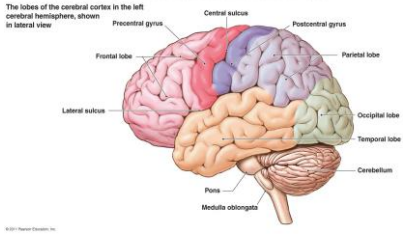
The Neuropsychology of Learning Disabilities:
Developing Evidenced-Based Reading, Writing, and Math Interventions



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Course Outline

- Six part webinar series on reading, writing, & math disabilities sponsored by Jack Hirose & Associates.
- Introduce a brain-based educational model of dyslexia, dysgraphia, and dyscalculia and classify each disability into distinct subtypes.
- Discuss targeted interventions for all students with academic learning issues.
- Introduce the concept of diagnostic achievement tests versus traditional achievement tests.
- Questions and Comments: **feifer@comcast.net**

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Dr. Feifer's Journey 1993 - 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
  www.schoolneuropsychpress.com

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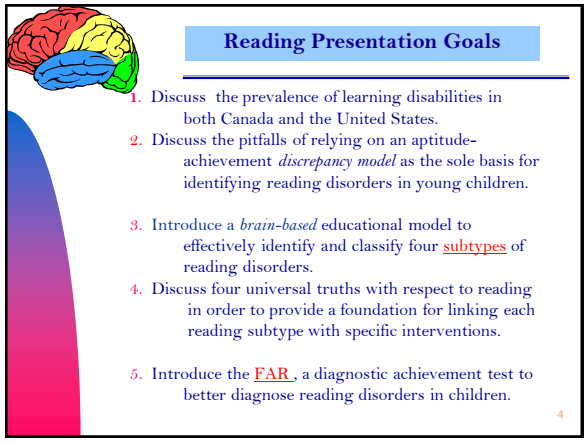
Reading Presentation Goals
1. Discuss the prevalence of learning disabilities in both Canada and the United States.
2. Discuss the pitfalls of relying on an aptitude-achievement *discrepancy model* as the sole basis for identifying reading disorders in young children.
3. Introduce a *brain-based* educational model to effectively identify and classify four subtypes of reading disorders.
4. Discuss four universal truths with respect to reading in order to provide a foundation for linking each reading subtype with specific interventions.
5. Introduce the FAR , a diagnostic achievement test to better diagnose reading disorders in children.
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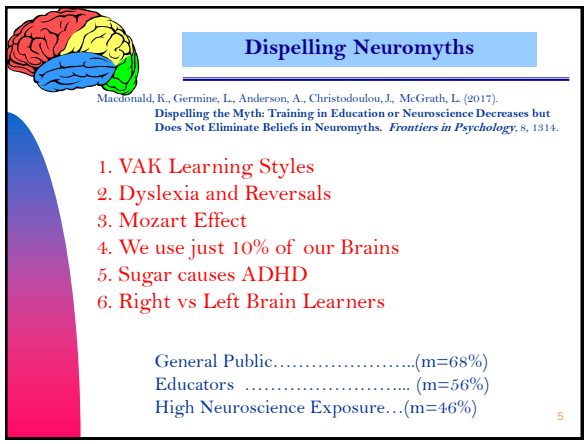
Dispelling Neuromyths
Macdonald, K., Germine, L., Anderson, A., Christodoulou, J., McGrath, L. (2017).
Dispelling the Myth: Training in Education or Neuroscience Decreases but Does Not Eliminate Beliefs in Neuromyths. *Frontiers in Psychology*, 8, 1314.
1. VAK Learning Styles
2. Dyslexia and Reversals
3. Mozart Effect
4. We use just 10% of our Brains
5. Sugar causes ADHD
6. Right vs Left Brain Learners
General Public……..(m=68%)
Educators …….... (m=56%)
High Neuroscience Exposure…(m=46%)
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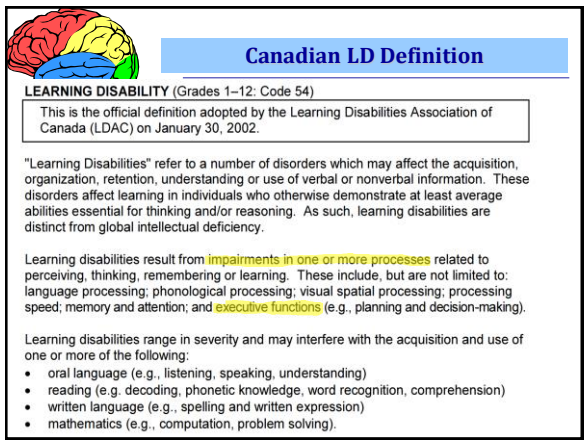
Canadian LD Definition
LEARNING DISABILITY (Grades 1–12: Code 54)
This is the official definition adopted by the Learning Disabilities Association of Canada (LDAC) on January 30, 2002.
"Learning Disabilities" refer to a number of disorders which may affect the acquisition, organization, retention, understanding 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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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

