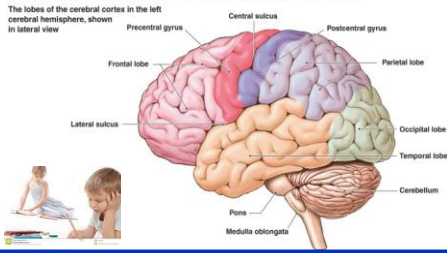


The Neuropsychology of Reading & Written Language Disorders: A Framework for Effective Interventions



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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**.

Further Reading Materials



www.schoolneuropsychpress.com




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.


4



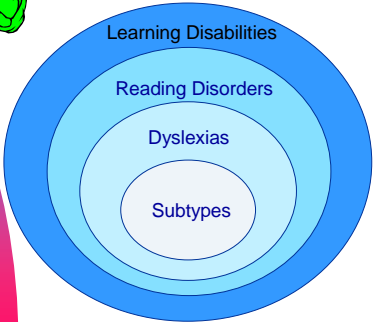
DEVELOPMENTAL DYSLEXIA

- ▶ 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).

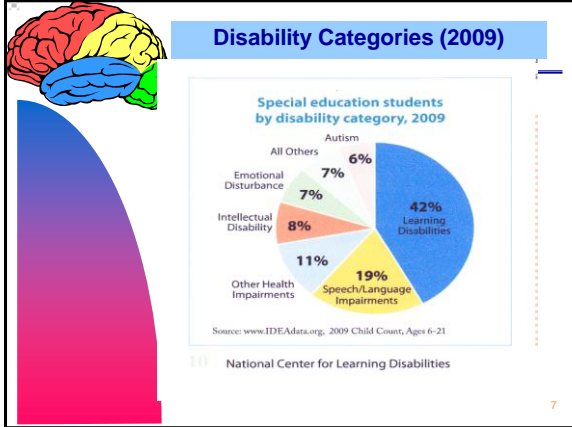
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DEVELOPMENTAL DYSLEXIA



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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:

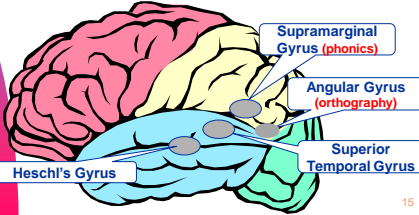
- Closed syllables (just one vowel..."cat")
- Open syllables (ends in long vowel..."baby")
- Vowel-Consonant **E** Syllables (silent **e** elongates vowel..."make")
- Vowel-Team Syllables (two vowels make one sound..."caution")
- R-Controlled Syllables (vowel followed by "r" changes sound..."hurt")
-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



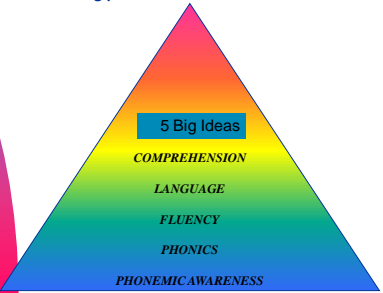
- Supramarginal Gyrus (phonics)
- Angular Gyrus (orthography)
- Superior Temporal Gyrus
- Heschl's Gyrus

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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:

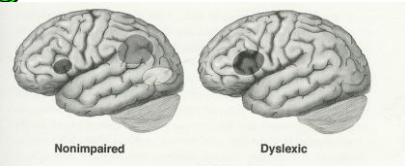
- COMPREHENSION
- LANGUAGE
- FLUENCY
- PHONICS
- PHONEMIC AWARENESS

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NEURAL CIRCUITRY OF DYSLEXIA

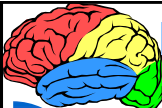
(Shaywitz, 2003)



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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REMEDATION STRATEGIES FOR DYSPHONETIC DYSLEXIA

| | |
|---|--|
| <p>Over Age 12:</p> <p>(Top-Down)</p> | <p>Wilson Reading System SRA Corrective Reading & REACH System Read 180 HOSTS Kaplan Spell/Read</p> |
| <p>Ages 7 - 12:</p> | <p>Alphabetic Phonics (Orton-Gillingham) Recipe for Reading SRA Corrective Reading Earobics II SIPPS Lindamood Seeing Stars Program LEXIA</p> |
| <p>(Bottom-Up)</p> <p>Under Age 7:</p> | <p>Horizons Read Well DISTAR (<i>Reading Mastery</i>) 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**.

