

The lobes of the cerebral cortex in the left cerebral hemisphere, shown in lateral view.

Brain Based Strategies and Interventions to Help Children with Reading and Written Language Disorders

jack hirose
SCHOOL NEUROPSYCH PRESS

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

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Presentation Goals

1. Discuss the prevalence of learning disabilities in both Canada and the United States and define developmental dyslexia.
2. Discuss four universal truths with respect to teaching reading based upon brain-behavioral principles.
3. Introduce a *brain-based* educational model to identify **subtypes** of reading and written language disorders, and link specific remediation strategies with each subtype.
4. Discuss five essential steps for effective written language instruction.
5. Introduce the **FAR** and **FAW**, as a more efficient means to both diagnose and remediate learning disorders in children.

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Dr. Feifer's Journey 1992 - present

- > School psychologist 20+ years
- > Diplomate in school neuropsychology
- > 2008 Maryland School Psychologist of the Year
- > 2009 National School Psychologist of the Year
- > Author: 8 books on learning and emotional disorders
- > Test Author: **FAR & FAM** (FAW coming soon)
- > Currently in private practice at Monocacy Neurodevelopmental Center in Maryland.
- > ABSNP Diplomate and Faculty Instructor

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Prevalence of LD in Canada

- More Canadian children have a learning disability than all other types of educational disabilities combined.
- According to Statistics Canada, 3.2% of Canadian children have a learning disability – whereas up to 20% may have dyslexia.
- More than half a million adults in Canada live with a learning disability, making it more challenging for them to learn in universities, and on the job.
- Research from the Literacy and Policing Project indicates that **65% of the incarcerated population** in Canada reads at less than a grade 8 level of literacy 4

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Literacy in Canada

Program for International Student Assessment (2018)

Canadian results in reading over time, 2009–2018

| | 2009 | | 2012 | | 2015 | | 2018 | |
|---------------------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|
| | Average score | Standard error | Average score | Standard error | Average score | Standard error | Average score | Standard error |
| Canada | 524 | (1.5) | 523 | (3.2) | 527 | (4.1) | 520 | (4.0) |
| Newfoundland and Labrador | 506 | (3.7) | 503 | (4.5) | 505 | (4.9) | 512 | (5.6) |
| Prince Edward Island | 486 | (2.4) | 490 | (3.7) | 515* | (7.0) | 503 | (9.0) |
| Nova Scotia | 516 | (2.7) | 508 | (4.0) | 517 | (6.0) | 516 | (5.2) |
| New Brunswick | 499 | (2.5) | 497 | (3.7) | 505 | (6.3) | 489 | (5.0) |
| Quebec | 522 | (3.1) | 520 | (4.4) | 532 | (5.8) | 519 | (5.0) |
| Ontario | 531 | (3.0) | 528 | (5.1) | 527 | (5.6) | 524 | (5.0) |
| Manitoba | 495 | (3.6) | 495 | (4.2) | 498 | (6.0) | 494 | (4.9) |
| Saskatchewan | 504 | (3.3) | 505 | (3.8) | 496 | (4.9) | 499 | (4.6) |
| Alberta | 533 | (4.6) | 525 | (4.8) | 533 | (6.2) | 532 | (5.5) |
| British Columbia | 525 | (4.2) | 535 | (5.2) | 536 | (6.5) | 519 | (5.7) |

* Significant difference compared with baseline (2009)
Note: The linkage error is incorporated into the standard error for 2012, 2015, and 2018.

- 487 International Reading Average-79 countries
- 22,500 students -800 schools participated
- Includes anglophone and francophone school systems
- Canada mean =520 (Tied 8th) U.S. mean=505 5

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Literacy in Canada


Program for International Student Assessment (2018)

