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**What is Dyslexia and
What can we do about it?**

An in depth look at dyslexia identification, research, treatment, and outcomes

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Outline

- What is dyslexia (and what it's not)
- Associated conditions
- What causes dyslexia and associated research
- Assessment/Evaluation of dyslexia
- Treatment of dyslexia
- Outcomes for individuals with dyslexia

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What is Dyslexia?

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What it's not: a Visual Problem

- Early theories → Dyslexia is a visual problem (e.g., b/d, was/saw)
- Due to early explanations from the 1920s
- Prescribed eye training programs → no evidence for these
- Is language-based learning disability
- Do not "read backwards"
- Letter reversals may or may not be present

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What is Dyslexia? IDA Definition

- "Dyslexia is a specific learning disability that is neurobiological in origin. It 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."

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Early Risk Factors

- Difficulty...
 - Learning to speak (delayed language development)
 - Ongoing language problems (expressive and receptive)
 - vocabulary development, naming, listening and following directions
 - Learning letters and their sounds
 - Difficulty recognizing rhyming patterns
 - Learning other rote skills (colors, shapes, numbers)
 - Lasting problems with articulation
 - Blending sounds

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Primary Grades

- Difficulty generating rhyming words / counting syllables in words
- Difficulty distinguishing different sounds/making words “come apart”
- Substituting unrelated word (e.g., says “puppy” for dog)
- Making whole word guesses (read *depend* as “deepen” or “dispose”)
- Mistakes on “little” sight words (a, the, of) or words that cannot be “sounded out” (said)
- No strategy for reading unfamiliar words
- Difficulty learning rules for spelling
 - spell words the way they sound (e.g., *lik* for *like*); use the letter name to code a sound (*lafant* for *elephant*)
- Listening comprehension is usually better than reading comprehension

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Older Elementary, Middle, and High School

- Reluctant readers
- Slow, word-by-word readers; great difficulty with words in lists, nonsense words and words not in their listening vocabulary
- Very poor spellers—miscode sounds, leave out sounds, add or leave out letters or whole syllables
- Non-fluent writers—slow, poor quality and quantity of the product
- Substitute another word that sounds the same
- Mispronunciation of long, unfamiliar, or complicated words
- Weak vocabulary knowledge and use/filler words

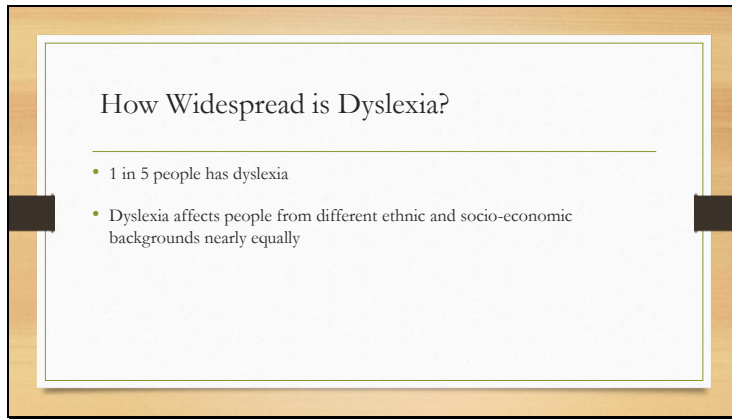
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Related Academic Problems

- Organizing written and spoken language
- Memorizing facts/lists/rote information
- Persisting with and comprehending longer reading assignments
- Learning a foreign language
- Math operations and problem solving
- ***Not all students who have difficulties with these skills have dyslexia***

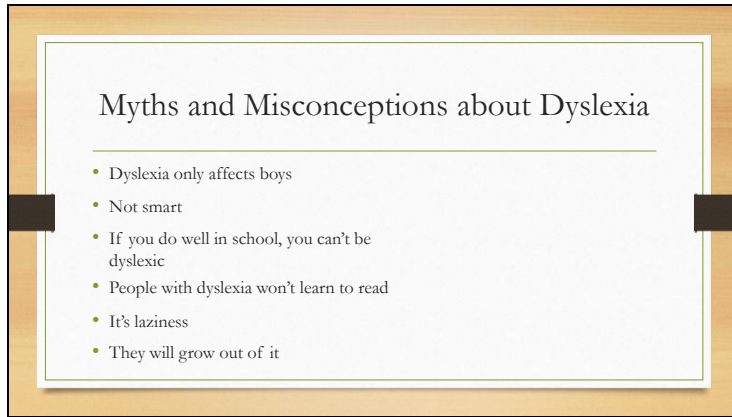
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How Widespread is Dyslexia?