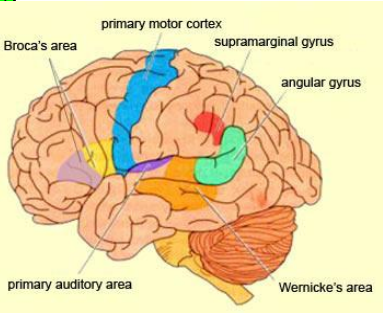
| WORD | READ AS |
|--------|---------|
| island | izland |
| grind | grinned |
| listen | liston |
| begin | beggin |
| lace | lake |

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>

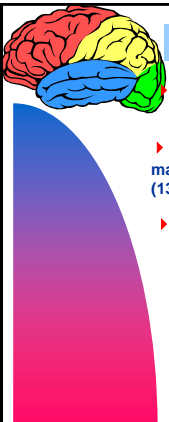
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REMEDICATION OF SURFACE DYSLEXIA

- 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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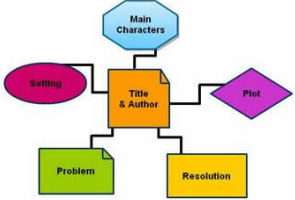
Reading Comprehension Interventions

- 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 weary of having children read out loud in class.

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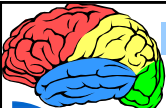


90 Minute Dyslexia Evaluation

- ▶ 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

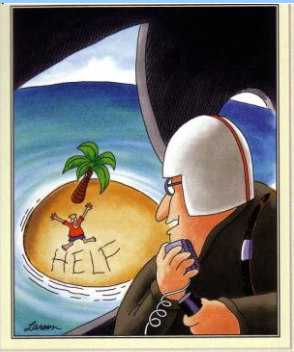
3. **Mixed Dyslexia:**
 - ▶ Phonological and orthographical deficits (PI, FI)
 - ▶ Poor oral reading skills (ORF-time/accuracy)
 - ▶ Slower retrieval speed (VF)
 - ▶ Significantly below grade level
 - ▶ Failure to respond-to-Interventions
4. **Comprehension Deficits:**
 - ▶ Poor text attention (SRF-C)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

* Red denotes FAR subtest



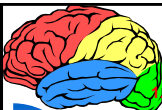


WRITTEN LANGUAGE: A Survival Skill!!



"Wait! Wait! Cancel that. ... I guess it says 'help.'"

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Presentation Goals

1. Discuss national trends in written language, and the need for educators and psychologists to explore writing from a brain-based educational perspective.
2. Discuss the neural architecture involved with written language and learn key frontal lobe brain processes responsible for the **organization** and **production** of written language.
3. Introduce a *brain-based* educational model of written language disorders based upon **three** specific subtypes, with targeted intervention strategies linked to each subtype.
4. Introduce the **90 minute** dysgraphia evaluation as a more comprehensive means to assess **eight** core cognitive constructs associated with learning disorders in children.

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Measuring Written Language

The National Assessment for Educational Progress (NAEP) administered the first computer based assessment in writing in 2011.

- In this new national writing assessment sample, 24,100 8th graders and 28,100 12th graders participated and composed their responses on a computer. The assessment tasks reflected writing situations common to both academic and workplace settings including:
 - PERSUADE
 - EXPLAIN
 - CONVEY EXPERIENCE
- Scored as Basic, Proficient, or Advanced.

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NAEP Writing Results for 8th & 12th grades (2011)

| Grade | Below Basic | Basic | Proficient | Advanced |
|----------|-------------|-------|------------|----------|
| Grade 8 | 20 | 54 | 24 | 3 |
| Grade 12 | 21 | 52 | 24 | 3 |

- 24% of students at both grades 8 and 12 performed at the **Proficient** level in writing in 2011.
- 54% of eighth-graders and 52% of twelfth-graders performed at the **Basic** level in writing in 2011.
- Proficiency Rates:** * 8th: 33% in 2007....31% in 2002.
* 12th: 24% in 2007....24% in 2002.