Percentage of students by time spent reading for enjoyment

| Province/Region | do not read for enjoyment | More than 30 minutes to less than 60 minutes a day | 30 minutes or less a day | 1 to 2 hours a day | More than 2 hours a day |
|---------------------------|---------------------------|--|--------------------------|--------------------|-------------------------|
| Newfoundland and Labrador | 49 | 21 | 15 | 10 | 5 |
| Prince Edward Island | 47 | 26 | 15 | 7 | 5 |
| Nova Scotia | 47 | 26 | 14 | 8 | 5 |
| New Brunswick | 45 | 26 | 15 | 7 | 5 |
| Quebec | 44 | 29 | 14 | 8 | 4 |
| Ontario | 39 | 26 | 17 | 11 | 7 |
| Manitoba | 41 | 29 | 15 | 9 | 6 |
| Saskatchewan | 43 | 29 | 14 | 9 | 5 |
| Alberta | 37 | 26 | 19 | 11 | 7 |
| British Columbia | 37 | 28 | 19 | 10 | 6 |
| Canada | 40 | 27 | 17 | 10 | 6 |
| OECD | 42 | 24 | 17 | 11 | 6 |

Notes: Percentages may not add up to 100% due to rounding.

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The State of Learning Disabilities in U.S.

National Center for Learning Disabilities (2017)

- 39 percent of children in special education have a specific learning disability, making this the largest of the 13 disability categories covered under special education law.
- One third of all students with a learning disability have repeated a grade, which greatly increases the risk of dropping out.
- The dropout rate for students with a learning disability is 18.1% and nearly three times the rate of students without a disability (6.5%).
- Only 1 in 4 students with a learning disability tell their respective colleges.
- Incarcerated individuals are 2 to 3 times more likely to be dyslexic.
- Dyslexia symptoms occur in up to 5-17% of the population (Munzer et al., 2020)

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Defining Dyslexia

➤ *“Dyslexia is characterized by difficulties with **accurate** and / or **fluent** word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.”*

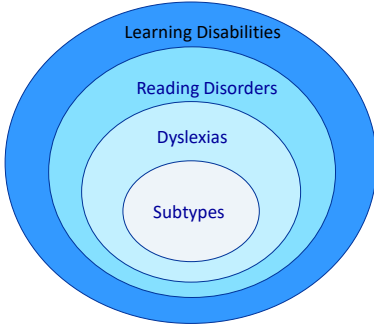
- International Dyslexia Association

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DEVELOPMENTAL DYSLEXIA



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Canadian LD Definition

LEARNING DISABILITY (Grades 1–12; Code 54)

This is the official definition adopted by the Learning Disabilities Association of Canada (LDAC) on January 30, 2002.


"Learning Disabilities" refer to a number of disorders which may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from global intellectual deficiency.

Learning disabilities result from **impairments in one or more processes** related to perceiving, thinking, remembering or learning. These include, but are not limited to: language processing; phonological processing; visual spatial processing; processing speed; memory and attention; and **executive functions** (e.g., planning and decision-making).

Learning disabilities range in severity and may interfere with the acquisition and use of one or more of the following:

- oral language (e.g., listening, speaking, understanding)
- reading (e.g. decoding, phonetic knowledge, word recognition, comprehension)
- written language (e.g., spelling and written expression)
- mathematics (e.g., computation, problem solving).

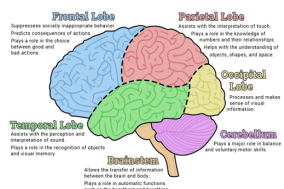
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School Neuropsychology

➤ **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 academic tasks.

The Human Brain



Frontal Lobe: Regulates socially appropriate behavior. Predicts consequences of actions. Plays a role in the decision between good and bad choices.

Parietal Lobe: Assists with the integration of touch. Plays a role in the knowledge of numbers and the understanding of objects, space, and time.


Occipital Lobe: Processes and makes sense of visual information.

Temporal Lobe: Assists with the perception and interpretation of sound. Plays a role in the recognition of objects and visual memory.

Cerebellum: Plays a major role in balance and voluntary motor skills.

Brainstem: Allows the transfer of information between the brain and body. Plays a role in automatic functions, such as the heartbeat and breathing.

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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 identifying, recognizing, categorizing, and/or manipulating phonological units at all linguistic levels (Goswami, 2007).