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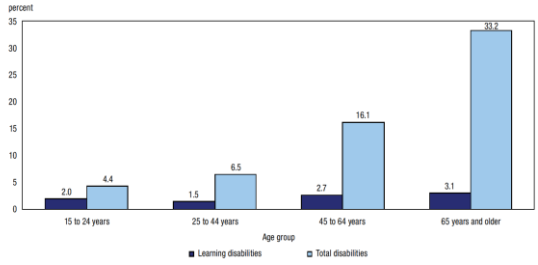
Canadian LD Prevalence Rate

Chart 1
Prevalence of learning disabilities and total disabilities by age group, aged 15 years and older, Canada, 2012



Source: Statistics Canada, Canadian Survey on Disability, 2012.

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Canadian LD Prevalence Rate

Table 2
Effect of disability on educational experiences for adults with a learning disability, aged 15 years and older, Canada, 2012

Effect of disability	Percentage
Took longer to achieve current level due to disability	64.6
Took fewer courses due to disability	63.5
Choice of courses/career influenced by disability	63.4
People avoided/excluded you in school due to disability	57.5
Bullied at school because of disability	49.8
Changed course of studies due to disability	49.0
Education interrupted due to disability	47.4
Attended special education classes in regular school	47.2
Discontinued education due to disability	41.4

Note: Learning disabilities includes those in school within the last 5 years and had disability while in school.
Source: Statistics Canada, Canadian Survey on Disability, 2012.

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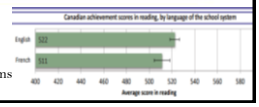
Literacy in Canada

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 U.S. mean=505

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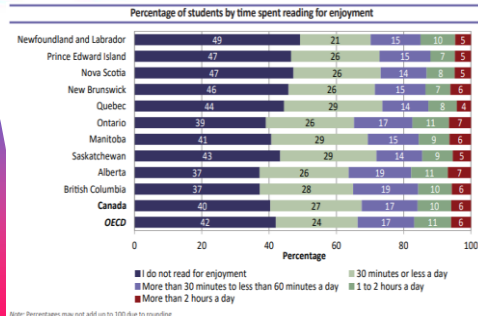
Literacy in Canada

Program for International Student Assessment (2018)



Note: Percentages may not add up to 100 due to rounding.

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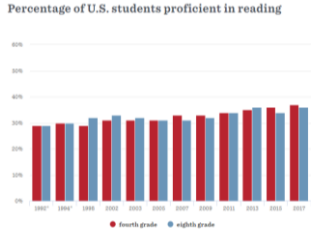
U.S. Literacy Rates: 1992-2017



- Developmental dyslexia occurs in approximately 5-12 of the population (Lyon et al., 2003).