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NAEP Writing Results for 8th & 12th grades Gender Differences (2011)

| Grade | Gender | Below Basic | Basic | Proficient | Advanced |
|----------|--------|-------------|-------|------------|----------|
| Grade 8 | Male | 27 | 55 | 16 | 2 |
| | Female | 12 | 52 | 32 | 5 |
| Grade 12 | Male | 28 | 52 | 19 | 2 |
| | Female | 14 | 53 | 29 | 4 |


- Female students scored 19 points higher on average than male students in 2011 at grade 8.
- Female students scored 14 points higher on average than male students in 2011 at grade 12.

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Why the disconcerting trend?

- ▶ Most students rely on writing, either e-mail, text messages, word processing, or other computerized technology to communicate.
- ▶ Downward extension of our curriculum whereby reading and written language are skills emphasized in kindergarten.
- ▶ Most state assessments require written language responses, short answers, and brief constructed responses even in subjects such as mathematics. Therefore, most school curriculums readjusted to emphasize state testing requirements.



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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...by surveying underlying cognitive processes.
- ▶ Why the need to survey cognitive processes??

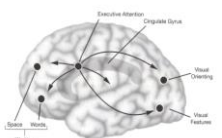
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Cognitive Constructs Involved with Written Language


Attention

- ▶ Poor planning
- ▶ Uneven tempo
- ▶ Erratic legibility
- ▶ Inconsistent spelling
- ▶ Poor self monitoring
- ▶ Impersistence



BRAIN REGION - Anterior Cingulate Gyrus

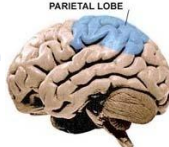
51



Cognitive Constructs Involved with Written Language


Spatial Production

- ▶ Poor spatial production
- ▶ Poor visualization
- ▶ Poor margination
- ▶ Organization problems
- ▶ Uneven spacing
- ▶ Poor use of lines



PARIETAL LOBE

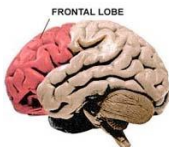
BRAIN REGION - Right Parietal Lobe



Cognitive Constructs Involved with Written Language

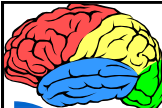
Sequential Production

- ▶ Poor connected writing
- ▶ Letter reversals
- ▶ Organizational deficits
- ▶ Lack of cohesive ties
- ▶ Deficits in working memory, especially with ADHD kids, leads to poor sequential dysfunction.



FRONTAL LOBE

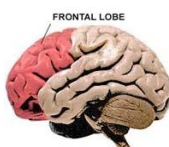
BRAIN REGION - Left Prefrontal Cortex



Cognitive Constructs Involved with Written Language

Working Memory Skills

- ▶ Poor *word retrieval* skills
- ▶ Poor spelling
- ▶ Poor grammar rules
- ▶ Loss of train of thought
- ▶ Deterioration of continuous writing
- ▶ Poor elaboration of ideas
- ▶ Cortical mapping of language is *distributed* throughout brain (i.e. *nouns vs. verbs*)



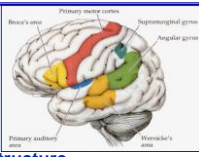
FRONTAL LOBE

BRAIN REGION - Semantic memories stored in Temporal Lobes. Retrieved by Frontal Lobes

Cognitive Constructs Involved with Written Language

Language

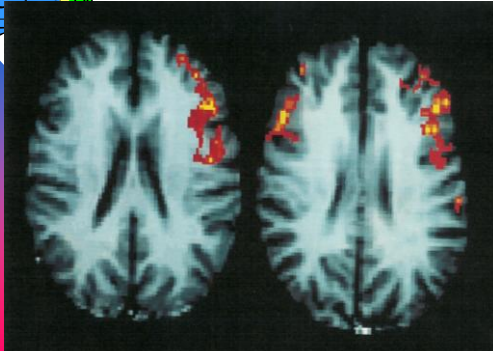
- ▶ Poor vocabulary
- ▶ Lack of cohesive ties
- ▶ Poor grammar
- ▶ Simplistic sentence structure
- ▶ Left hemisphere stores language by converging words into semantic baskets; right hemisphere excels in more divergent linguistic skills (simile and metaphor)