Screening for Success (Hulme & Snowling, 2016)

1. **Phonological awareness skills.**
2. **Ability to link sounds with letters.**
- *3. **Rapid letter-naming skills.**
 - a) Rapid naming of letters better than objects (Kilpatrick, 2015).
 - b) Rapid naming of letters is moderately correlated with reading performance (.28-.57%) and explains some of the reading variance independent of phonological awareness (Truong et al., 2019)

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Four Universal Truths of Reading

2. The English language *is not* a purely phonological!

- 1 letter grapheme: c a t. The sounds /k/ is represented by the letter 'c'.
- 2 letter grapheme: l e a f. The sound /ee/ is represented by the letters 'e a'.
- 3 letter grapheme: n i g h t. The sound /ie/ is represented by the letters 'i g h'.
- 4 letter grapheme: t h r o u g h. The sound /oo/ is represented by the letters 'o u g h'.


➤ The English language includes over **1,100** ways of representing **44 sounds** using a series of different letter combinations (Uhry & Clark, 2005). 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—*homonyms* (i.e. "tear", "bass", "wind", etc.)

➤ **Summary:** We need to develop orthography!!

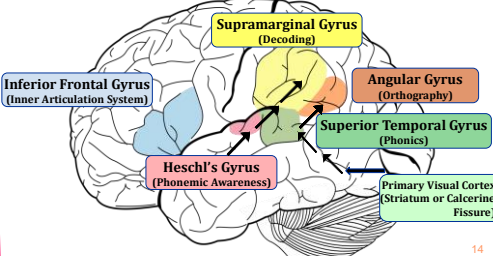
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The Reading Brain: How Words are Assembled

3. Specific neuroimaging techniques have demonstrated that **phonological** processing and **orthographic** processing are a by-product of the functional integrity of the **temporal-parietal** junctures in the left hemisphere of the brain (Paz-Alonso et al., 2018; Glezer et al., 2016; Sandak et al., 2004; McCandliss & Noble, 2003).



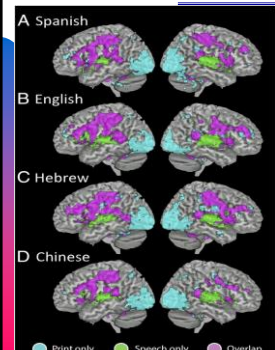
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A Universal Reading Brain

Rueckl et al. (2015). Universal brain signature of proficient reading: Evidence from four contrasting languages. *Proceedings of the National Academy of Sciences*, 112(50): 15510–15515




➤ Proficient reading entails the convergence of phonological and orthographic processing systems onto a common network of neural structures dominated by the left perisylvian regions of the brain.

➤ Dyslexics in transparent orthographic systems, such as Spanish, German, Italian, Greek have difficulty in acquiring reading speed as a hallmark deficit of dyslexia (Ziegler et al., 2003; Davies et al., 2007; Constantinidou & Stainthorp, 2009; Wimmer et al., 2010).

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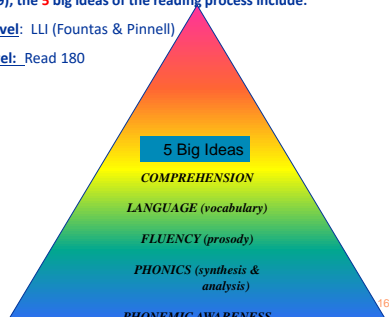


Four Universal Truths of Reading

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

Elementary Level: LLI (Fountas & Pinnell)

Secondary Level: Read 180



5 Big Ideas

COMPREHENSION

LANGUAGE (vocabulary)


FLUENCY (prosody)

PHONICS (synthesis & analysis)

PHONEMIC AWARENESS

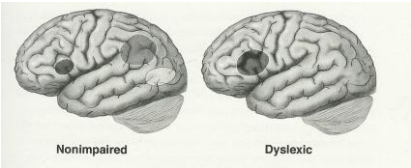
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NEURAL CIRCUITRY OF DYSLEXIA

(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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Do Interventions Change the Brain?

▸ Barquero, L.A., Davis, N., & Cutting, L. E. (2014). Neuroimaging of reading intervention and activation likelihood estimate meta-analysis. Plos One, 9(1), 1-16.

- Research is beginning to show two specific brain changes with LD kids as a result of reading interventions:
 1. Hemispheric **"normalization"** – the left hemisphere begins to assert dominance after just four weeks of intervention.
 2. Hemispheric **"compensation"** – children with reading difficulty also activate brain structures in the frontal lobe following intervention, suggesting greater text attention and working memory engagement (IFG), and enhanced error detection and EF skills (ACC).