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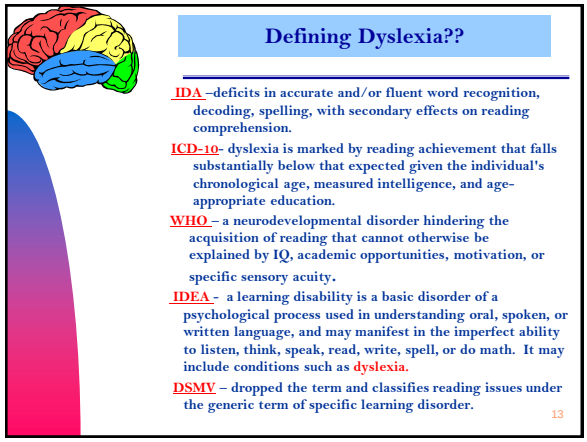
Defining Dyslexia??
IDA –deficits in accurate and/or fluent word recognition, decoding, spelling, with secondary effects on reading comprehension.
ICD-10- dyslexia is marked by reading achievement that falls substantially below that expected given the individual's chronological age, measured intelligence, and age-appropriate education.
WHO – a neurodevelopmental disorder hindering the acquisition of reading that cannot otherwise be explained by IQ, academic opportunities, motivation, or specific sensory acuity.
IDEA - a learning disability is a basic disorder of a psychological process used in understanding oral, spoken, or written language, and may manifest in the imperfect ability to listen, think, speak, read, write, spell, or do math. It may include conditions such as dyslexia.
DSMV – dropped the term and classifies reading issues under the generic term of specific learning disorder.
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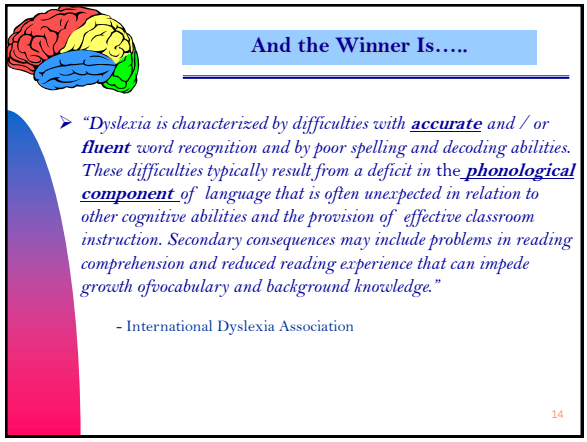
And the Winner Is…..
"Dyslexia is characterized by difficulties with accurate and / or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth ofvocabulary and background knowledge."
- International Dyslexia Association
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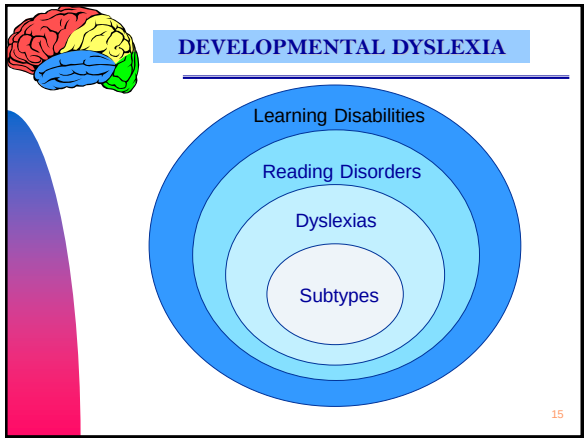
DEVELOPMENTAL DYSLEXIA
Learning Disabilities
Reading Disorders
Dyslexias
Subtypes
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Dyslexia Legislation 2019

Dyslexia Legislation by State

At present, the US is rapidly introducing new dyslexia legislation that will give more students access to support and ensure the right intervention is in place to help:

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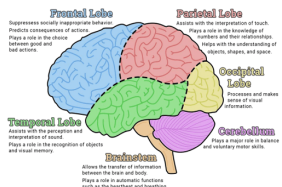
School Neuropsychology

- *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 cognitive tasks.

The Human Brain



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NASP LD POSITION STATEMENT

NASP
National Association of School Psychologists

- 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.
- 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).

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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?

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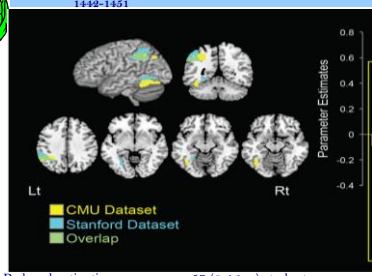
Tanaka, H. et al. (2011). *The Brain Basis of the Phonological Deficit in Dyslexia is Independent of IQ.* Psychological Sciences, 22(11): 1442-1451



- Reduced activation seen among 57 (8-12yo) students from Carnegie Mellon and 74 students from Stanford (7-16yo) in discrepant AND non-discrepant readers in left parietal and visual word form area.
- IQ is not a factor in phonological processing!! (Siegal, 1991: Fletcher, et al. 1994; Stanovich, 2005: Shaywitz, 2010).

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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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Problems with "*Phonological Deficit*" Hypothesis of Reading

1. Assumes dyslexia is a homogenous condition.
2. Does not account for the developmental trajectory of phonological awareness being more significant with younger than older readers (Araujo et al., 2010; Frijters et al., 2011).
3. The model fails to account why numerous phonological skills are preserved for disabled readers (Shany & Share, 2011).
4. The model suggests that phonological training is the only course of intervention.
5. Inconsistent with IDA definition and neuroscience.

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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 ea f. The sound /ee/ is represented by the letters 'e a'.
- 3 letter grapheme: n igh t. The sound /ie/ is represented by the letters 'i g h'.
- 4 letter grapheme: th r ough. 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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Six Syllable Subtypes

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

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

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The Problem with English Orthography?