BRAIN REGION - Left Temporal Lobe

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Male vs. Female Brain in Phonological Processing

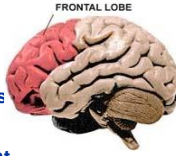


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Cognitive Constructs Involved with Written Language


Intelligence

- ▶ Concrete ideation
- ▶ Poor development of ideas
- ▶ Poor audience awareness
- ▶ Weak opinion development
- ▶ Simplistic sentence structure



BRAIN REGION - Inferior Parietal Lobes

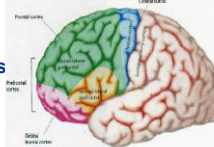
67




Cognitive Constructs Involved with Written Language

Executive Functioning

- ▶ Organize and plan ideas
- ▶ Self monitor
- ▶ Task initiation
- ▶ Sustain attention to task
- ▶ Difficulty making cognitive shifts from one topical area to another.



BRAIN REGION – Dorsolateral Prefrontal Cortex




Cognitive Constructs Involved with Written Language

Motor Output Speed

| Grade Levels | Handwriting Speed |
|--------------|---------------------------|
| Grade 1 | 15 -32 letters per minute |
| Grade 2 | 20 -35 letters per minute |
| Grade 3 | 25 -47 letters per minute |
| Grade 4 | 34 -70 letters per minute |
| Grade 5 | 38 -83 letters per minute |
| Grade 6 | 46 -91 letters per minute |

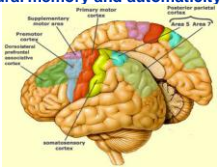
BRAIN REGION – Basal Ganglia (Pollack et al., 2009)




3 Subtypes of Written Language Disorders

(1) **Graphomotor Dysgraphias** - apraxia refers to a wide variety of motor skill deficits in which the voluntary execution of a skilled motor movement is impaired.

- a) **Premotor cortex** plans the execution of a motor response.
- b) **Supplementary motor area** – guides motor movement
- c) **Cerebellum** - provides proprioceptive feedback.
- d) **Basal Ganglia**– procedural memory and automaticity of handwriting.





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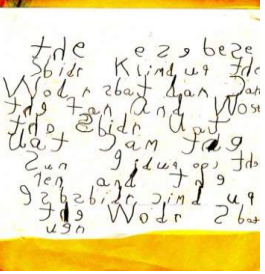
The Role of the Cerebellum

- ▶ The cerebellum contains 50% of neurons in the brain.
- ▶ Guides and corrects motor movements based upon proprioceptive feedback.
- ▶ Made up of purkinje cells and granule cells which are primarily excitatory, and help fine tune the writing process.
- ▶ Over time, the physical act of sequencing subtle motor movements from stored cognitive templates becomes less effortful and more reflexive.
- ▶ Deficits mainly lead to motor coordination issues....ataxia....("3971" ATM Code: 01 spatial/sequential)

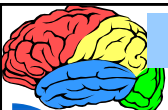




Example of Graphomotor Dysfunction



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(2) Dyslexic Dysgraphias: Spelling Miscues

a) **Dysphonetic dysgraphia** - the hallmark feature of this disorder is an inability to spell by *sound* due to poor *phonological* skills. There is often an over-reliance on the visual features of words when spelling.

| <u>Target Word</u> | <u>Misspelling</u> |
|--------------------|--------------------|
| point | pot |
| train | chan |
| old | od |
| climbing | cling |
| job | joib |
| video | veio |
| kitchen | tihn |