- 1 in 5 people has dyslexia
- Dyslexia affects people from different ethnic and socio-economic backgrounds nearly equally

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Myths and Misconceptions about Dyslexia

- Dyslexia only affects boys
- Not smart
- If you do well in school, you can't be dyslexic
- People with dyslexia won't learn to read
- It's laziness
- They will grow out of it

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Related Conditions

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Dysgraphia

- Unexpected difficulties with written expression
 - Impaired (poor or slow) handwriting
 - Impaired spelling (separate from reading problems), impaired sentence and paragraph composition
 - Messy and disorganized papers
 - Difficulty copying
 - Poor fine motor skills
 - Difficulty remembering motor movements to form letters

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Dyscalculia

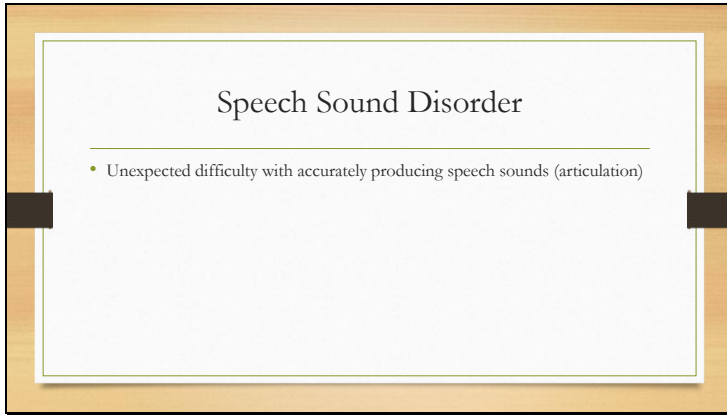
- Unexpected difficulty with math
 - Difficulty counting correctly
 - May misread numbers
 - Difficulty memorizing retrieving math facts
 - Difficulty copying math problems and organizing written math
 - Calculation errors
 - Difficulty retaining math vocabulary concepts

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Language Impairment

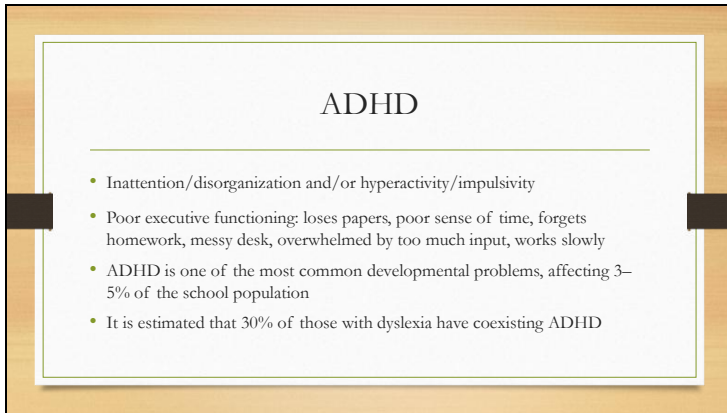
- Unexpected difficulty with structural language acquisition
 - Difficulty with:
 - morphology—word parts that mark meaning and grammar
 - syntax—structures for ordering words and understanding word functions
 - finding words in memory
 - making inferences that go beyond what is stated in text
 - vocabulary development