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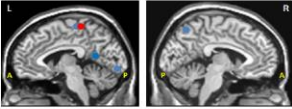


Do Interventions Change the Brain?

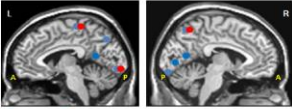
† Horowitz-Kraus, T., Vannest, J.J., Kadis, D., Cicchino, N., Wang, Y.Y. & Holland, S. K. (2014). Reading acceleration training changes brain children with reading disorders. *Brain and Behavior*, 886-902.

- 33 children with reading disorders 8-12 years-old.
- RAP training...4 weeks...20 min daily...fluency and comprehension
- Computer presentation of sentences...which dissipate based on response accuracy...and students select correct answer.

Typical readers




Children with RD



● Test 1 ● Test 2

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Four Subtypes of Reading Disorders

- (1) **Dysphonetic Dyslexia** – difficulty sounding out words in a phonological manner.
- (2) **Surface Dyslexia** – difficulty with the rapid and automatic recognition of words in print.
- (3) **Mixed Dyslexia** – multiple reading deficits characterized by impaired phonological and orthographic processing skills. Most severe form of dyslexia.
- (4) **Comprehension Deficits** – mechanical side of reading is fine but difficulty persists deriving meaning from print.

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REMEDIATION STRATEGIES FOR DYSPHONETIC DYSLXIA

| | |
|--|---|
| <p style="color: red;">Over Age 12:</p> <p>(Top-Down)</p> <p style="color: red;">Ages 7 - 12:</p> <p>(Bottom-Up)</p> <p style="color: red;">Under Age 7:</p> | <p>Wilson Reading System</p> <p>SRA Corrective Reading & REACH System</p> <p>Read 180</p> <p>HOSTS</p> <p>Kaplan Spell/Read</p> <p>LEXIA Strategies for Older Students</p> <p>ASDEC Language Foundations (Orton-Gillingham)</p> <p>SRA Corrective Reading</p> <p>Eaerobics II</p> <p>LIPS</p> <p>LEXIA Primary Reading</p> <p>Horizons</p> <p>Fast Forward II(Tallal)</p> <p>Eaerobics I</p> <p>Phono-Graphix</p> <p>Saxon Phonics Program</p> <p>Success for All</p> <p>Ladders to Literacy</p> <p>Foundations</p> <p>Road to the Code</p> <p>SIPPS</p> <p>Scott Foresman Early Intervention Reading</p> |
|--|---|

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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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REMIEDIATION 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

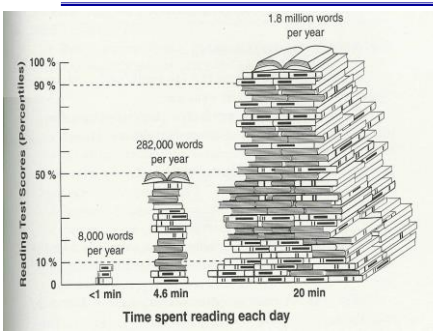
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TIME SPENT READING AFTER SCHOOL

(Shaywitz, 2003)



The chart shows that as the time spent reading each day increases, the number of words read per year increases significantly, and the percentage of students achieving higher reading test scores also increases. For example, reading for 20 minutes per day leads to reading 1.8 million words per year and achieving scores above 90%.

| Time spent reading each day | Words per year | Reading Test Scores (Percentiles) |
|-----------------------------|----------------------------|-----------------------------------|
| <1 min | 8,000 words per year | ~10% |
| 4.6 min | 282,000 words per year | ~50% |
| 20 min | 1.8 million words per year | ~90% |

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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.
- (3) Socioeconomic Status** - 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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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-organize verbal information to facilitate recall.
- 4. Language Foundation** – vocabulary knowledge is vital for passage comprehension.

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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.
- 5. Active Engagement** – encourage active, not passive reading, by having children take notes or putting an asterisk next to important information. Also, multiple colors for highlighting.