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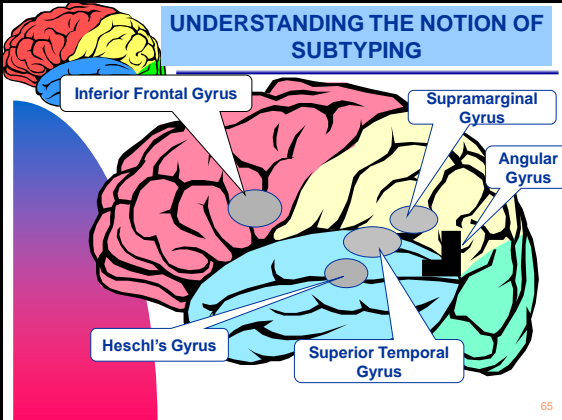


(2) Dyslexic Dysgraphias: Spelling Miscues

b) **Surface dysgraphia** - a breakdown in the orthographic representation of words. Miscues made primarily on phonologically irregular words.

| <u>Target Word</u> | <u>Misspelling</u> |
|--------------------|--------------------|
| <i>knock</i> | <i>nok</i> |
| <i>build</i> | <i>bild</i> |
| <i>mighty</i> | <i>mite</i> |
| <i>juice</i> | <i>juse</i> |
| <i>onion</i> | <i>unnyun</i> |
| <i>said</i> | <i>sed</i> |
| <i>yacht</i> | <i>yot</i> |
| <i>laugh</i> | <i>laf</i> |

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UNDERSTANDING THE NOTION OF SUBTYPING

Inferior Frontal Gyrus

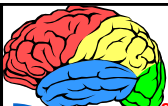
Supramarginal Gyrus

Angular Gyrus

Heschl's Gyrus

Superior Temporal Gyrus

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(2) Dyslexic Dysgraphias: Spelling Miscues

c) **Mixed Dysgraphia** - characterized by a combination of both phonological errors and orthographical errors depicting faulty arrangement of letters and words.

| <u>Target Word</u> | <u>Misspelling</u> |
|--------------------|--------------------|
| <i>advantage</i> | <i>advangate</i> |
| <i>cobweb</i> | <i>coweb</i> |
| <i>illusion</i> | <i>elushn</i> |
| <i>pocket</i> | <i>poet</i> |
| <i>work</i> | <i>wrok</i> |
| <i>kitchen</i> | <i>kinchen</i> |

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3 Subtypes of Written Language Disorders

(3) **Executive Dysgraphias** - an inability to master the implicit rules for grammar which dictate how words and phrases can be combined. Deficits in working memory and executive functioning in frontal lobes hinders syntax!

- ▶ Word omissions
- ▶ Word ordering
- ▶ Incorrect verb usage
- ▶ Word ending errors
- ▶ Poor punctuation
- ▶ Lack of capitalization
- ▶ Oral vs. written language discrepancy

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3. Executive Dysgraphia

- a) **Verbal Retrieval Skills** – the frontal lobes are critical in retrieving words stored throughout the cortex, often stored by semantic categories.
- b) **Working Memory Skills** – helps to recall spelling rules and boundaries, grammar rules, punctuation, and maintaining information in mind long enough for motoric output.
- c) **Executive Functioning Skills** – syntactical arrangement of thought needed to sequence mental representations.


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Executive Functioning and Written Language

| <u>Classification</u> | <u>Writing Dysfunction</u> |
|-----------------------|--|
| (1) Initiating | * Poor idea generation * Poor independence |
| (2) Sustaining | * Lose track of thoughts * Difficulty finishing * Sentences disjointed |
| (3) Inhibiting | * Impulsive/Distractible |
| (4) Shifting | * Perseverations * “Stuck” on topic |


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Executive Functioning and Written Language

| <u>Classification</u> | <u>Writing Dysfunction</u> |
|-----------------------|--|
| (5) Poor Organization | * Frequent erasers * Forget main idea * Disjointed content |
| (6) Poor Planning | * Poor flow of ideas * Incorrect spacing * Lack of cohesive ties |
| (7) Poor Self Monitor | * Spelling miscues * Sloppy work * Careless errors |


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INTERVENTION KEYS: AUTOMATICITY

- 1) Motor Skills Automaticity:
 - ▶ Handwriting without tears
 - ▶ Technology Devices
- (2) Spelling Automaticity:
 - ▶ Developmental approach integrating phonology, orthography, and morphology
- *(3) Executive Functioning Automaticity:
 - ▶ Graphic Organizers
 - ▶ Story Maps
- *(4) Self Monitoring Automaticity:
 - ▶ COPS Strategy
 - ▶ Peer Review


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5 Spelling Strategies

1. Learn the six syllable subtypes for vowel representations.
 - ▶ More than 90% of English words follow the six-syllable type sound-spelling pattern. The six syllable rules are as follows:
 - 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")
 - ▶ Use grapheme tiles to practice spelling!