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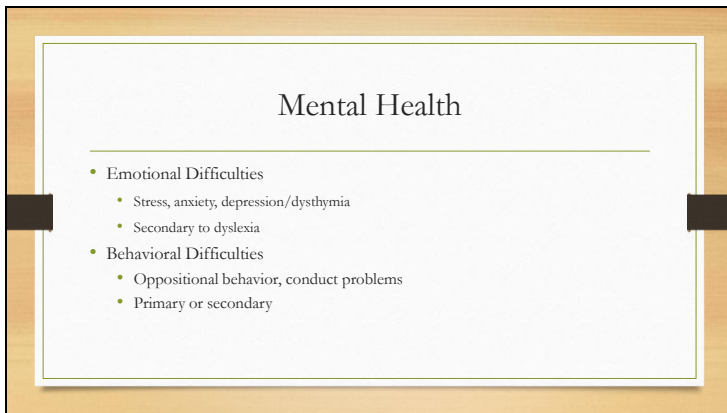
Slide 16 features a title box with a light green border containing the text "Speech Sound Disorder". Below the title is a horizontal line and a single bullet point: "Unexpected difficulty with accurately producing speech sounds (articulation)". The slide is framed by a light brown border with black corner tabs on the left and right sides.

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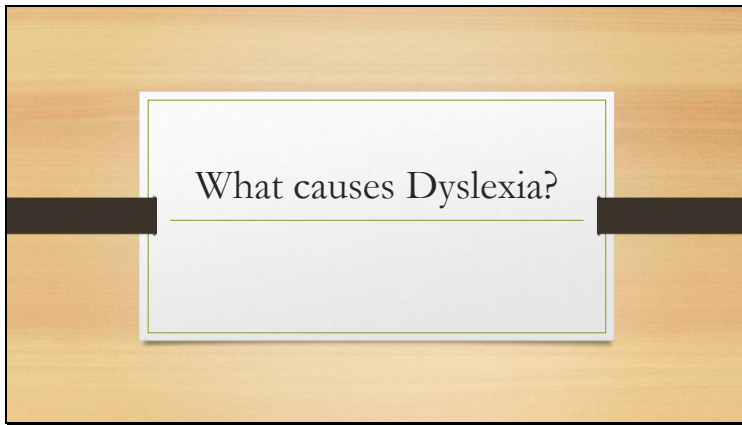
Slide 17 features a title box with a light green border containing the text "ADHD". Below the title is a horizontal line and a list of four bullet points: "Inattention/disorganization and/or hyperactivity/impulsivity", "Poor executive functioning: loses papers, poor sense of time, forgets homework, messy desk, overwhelmed by too much input, works slowly", "ADHD is one of the most common developmental problems, affecting 3–5% of the school population", and "It is estimated that 30% of those with dyslexia have coexisting ADHD". The slide is framed by a light brown border with black corner tabs on the left and right sides.

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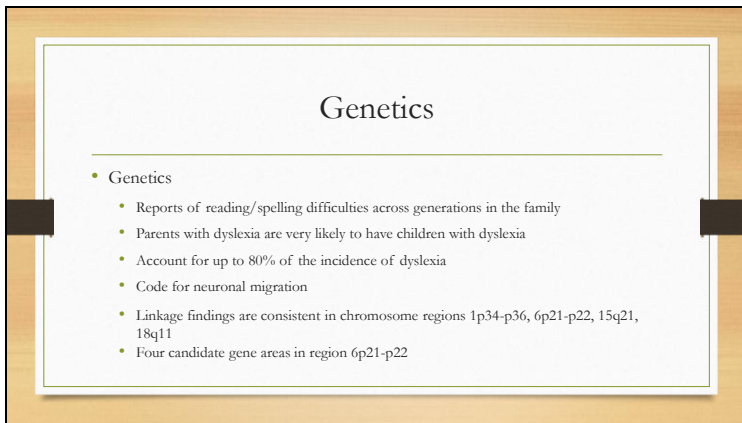


Slide 18 features a title box with a light green border containing the text "Mental Health". Below the title is a horizontal line and a list of three main bullet points: "Emotional Difficulties" (with sub-bullets "Stress, anxiety, depression/dysthymia" and "Secondary to dyslexia"), "Behavioral Difficulties" (with sub-bullets "Oppositional behavior, conduct problems" and "Primary or secondary"). The slide is framed by a light brown border with black corner tabs on the left and right sides.