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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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Comprehensive Reading 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)


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Steven G. Feifer, D.Ed., ABSNP

- A neurodevelopmental assessment of reading
- Pre-K to College (Ages 4-21)
- Normative sample included 1,074 students
- 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



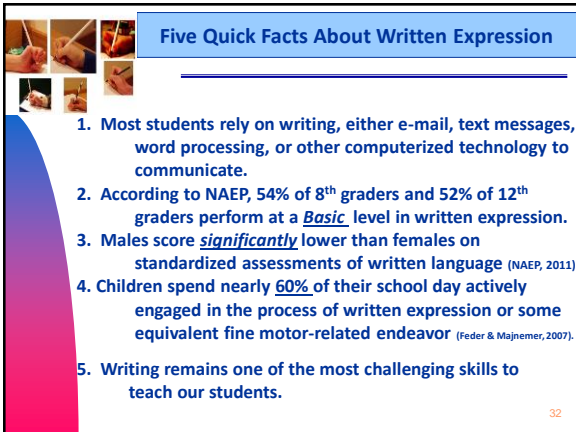
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| Index | Subtest | Grade range | Approximate administration time in minutes |
|--------------------------|--------------------------------------|--------------------|--|
| Phonological Index (PI) | Phonemic Awareness (PA) | PK to college | 5 to 10 |
| | Nonsense Word Decoding (NWD) | Grade 2 to college | 2 |
| | Isolated Word Reading Fluency (ISD) | K to college | 1 |
| | Oral Reading Fluency (ORF) | K to college | 2 to 3 |
| | Positioning Sounds (PS) | PK to college | 3 to 4 |
| Fluency Index (FI) | Rapid Automatic Naming (RAN) | PK to college | 2 |
| | Verbal Fluency (VF) | PK to college | 2 |
| | Visual Perception (VP) | PK to college | 1 |
| | Orthographical Processing (OP) | K to college | 8 |
| | Irregular Word Reading Fluency (IRR) | Grade 2 to college | 1 |
| | Semantic Concepts (SC) | PK to college | 5 to 8 |
| Comprehension Index (CI) | Word Recall (WR) | PK to college | 4 |
| | Print Knowledge (PK) | PK to Grade 1 | 4 |
| | Morphological Processing (MP) | Grade 2 to college | 7 |
| | Silent Reading Fluency (SRF) | Grade 2 to college | 8 |

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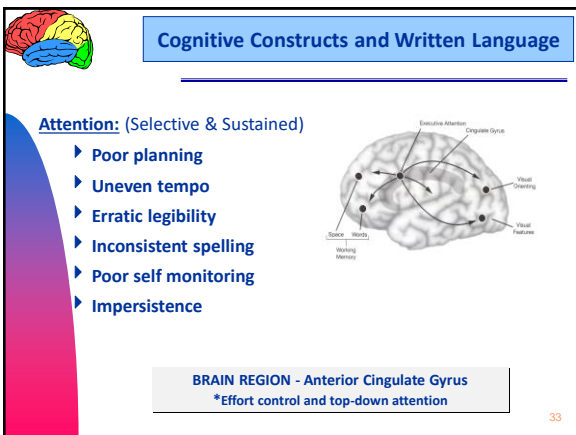


Five Quick Facts About Written Expression

1. Most students rely on writing, either e-mail, text messages, word processing, or other computerized technology to communicate.
2. According to NAEP, 54% of 8th graders and 52% of 12th graders perform at a *Basic* level in written expression.
3. Males score *significantly* lower than females on standardized assessments of written language (NAEP, 2011).
4. Children spend nearly 60% of their school day actively engaged in the process of written expression or some equivalent fine motor-related endeavor (Feder & Majhmer, 2007).
5. Writing remains one of the most challenging skills to teach our students.

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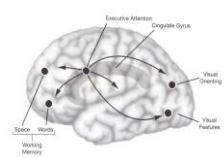
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Cognitive Constructs and Written Language

Attention: (Selective & Sustained)

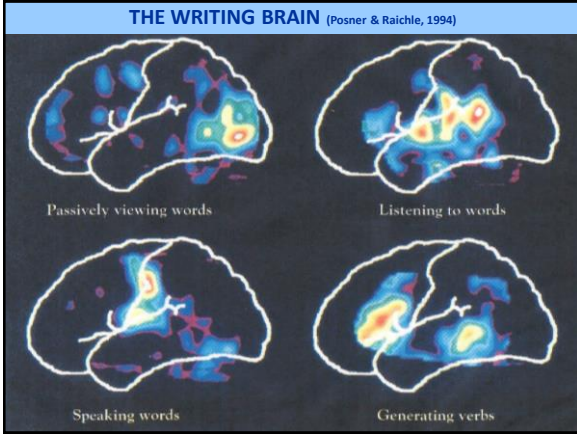
- ▶ Poor planning
- ▶ Uneven tempo
- ▶ Erratic legibility
- ▶ Inconsistent spelling
- ▶ Poor self monitoring
- ▶ Impersistence