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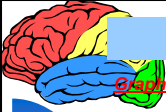
5 Spelling Strategies

2. Incorporate nonsense words into weekly spelling instruction to show mastery of the spelling patterns as opposed to just rote memorization.
3. Place a heavy focus on prefixes and suffixes during instruction
4. Have students write each word with white space in between each syllable in the word using the box approach (i.e. fascinate)

f
a
s
c
i
n
a
t
e

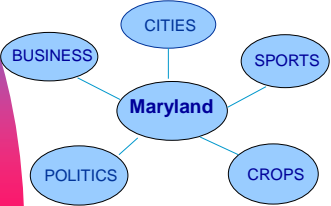
5. Have students color-code vowel digraphs in words (i.e. Sauce)

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GRAPHIC ORGANIZERS

Graphic Organizers – this involves a pre-writing activity whereby the student simply lists a word or phrase pertaining to the topic. An example may include a brainstorming a web:




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Self Monitoring Strategies

COPS strategy – a directional proof-reading strategy where the student re-reads their passage four times prior to completion.

- 1) **C**apitalize the first word of each sentence.
- 2) **O**rganize the information by reviewing topic sentences and double check paragraph breaks. separations.
- 3) **P**unctuation miscues must be reviewed.
- 4) **S**pelling miscues must be reviewed.



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Self Monitoring: Writing Self Rubric


IDEAS

- 4 The topic and details are well developed.
- 3 The topic is clear but more details are needed.
- 2 Details that don't fit the topic confuse the reader.
- 1 The topic is not clear.

ORGANIZATION

- 4 The beginning, middle, and ending work well.
- 3 Some parts of the essay are unclear.
- 2 All parts of the essay run together.
- 1 The order of information is confusing.

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Self Monitoring: Writing Self Rubric

WORD CHOICE

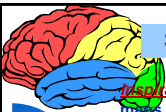
- 4 Words make the meaning clear.
- 3 Clearer words are needed.
- 2 Some words are overused.
- 1 Words are used incorrectly.

CONVENTIONS

- 4 Conventions are used well.
- 3 There are few errors.
- 2 Errors make the essay hard to understand.
- 1 Help is needed to make corrections

AUDIENCE AWARENESS

- 4 The passage is clear and understandable for the intended audience.
- 3 The reader may need background knowledge to fully comprehend.
- 2 There are some parts of the passage that are difficult to understand.
- 1 The passage is extremely confusing for the intended audience.




Strategies for Secondary Students

Insulations - teaches how to craft concept maps, idea maps, and other visual webbing techniques to assist in planning, organizing, and outlining his thoughts and ideas when writing. In addition, this software can assist with note-taking skills and help develop main and supporting ideas when writing. Very effective word predictive software.

Keyboarding - speed up output to reduce pressure from working memory skills to retain information over longer periods of time. Often leads to greater elaboration when writing.

Livescribe - a "smart" pen which would both record lecture information in the class, as well as transcribe notes to a computer screen. Smart pens allow students to better organize their notes, and also allows students to synchronize everything written with what was heard.




Strategies for Secondary Students

Kurzweil Technology - adaptive technology to further practice grammar, spelling, punctuation, and comprehension to assist with the writing process. Voice activated software also an option.

Journal or Diary – students need to practice any skill a minimum of 15-20 minutes per day to develop consistent improvement. Creating a journal or diary can be a fun and effortless way to practice writing on a daily basis.


