The Neuropsychology of Reading Disorders: A Framework for Effective Interventions

Steven G. Feifer, D.Ed, NCSP, ABSNP
Monocacy Neurodevelopmental Center
feifer@comcast.net

PRESENTATION GOALS

1. Review four basic subtypes of reading disorders from a brain-behavioral perspective, and discuss children most vulnerable to deficits with reading comprehension skills.

2. Explore specific neural pathways and brain regions associated with reading comprehension skills.

3. Examine the relationship between executive functioning skills, working memory skills, and language development skills in comprehension.

4. Discuss specific classroom strategies and interventions for children with reading comprehension deficits.

Further Reading Materials

www.schoolneuropsychpress.com
CASE STUDIES

Billy is a 12 year old student with an attention-deficit-disorder. He needs accommodations due to difficulties with poor planning and organizational skills. He struggles to take notes in class, has difficulty with reading comprehension skills, and frequently turns in assignments late.

Sam is a 9 year-old student with Asperger's Syndrome. His academic skills are fairly strong though he struggles comprehending more abstract text. Sam has few friends, seems socially awkward and immature, and has difficulty reading social cues from others.

Joe is a 16 year-old junior in High School with an IQ of 135. He is performing poorly in most academic classes, puts forth minimal effort and rarely turns in assignments. He tends to bring multiple books from home to school, and reads them under his desk.

Martin is an 11 year-old student in 6th grade. He has extreme difficulty managing his emotional impulses and has been suspended numerous times for fighting and using inappropriate language. His grades are extremely poor despite numerous interventions.

Reading Comprehension Profiles

8-10% of all school aged children have adequate decoding skills but struggle with reading comprehension (Cutting et al., 2009)

The types of children who struggle most with reading comprehension include:

* ADHD
* Hyperlexia
* ESL students
* High IQ/Poor Executive Function
* Emotional Disorders
* Poor reading fluency
* Lower verbal IQ
* Poor working memory
Disability Categories (2009)

- Autism: 6%
- Emotional Disturbance: 7%
- Intellectual Disability: 8%
- Speech/Language Impairments: 19%
- Other Health Impairments: 11%
- Learning Disabilities: 42%
- All Others: 7%

Source: www.ideal.org, 2009 Child Counts, Ages 21

School Neuropsychological Assessment

- A neuropsychological approach to assessment attempts to identify the core underlying processes responsible for learning as opposed to boxing kids into diagnostic categories.
- Reports based upon a brain-behavioral paradigm which attempts to describe how a child learns and processes information.
- Focus on why the child has not been successful in school as opposed to IQ scores.
- Examine the cognitive and emotional strengths and weaknesses of the child and link to specific educational strategies and interventions.

Forest Grove School District case reached the Supreme Court in June, 2009. The local school psychologist evaluated a child and concluded there was no disability.

- The parents sought a private school neuropsychological assessment that was more comprehensive and found evidence of a disability. The Due Process Hearing Officer concluded the school district failed to provide FAPE and the school district was liable for private school services.
- Supreme Court justice John Paul Stevens agreed with the Due Process Hearing Officer and ruled the school had overlooked a disability by not completing a more comprehensive evaluation in all areas of the suspected disability. Cost of tuition...$5200 per month.
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.

UNDERSTANDING THE NOTION OF SUBTYING

- **Inferior Frontal Gyrus** – end point for inner articulation region.
- **Supramarginal Gyrus** – cross modal association area underlying the spatial appreciation and positioning of sounds.
- **Angular Gyrus** – cross modal association area underlying mapping symbols to sounds (orthography).
- **Heschl’s Gyrus** – auditory perception and discrimination (phonemic awareness).
- **Superior Temporal Gyrus** – modulating the 44 phonemes of the English language.
- **Fusiform Gyrus** – automatic word recognition skills and the development of fluency in reading.
1. **Content Affinity** - attitude and interest toward specific material. Developing an emotional connection.

2. **Working Memory** - the ability to temporarily suspend new information with previously read information.

3. **Executive Functioning** - the strategies used to self-organize information to facilitate retrieval.

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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**Working Memory and Learning**

1. **Writing** - the ability to simultaneously plan and organize our thoughts, remember spelling rules and boundaries, recall grammar rules, concentrate on penmanship, word choice selection, and holding ideal in mind when proofreading.

2. **Mathematics** - involved in remembering longer math algorithms when problem solving, as well as holding facts in memory while problem solving.

3. **Reading** - involved in the comprehension process linking up new information with previous read information and background knowledge and experience.

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**Working Memory Systems**

A) **Phonological Loop** (left)  
B) **Visual-Spatial Sketch Pad** (right)
Working Memory and Reading

- Working memory is a learning facilitator for executive functioning when reading. It holds information in conscious awareness to allow for the strategic manipulation and storage for later recall.
- Most ADHD kids and LD kids have significant working memory deficits.
- WISC IV is not a comprehensive measure of working memory skills.
- There is an inverse relationship between anxiety and working memory skills.

What Are Executive Functions?

- Directive capacities of the mind.
- Multiple in nature, not a single capacity.
- Cue the use of other mental abilities.
- Direct and control perceptions, thoughts, actions, and emotions.
- Part of neural circuits that are routed through the frontal lobes.
- The concept of executive functions is not synonymous with the concept of intelligence or “IQ”.