BRAIN REGION - Anterior Cingulate Gyrus
*Effort control and top-down attention

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Cognitive Constructs and 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

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Cognitive Constructs and 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 sequential dysfunction.

FRONTAL LOBE

BRAIN REGION – Left Prefrontal Cortex

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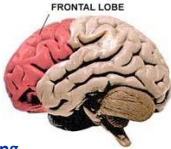


Cognitive Constructs and Written Language

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*)


BRAIN REGION – Semantic memories stored in temporal lobes. Retrieved by frontal lobes



FRONTAL LOBE

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Cognitive Constructs and 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).
- ▶ Writing genre impacts retrieval!

BRAIN REGION – Temporal Lobes



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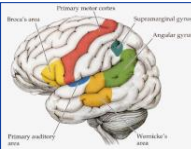


Cognitive Constructs and Written Language

Intelligence

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

BRAIN REGION – Inferior Parietal Lobes



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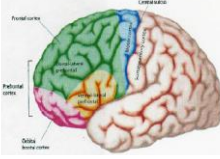
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Cognitive Constructs and Written Language

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

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Motor Output Speed (Pollock et al, 2009)

| 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

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3 Subtypes of Written Language Disorders


(1) Graphomotor Dysgraphia - 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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Cognitive Constructs and Written Language

- The cerebellum contains 50% of the 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 becomes less effortful and more reflexive.
- Deficits mainly lead to motor coordination issues....ataxia....("3971" ATM Code spatial/sequential)



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3 Subtypes of Written Language Disorders

(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 (i.e. "sommr" for "summer").
- b) Surface dysgraphia - a breakdown in the orthographic representation of words. Miscues made primarily on phonologically irregular words (i.e. "laf" for "laugh"; "juse" for "juice"; "mite" for "mighty").
- c) Mixed Dysgraphia - characterized by a combination of both phonological errors and orthographical errors depicting faulty arrangement of letters and words (i.e. "ceshinte" for "kitchen").

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Key Spelling Strategies

1. Incorporate nonsense words into weekly spelling instruction to make sure students can represent each sound with a letter.
2. Use tile spelling markers to color-code vowel digraphs in words by families (i.e. Sauce, Pause, cause, etc...)
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. Show multiple spellings of a word and have the student select the correct choice (i.e. wuz, was, whas).

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3 Subtypes of Written Language Disorders

(3) Executive Dysgraphia - an inability to master how words and phrases can be combined. Deficits in *working memory* and *executive functioning* in frontal lobes hinders syntax!

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

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Features of 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) **Organization & Planning** – syntactical arrangement of thought needed to sequence mental representations.

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Executive Functioning and Written Language

| | |
|---|---|
| <p><u>Classification</u></p> <p>(1) Initiating</p> <p>(2) Sustaining</p> <p>(3) Inhibiting</p> <p>(4) Shifting</p> | <p><u>Writing Dysfunction</u></p> <ul style="list-style-type: none"> * Poor idea generation * Poor independence * Lose track of thoughts * Difficulty finishing * Sentences disjointed * Impulsive/Distractible * 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 * Lack of cohesive ties |
| (7) Poor Word Retrieval | * Limited word choice * Simplistic sentences |
| (8) Poor Self Monitor | * Careless miscues * Sloppy work |

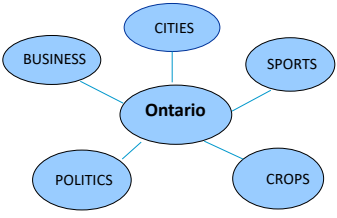
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Executive Functioning Interventions

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:




```

graph TD
    Ontario((Ontario)) --- BUSINESS((BUSINESS))
    Ontario --- CITIES((CITIES))
    Ontario --- SPORTS((SPORTS))
    Ontario --- POLITICS((POLITICS))
    Ontario --- CROPS((CROPS))
  
```

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Self Monitoring Strategies


COPS strategy – a directional proof-reading strategy where the student re-reads the passage 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.
- 3) **P**unctuation miscues must be reviewed.
- 4) **S**pelling miscues must be reviewed.