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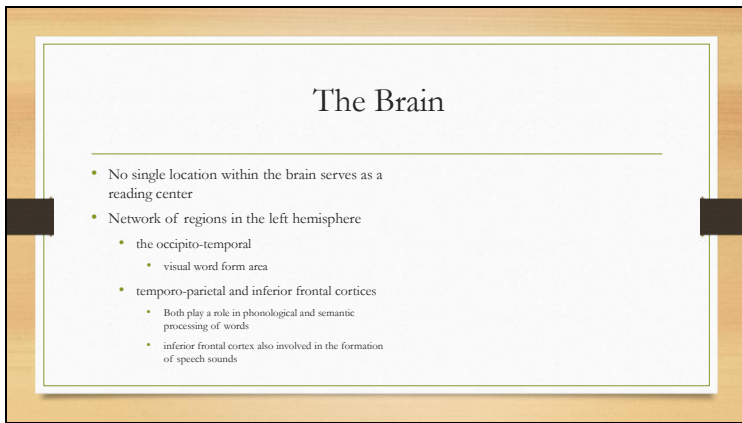


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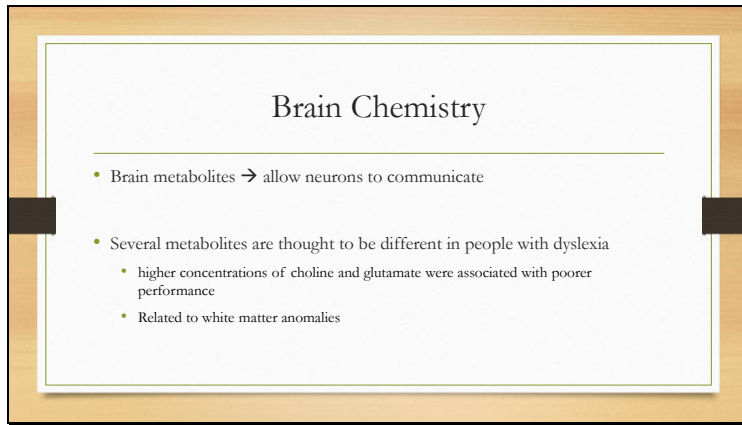
- Genetics
 - Reports of reading/spelling difficulties across generations in the family
 - Parents with dyslexia are very likely to have children with dyslexia
 - Account for up to 80% of the incidence of dyslexia
 - Code for neuronal migration
 - Linkage findings are consistent in chromosome regions 1p34-p36, 6p21-p22, 15q21, 18q11
 - Four candidate gene areas in region 6p21-p22

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- No single location within the brain serves as a reading center
- Network of regions in the left hemisphere
 - the occipito-temporal
 - visual word form area
 - temporo-parietal and inferior frontal cortices
 - Both play a role in phonological and semantic processing of words
 - inferior frontal cortex also involved in the formation of speech sounds

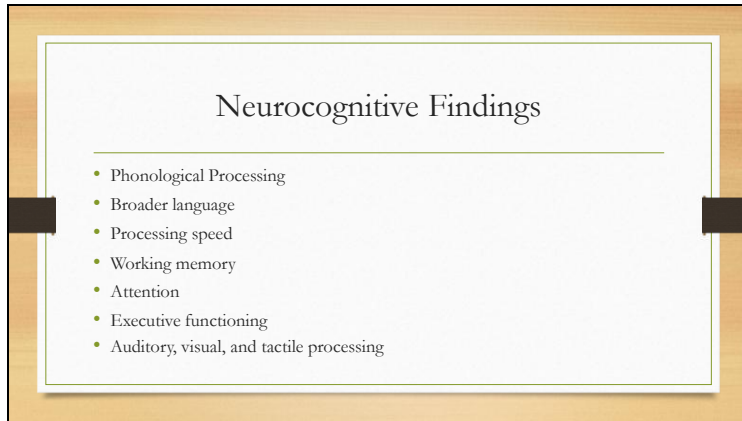
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Brain Chemistry

- Brain metabolites → allow neurons to communicate
- Several metabolites are thought to be different in people with dyslexia
 - higher concentrations of choline and glutamate were associated with poorer performance
 - Related to white matter anomalies