Frontal Lobe Functions

- Orbital frontal cortex is end point for ventral stream
- Dorsal-lateral cortex is end point for dorsal stream
Executive Functioning and Reading Comprehension

Planning Skills - read with a specific question or purpose in mind when seeking specific information. In other words, plan a strategy!!

Organizational Skills – stitch together text in a cohesive manner and slot information appropriately (i.e. characters, setting, main idea, central problems, details, etc.)

Working Memory – temporarily suspend previously read information in mind while simultaneously linking new information being read.

Concept Formation – depth of understanding of the text.

Response Inhibition - refrain from jumping ahead when reading text and missing salient aspects of the passage.

Sustained Attention – the ability to stay focused on the text for prolonged periods of time and resist distractions.

Cognitive Flexibility – shifting patterns of thought processes to the organizational parameters of the text being read, and not just perseverating on the same material over again.

Self-Monitoring – staying aware and engaged in what you are reading while you are reading.

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. 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.

9. Medication Management – ADHD students in particular can better focus and sustain their attention if appropriately medicated.
10. Practice Terminology – review vocabulary terms and concepts prior to reading the text.
11. Classroom Discussions – introduce new topic areas with a discussion aimed at capturing a student’s interest, providing them with background knowledge, and engaging an emotional connection with the text.
12. Fluency Building – for younger students, greater reading fluency allows for greater automaticity to free up cognitive resources to concentrate on the passage.
Measuring Executive Functions?

Generic Measures:  
- BRIEF  
- CEFI  
- DKEFS  
- WCST  
- TEC  
- NEPSY II

Reading Measures:  
- CVLT  
- KTEA-II (Inferential vs. Literal)  
- PAL II (Morphological vs. Syntactical Coding)  
- GORT 5 (Oral Rdg) vs WIAT III (Silent Rdg)

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.

SOAR to SUCCESS

A comprehension program for grades 3-6.  
- 30-35 minute lessons...18 weeks.  
- 4 Key Strategies:  
  a) Summarize  
  b) Clarify  
  c) Question  
  d) Predict  
- 5 Key Aspects of Program.  
  1) Revisiting – re-read previous story with a partner.  
  2) Reviewing – graphic organizer used to summarize.  
  3) Rehearsing – preview text and make predictions of book to be read that day.  
  4) Read and Reciprocal Teaching – silent reading and practicing strategies.  
  5) Reflecting – discussing story.
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 (51wpm) though 8th (133 wpm) grades.
- Each level of the program has 24 non-fiction stories.
  a) Student placed in level and goal is set.
  b) Cold read for one minute graphing wpm and identifying difficult words.
  c) Read with tape three times consecutively.
  d) Hot read is attempted.
  e) Comprehension questions involve main idea, details, vocabulary, inferences, and short answers.

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.

Early Enrichment and Vocabulary Development

- At birth, human brain weighs 25% of adult weight (compared to chimpanzee's brain, which is 46% of adult weight), thereby leaving more room for the environment to shape brain growth more than any other species.
- Thus, experience at critical junctures in a child's development can greatly influence neural connections
- Human brain volume 95% of its adult weight by age 5 (Stahl, 2000).
ENVIRONMENTAL EXPERIENCE

- Average number of words spoken daily in a professional household ..........1500 - 2500
  3.5 million words by age three
- Average number of words spoken in a middle class household..................1000 - 1500
  2.0 million words by age three
- Average number of words spoken by welfare mothers .........................500 - 800
  1.0 million words by age three

TIME SPENT READING AFTER SCHOOL

(Shaywitz, 2003)

VOCABULARY DEVELOPMENT

The typical child enters school with a receptive vocabulary of 13,000 words and an expressive vocabulary of 5000 words (Eliot, 1999).

- Vocabulary is enhanced by reading and by conversing!!
- Practice terminology before reading text. Very important for science and mathematics.
- Enhance depth through experiential learning and field trips.
- Differentiate between details and inferences.
- Classroom discussions to put words in context, not just memorize them.

The brain craves context!!
Aoccdng to a rscheearch at an Elingsh univerisy, it deosn’t mttaer in what oder the ltteers in a word are, the olny iprmoetnt tihng is that frist and lsat ltteer is at the rghit pclae. The rsel can be a toatl mses and you can still raed it wouthit porbelm. This is bcuseae we do not raed ervry ltteer by it slef but the word as a whole.

Sample Case: Bobby’s Psychological Profile
(9 yrs–old/3rd grade)

WISC IV:

- Full Scale IQ = 87
  - Verbal IQ = 83
  - Perceptual Reasoning = 96
  - Working Memory = 80
  - Processing Speed = 103

WJIII Achievement:

- Broad Reading = 86
- Broad Math = 96
- Broad Writing = 92

Most school psychologists would not qualify Bobby since there is no discrepancy between IQ and achievement. Big mistake!!
Bobby’s Recommendations

- Bobby needs a highly structured type of reading program focusing on teaching phonics through visual cues and morphology, and not acoustically based phonics programs with numerous rules to remember.

- Recommend:
  - Horizons Fast Track
  - Soar to Success
  - Great Leaps
  - CBM to progress monitor!