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Self Monitoring Writing 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 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.

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Strategies for Secondary Students

- > **Inspirations** – teaches how to craft concept maps, idea maps, and other visual webbing techniques to assist in planning, organizing, and outlining. Very effective word predictive software.
- > **Kurzweil Technology** - adaptive technology to further practice grammar, spelling, and punctuation. Voice activated software also an option.
- > **Journal or Diary** – can be a fun and effortless way to practice writing on a daily basis.
- > **Keyboarding** - speed up output to reduce pressure from working memory skills to retain information over longer periods of time.
- > **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.

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10 Research Based Strategies (Graham & Perin, 2007)

- (1) 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)*


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5 Steps for Executive Dysgraphia (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 base upon a writing rubric.



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Comprehensive Dysgraphia Evaluation


1. **Intelligence Measures (Gc):** WISC5, SB5, CAS2, RIAS2, KABCII, WIJIV, DASII...
2. **Visual-Motor Integration (G?):** VMI, WRAVMA, WIAT III, PAL II, NEPSYII...
3. ***Attention* (Gs):** NEPSYII, Tea-CH2, CAS2, WIJIV, Conners Scale, BASC3, TOVA...
4. ***Working Memory*(Gsm):** WISC5, KABCII, WRAML2, SB5, CHAMP, WIJIV...
5. ***Executive Functions*(Gf):** BRIEF2, CEFI, MEFS, WCST, WIATIII Sent Comp...
6. **Writing and Spelling Skills:** WIJIV, KTEAIII, WIATIII, OWLS II, TOWL4, AAB...
7. **Phonological Awareness Skills: (Ga):** CTOPP2, FAR, KTEAIII, WIJIV, TAP54...
8. ***Retrieval Fluency Skills (Glr):** DKEFS, NEPSYII, FAR, WIJIV, KTEAIII, CIFA...
9. **Social Emotional Measures (G?):** RCMAS2, MASC2, BASC3, PAI-A, CD12...

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- A neurodevelopmental assessment of written language disorders.
- Pre-K to College (Ages 4-21)
- 12 subtests in complete battery/10 subtests core
Diagnoses 3 subtypes of writing disorders:
 - 1) **Graphomotor Dysgraphia**
 - 2) **Dyslexic-Dysgraphia**
 - 3) **Executive Dysgraphia**
- Includes the FAW-5 dysgraphia screening battery
- Yields a Compositional Writing Index (CWI)




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Structure of the FAW

| Index | Subtest | Grade range | Approximate administration time in minutes |
|---|--------------------------------------|--------------------|--|
| Graphomotor Index (GI) | Alphabet Tracing Fluency (ATF) | PK to college | 1 - 2 |
| | Motor Sequencing (MS) | PK to college | 3 - 4 |
| | Copying Speed (CS) | K to college | 3 - 4 |
| | Motor Planning (MP) | PK to college | 2 - 3 |
| Dyslexic Index (DI) | Homophone Spelling (HS) | K to college | 3 - 4 |
| | Isolated Spelling (IS) | PK to college | 4 - 6 |
| | Executive Working Memory (EWM) | Grade 2 to college | 10 - 12 |
| Executive Index (EI) | Sentence Scaffolding (SS) | Grade 2 to college | 13 - 16 |
| | Retrieval Fluency (RF) | PK to college | 7 - 8 |
| | Expository Writing (EW) | Grade 2 to college | 6 |
| Compositional Writing Index (CWI) <i>(optional)</i> | Expository Writing (EW) | Grade 2 to college | 6 |
| | Copy Editing (CE) <i>(optional)</i> | Grade 2 to college | 4 |
| | Story Mapping (SM) <i>(optional)</i> | Grade 2 to college | 6 |



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

Workshops: feifer@comcast.net

Books: www.schoolneuropsychpress.com
@schoolneuropsychpress

Tests: FAR- 2015 FAM- 2016 FAW - 2020



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