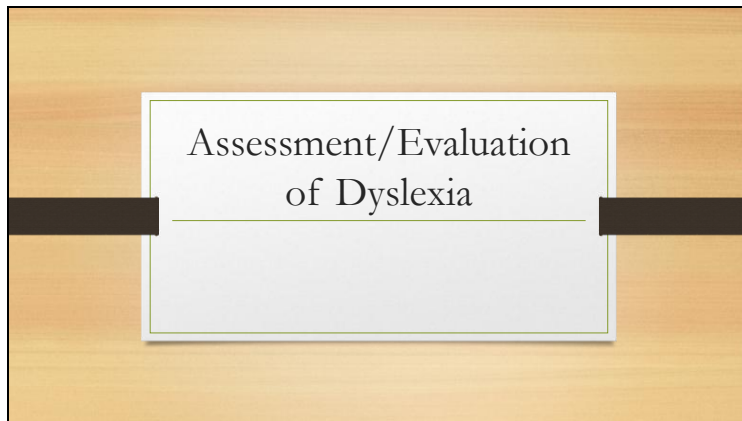
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Neurocognitive Findings

- Phonological Processing
- Broader language
- Processing speed
- Working memory
- Attention
- Executive functioning
- Auditory, visual, and tactile processing

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Assessment/Evaluation
of Dyslexia

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Why is a formal evaluation important?

- Establish the correct diagnosis
- Targeted/individualized intervention planning
 - Specific to a child's unique needs
 - At a child's grade level for reading skills
 - Addresses a child's specific neurocognitive comorbidities
- Documentation

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Evaluation for Dyslexia

- Individual assessment
- Who can perform
 - Clinicians with M.A., M.S., M.Ed., Ed.D., or Ph.D. degrees in Education, Reading, Speech Language Pathology, Educational Psychology, Psychology, Neuropsychology
- Medical evaluation (i.e., by a neurologist) or neuropsychological evaluation are not required

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What to expect

- Interview
 - Information about birth history, family history, child development, including speech and language development and early educational history.
- Review of records – grades, evaluations, treatments, efficacy of previous interventions
- Testing may be all in one day or split into multiple, shorter sessions
- Written report
 - referral question, history, battery of tests, standard scores and percentiles, diagnosis, treatment recommendations

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Reading Skills

- Single word reading - Real Words
- Nonsense word reading/Decoding
- Oral reading fluency for word lists
- Oral reading fluency for connected text
 - Accuracy at a story-telling pace
 - Facilitates comprehension

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Phonological processing

- Phonological Awareness
 - Say "cup" without saying /k/, blend /n/ /a/ /p/ into nap, what's the second sound in the word train (with real words and nonsense words)
- Phonological Memory
 - Repeat lists of digits, repeat nonsense words
- Rapid Automatic Naming (RAN)
 - Speed of naming objects, colors, digits, or letters

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Expressive and Receptive Language

- Receptive Vocabulary – understanding of words heard
- Receptive language – following directions
- Vocabulary knowledge /naming skills
- Verbal expression

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Written Language

- Spelling
 - Look for dysphonetic errors (e.g., mother → "mutr," camped → cant, fix → fsk)
- Writing
 - Sentence Level
 - Paragraph Level

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Math

- Not critical for diagnosis of dyslexia but important as part of comprehensive evaluation
- Untimed math calculations, math reasoning with math word problems read aloud, math fluency
- Problems:
 - Adequate math calculation and math reasoning skills when reading is accommodated (word problems read aloud) but poor math fluency
 - Struggle with mathematical language and have problems with math word problems that go beyond decoding difficulties

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Intelligence Testing

- Used to be required to obtain the IQ/Performance split
- While no longer required, is still important
 - Identify children who have a split
 - Identify patterns of strength and weakness
 - IQ tests evaluate dyslexia-related neurocognitive problems (working memory, processing speed)
 - Design targeted intervention program

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Dyslexia and the Neuropsychological Assessment

