy)





FLUENCY INDEX

- Rapid Automatic Naming (objects, letters, stencils)
- Visual Perception (letters, words)
- Orthographic Processing (words and nonwords)
- Irregular Word Reading Fluency
- Verbal Fluency (categories, letters)





COMPREHENSION INDEX

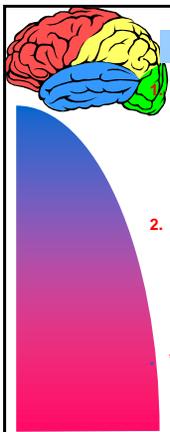
- Print Knowledge (grades PK-1)
- Semantic Concepts (synonyms, antonyms)
- Morphological Processing
- Word Recall
- Silent Reading Fluency (literal & inferential questions)





THE FAR ADVANTAGE

- Based upon a gradiential model of brain functioning.
- Use in conjunction with an academic achievement test
- Explains WHY a student is having reading difficulty, not just WHERE the student is reading.
- Directly informs intervention decision making.
- Can diagnose, screen, or use for progress monitoring.
- More ecologically valid to measure psychological processes while engaged in reading, than isolated.



School Neuropsychological Model

Dysphonetic Dyslexia:

- ▶ Phonemic awareness deficits (PA)
- ▶ Phonological processing deficits (PS)
- ▶ Poor decoding skills on (NWD)
- ▶ Tendency to "guess" on words (ISO)
- ▶ Relative weakness on PI

2. Surface Dyslexia:

- ▶ Visual perceptual deficits (VP)
- ▶ Slower Rapid Naming Skills (RAN)
- ▶ Orthographic processing deficits (OP)
- ▶ Inaccurate Reading of "Irregular Words" (IRR)
- ▶ Relative weakness on FI

* Red denotes FAR subtests





School Neuropsychological Model

- Mixed Dyslexia:**
 - Phonological and orthographical deficits (PI, FI)
 - Poor oral reading skills (ORF-time/accuracy)
 - Slower retrieval speed (VF)
 - Significantly below grade level
 - Failure to respond-to-Interventions
- Comprehension Deficits:**
 - Poor text attention (SRF-C)
 - Poor executive functioning (WR)
 - Limited vocabulary skills (SC, Morpho)
 - Slower Reading Speed (SRF-time)

* Red denotes FAR subtest





Let's Stay Connected!



Steven G. Feifer, D.Ed., ABSNP
Licensed Psychologist

Workshops: feifer@comcast.net

Books: www.schoolneuropsychpress.com
[@schoolneuropsychpress](https://twitter.com/schoolneuropsychpress)

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