IF THE GH SOUND IN ENOUGH IS PROUNCED "F"
& THE O IN WOMEN MAKES THE SHORT "I" SOUND
& THE TI IN NATION IS PRONOUNCED "SH"
THEN THE WORD

"GHOTI"

IS PROUNCED JUST LIKE

"FISH"

WELCOME TO THE ENGLISH LANGUAGE

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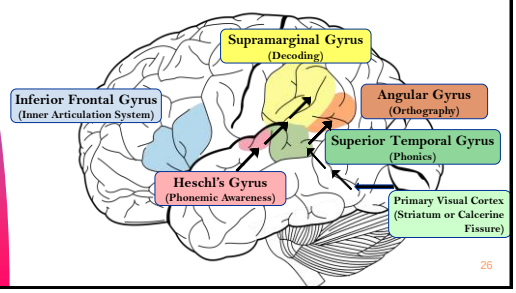
The Reading Brain: How Words are Assembled

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



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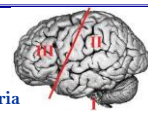
Three Functional Units of the Brain



Alexander Luria
(1902-1977)

*Unit #II: the unit for receiving analyzing, and storing information. Neurons arranged in hierarchical zones:

1) Primary zones are modality specific and receive input from sensory modalities (visual, auditory, tactile).

2) Secondary zones are associative or intermodal areas that integrate two different modalities (i.e. visual/auditory)

3) Tertiary zones are modality NONSPECIFIC and involved in higher order integration of organize human symbol systems. Posterior parietal regions.

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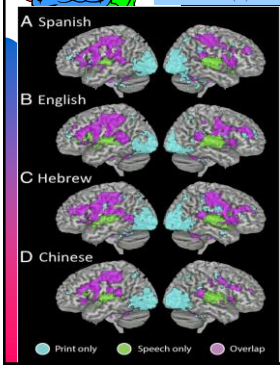
A Universal Reading Brain

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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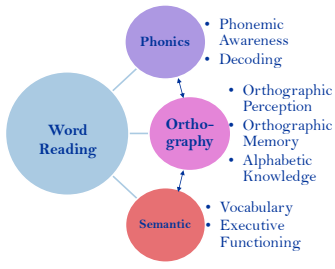
Multiple Cueing System of Reading

- **Recognizes that both phonological and orthographic and semantic cues can facilitate word recognition.**



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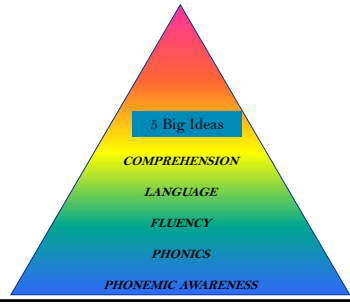
Four Universal Truths of Reading

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



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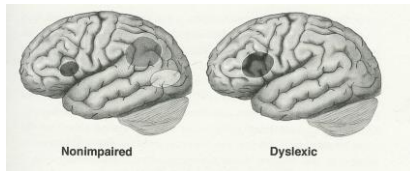
NEURAL CIRCUITRY OF DYSLEXIA
(Shaywitz, 2003)



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

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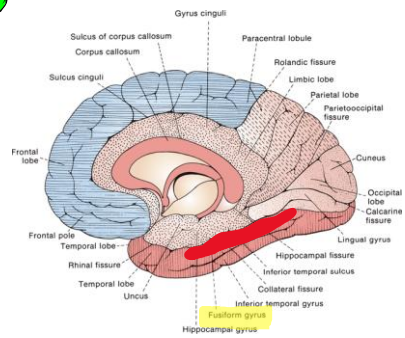
Left Fusiform vs Right Fusiform Gyrus



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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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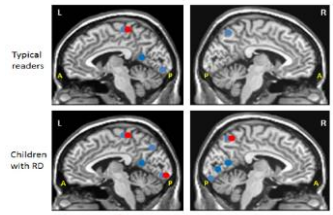
Do Interventions Change the Brain?

- 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.



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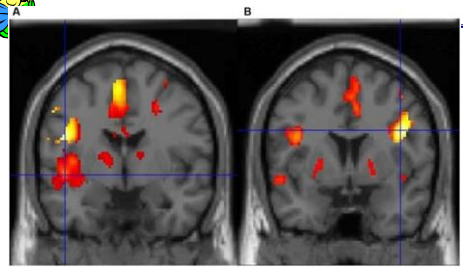
The Right Hemisphere Hypothesis



- Normal adults reading a list of nouns activating left superior temporal gyrus in hemisphere, whereas dyslexia adults activate right inferior frontal cortex.

Waldie K. E. (2002). "Reading with the right hemisphere: from normal development to dyslexia," in *Advances in Psychology Research* Vol. 9 ed. Shohov S. P., editor. (New York, NY: Nova Science Publishers, Inc;), 157-184.

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Let's Stay Connected!

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Tests: FAR- 2015 FAM- 2016 FAW - 2020
Psychological Assessment Resources

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