- Intellectual functioning
- Attention, Working Memory
- Processing Speed
- Learning and memory
- Executive Functioning
- Fine/sensorimotor functioning
- Emotional and Behavioral

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Treatment of Dyslexia

Research Supported Interventions

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Treatment of Dyslexia

- Early identification and treatment
 - Before second grade: focus on language skills, phonological awareness, memory, rapid naming → prevention
 - Don't wait for failure!
- One-on-one intervention to ensure they move forward at their own pace
- Phoneme awareness, specific reading instruction, and fluency training
 - Structured Literacy, Orton- Gillingham, Simultaneous Multisensory, Explicit Phonics
- Multisensory

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Components of intervention

- **Phonological awareness**
 - rhyming, counting words in spoken sentence, and clapping syllables in spoken words.
- **Sound-Symbol Association**
 - map the phonemes to symbols or printed letters.
 - visual to auditory (reading) and auditory to visual (spelling).
 - blending of sounds and letters into words as well as the segmenting of whole words into the individual sounds

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Components of intervention

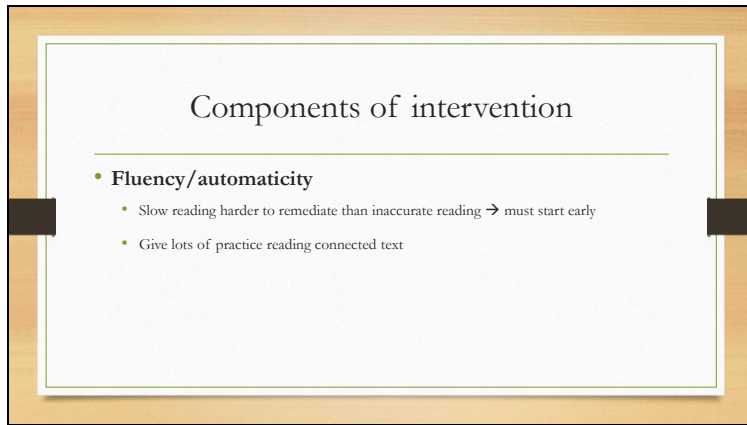
- **Syllable Instruction**
 - unit of oral or written language with one vowel sound
 - heighten the reader's awareness of where a long, unfamiliar word may be divided
- **Morphology**
 - smallest unit of meaning in the language
 - base words, roots, prefixes, and suffixes

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Components of intervention

- **Syntax**
 - set of principles that dictate the sequence and function of words in a sentence
 - includes grammar, sentence variation, and the mechanics of language
- **Semantics**
 - aspect of language concerned with meaning
 - instruction in the comprehension of written language

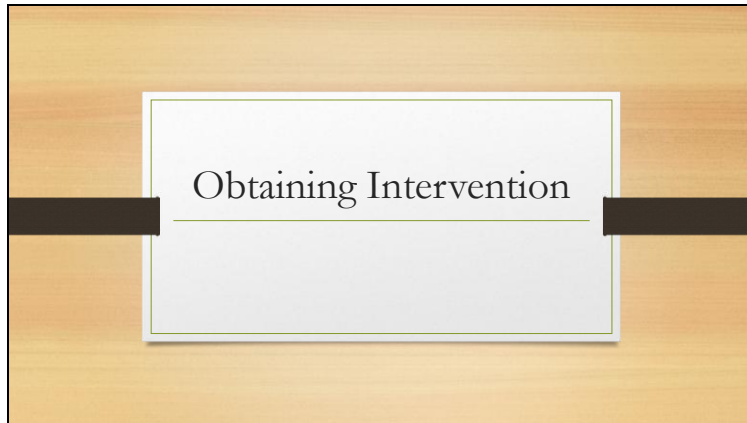
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Components of intervention