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Research Based Interventions (Graham & Perin, 2007)


- Writing Strategies (effect size .82)
- (2) Summarization (effect size .82)
- (3) Collaborative Writing (effect size .75)
- (4) Specific Product Goals (effect size .70)
- (5) Word Processing (effect size .55)
- (6) Sentence Combining (effect size .50)
- (7) Prewriting (effect size .32)
- (8) Inquiry activities (effect size .32)
- (9) Process Writing Approach (effect size .32)
- (10) Study of Models (effect size .25)
- (11) Writing for Content Learning (effect size .23)

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5 Major Steps of Writing Process (Ray, 2001)

- (1) **Prewriting** - use graphic organizers.
- (2) **Drafting** – use model to take notes and model how to organize in a text form using topic sentences.
- (3) **Revising** – second draft emphasizing content, and elaboration of ideas and making connections.
- (4) **Editing** – re-read for capitalization and punctuation errors.
- (5) **Publishing** – peer assisted strategies and teaching students to give and receive feedback.



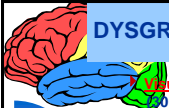
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90 Minute Dysgraphia Evaluation


- ▶ Intelligence Measures (Gc)
- ▶ Visual-Motor Integration
- ▶ *Attention* (Gs)
- ▶ *Working Memory* (Gsm)
- ▶ *Executive Functions* (Gf)
- ▶ Writing and Spelling Skills
- ▶ Phonological Awareness Skills (Ga)
- ▶ Retrieval Fluency Skills (Glr)

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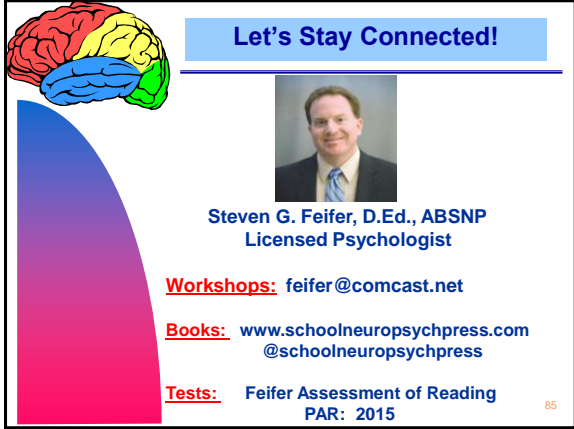
DYSGRAPHIA ASSESSMENT INSTRUMENTS

- ▶ **Visual-Motor Integration** - WIAT III Alphabet Writing Fluency (30 sec), NEPSY II Design Copying, PAL II Alphabet Writing PAL II Handwriting Subtests
- ▶ **Attention** - NEPSY II Auditory Attn & Response Set, NEPSY II Inhibition, Connors 3, Tea-CH, CAS-Receptive Attention, WJIV- Verbal Attention.
- ▶ **Working Memory** - WISC IV Integrated Subtests, PAL II WISC5, SB5, CAS2, WRAML-2, WJIV Short Term W.M.
- ▶ **Executive Functions** - WIAT III Sentence Composition, PAL II Expository Note Taking, PAL II Narrative Compositional Fluency, BRIEF, DKEFS, NEPSY II, CEFI.
- ▶ **Writing and Spelling Skills** - WIAT III Spelling (error analysis), PAL II Orthographic Spelling, WIAT III Essay Composition, PAL II Expository Note Taking & Writing, KTEA 3, WJIV Writing Samples
- ▶ **Retrieval Fluency Skills** - NEPSY II Word Generation, DKEFS Verbal Fluency, WJIV Phonological Process, KTEA3




DYSGRAPHIA ASSESSMENT SUMMARY

1. **Graphomotor Dysgraphia:**
 - ▶ Visual-motor integration deficits
 - ▶ Slower motor speed
 - ▶ Sloppy penmanship
2. **Dyslexic Dysgraphia:**
 - ▶ Major spelling deficits
 - ▶ Poor phonological processing
 - ▶ Lower working memory skills
 - ▶ Poor variety of words displayed
3. **Executive Dysgraphia:**
 - ▶ Poor executive functioning skills
 - ▶ Limited attention
 - ▶ Slower retrieval fluency skills
 - ▶ Lower working memory skills
 - ▶ Limited output....careless miscues..grammar errors....simplistic sentence structures.



Let's Stay Connected!



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PAR: 2015

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