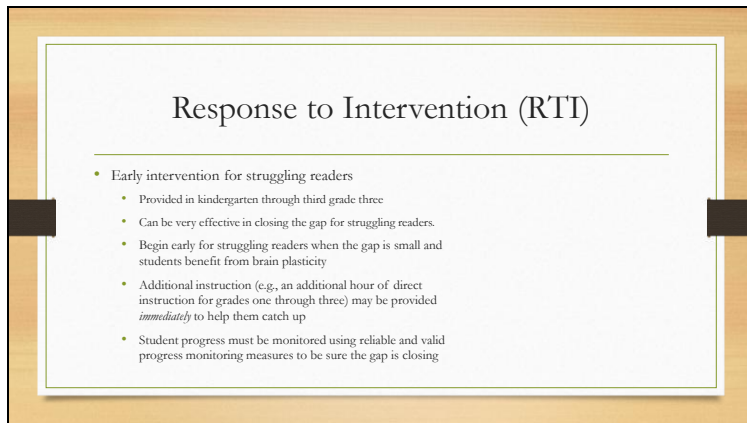
- **Fluency/automaticity**
 - Slow reading harder to remediate than inaccurate reading → must start early
 - Give lots of practice reading connected text

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Obtaining Intervention

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Response to Intervention (RTI)

- Early intervention for struggling readers
 - Provided in kindergarten through third grade three
 - Can be very effective in closing the gap for struggling readers.
 - Begin early for struggling readers when the gap is small and students benefit from brain plasticity
 - Additional instruction (e.g., an additional hour of direct instruction for grades one through three) may be provided *immediately* to help them catch up
 - Student progress must be monitored using reliable and valid progress monitoring measures to be sure the gap is closing

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Individualized Education Program (IEP)

- Comprehensive evaluation by Child Study Team → IEP
- Provides interventions and accommodations
- Retention does not work

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Accommodations

- extended time/ untimed tests
- provide a quiet area for reading/working testing
- help with taking notes / copies of lecture notes
- modified/alternative work assignments
- listening to books, use text reading
- reduce/eliminate oral reading in class
- don't penalize for spelling errors, grade on content
- oral exams
- eliminate or reduce spelling tests
- allow technology aides such as text readers, smartpen, and spelling and grammar checks
- teach students to use logic rather than rote memorization

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Accommodations

- Language waiver / course substitution
- Major course of study in areas of individual strength
- Receiving notes in advance, using a note taker
- Reduced course load – avoid too many reading intensive courses at once
- Preview reading
- Speech to text programs for writing

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Less than helpful “treatments”

- Beware of:
 - Exaggerated claims and false guarantees
 - Pseudoscience (there is no single cure)
 - Program doesn't specifically target reading
 - Short term gains don't translate to long term gains
 - Not supported by independent science

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Long Term Outcomes

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Outcomes

- Different for each person
- Depends on several factors
 - Severity of the condition
 - Effectiveness of instruction or remediation
 - Comorbid conditions
- Some individuals compensate for their difficulties early on but have difficulties that emerge later

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Without Intervention

- Downward trend of achievement over time
- Difficulty acquiring new knowledge because of lack of exposure (e.g., avoiding reading) → vocabulary, background knowledge, and comprehension skills.
- Poor spelling and writing → difficult to accurately express knowledge and ideas
- Slow and laborious reading
- Inconsistent school work
- Feel that they are “dumb” → underachievement (education, employment)

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With Appropriate Intervention

- Overcome or adapt to their difficulties while maintaining a positive self-image
- If receive intervention in kindergarten and first grade → significantly fewer problems in learning to read
 - 74% of the children who are poor readers in 3rd grade remain poor readers in the 9th grade and into adulthood
- Direct reading instruction for older students can still be beneficial → Never too late to diagnose
- Successful students in colleges and universities, as well as in professional and adult life.

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Job success

- May have difficulty with work-training courses, if these are not presented in ways that accommodate their learning needs
- Accommodations
 - written materials in an accessible format
 - restructured job tasks
 - assistive technology (text reading systems, reading pens, speech recognition systems, and portable word processors with spell and grammar checking)
- Protected under the ADA

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Resources for additional information

- International Dyslexia Association: www.interdys.org
- Learning Disability Association of America: www.ldamerica.org
- Learning Disabilities Online: www.ldonline.org
- The Yale Center for Dyslexia and Creativity: www.dyslexia.yale.edu
- Learning Ally: www.learningally.org
- www.decodingdyslexiani.org

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Questions?
