Diagnosis and Treatment of Dyslexia and Spoken-Written Language Disorders: Role of the SLP
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Western Michigan University

Miniseminar
Ohio Speech-Language-Hearing Association
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Objectives

- Outline 3 ways that assessment profiles for students with dyslexia are likely to differ from profiles for students with spoken-written language disorders.
- Describe one way that interventions for students with dyslexia and more comprehensive spoken-written language disorders are likely to be different.
- Describe two ways that interventions for students with dyslexia and more comprehensive spoken-written language disorders are likely to be similar.

Questions – Still unanswered

- Do most children who start out with S/LI eligibility in the area of language end up classified as having Specific Learning Disability (SLD)?
- Do any children end up classified as having SLD on the basis of spoken as well as written language without starting with S/LI eligibility?

Other Questions

- What is dyslexia?
- If it is a language disorder, how does it differ from other language disorders?
- If a child has a genetic risk for dyslexia, is there anything parents and educators do about it?
- Can prevention and intervention improve the wiring and efficiency of neural networks?

Multiple influences on school-age language-learning abilities...

- Individual differences (genetic makeup)
- Familial environment
- Educational environment

Acknowledgments/ Disclosure

- Many graduate students, colleagues, and Van Riper named professorship from WMU
- U.S. Department of Education, Office of Special Education Programs, and Institute of Education Sciences, National Center for Special Education Research for TILLS research.
  - Michele A. Anderson, Ph.D., Senior Research Associate
  - E. Brooks Applegate, Ph.D., WMU
  - Elena Plante, Ph.D., University of Arizona

N.W. Nelson, Western Michigan U.
It takes a whole brain to communicate by talking, listening, reading, and writing.

Can prevention and intervention improve the wiring and efficiency of neural networks?

No gene can “cause” language or reading problems...

“Genes do not specify behaviours or cognitive processes; they make regulatory factors, signalling molecules, receptors, enzymes, and so on, that interact in highly complex network(s), modulated by environmental influences, in order to build and maintain the brain”

(Fisher, 2006, p. 270).

Genetics and Language

<table>
<thead>
<tr>
<th>SPOKEN LANGUAGE</th>
<th>READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX-P2 (Chromosome 18)</td>
<td>DCDC2</td>
</tr>
<tr>
<td>- Necessary for synaptogenesis in Brodmann’s 41b (auditory association area)</td>
<td>- May affect neuronal migration in people with reading disability</td>
</tr>
<tr>
<td>- Associated with past-tense verb learning, but...</td>
<td>- As many as 20% cases with dyslexia due to the DCDC2 gene</td>
</tr>
<tr>
<td>- “the same ability requires virtually all the cortical areas, most of the genes, and highly elaborated language experience.”</td>
<td>- Statistical approach to study and compare specific DNA markers in 153 dyslexic families.</td>
</tr>
<tr>
<td>- (Finley, 2005, p. 212)</td>
<td>- Brain circuits must communicate with each other.</td>
</tr>
<tr>
<td></td>
<td>- In dyslexia, circuits are disrupted</td>
</tr>
<tr>
<td></td>
<td>- Compensatory brain circuits are inefficient.</td>
</tr>
<tr>
<td></td>
<td>- (Gruen and others, 2005)</td>
</tr>
</tbody>
</table>

Neural Development

Evidence from prenatal, perinatal, and postnatal wiring of the brain

| Prior to birth, embryos develop brain and spinal cord injuries that are not strengthened when born. |
| Developing neurons send out axons that grow to their target without general target accuracy. |
| Brain areas develop before they are normally used. |
| Another growth circuit that fires when children speak but is not strengthened when they are speaking. |

No gene can “cause” language or reading problems...

“Genes do not specify behaviours or cognitive processes; they make regulatory factors, signalling molecules, receptors, enzymes, and so on, that interact in highly complex network(s), modulated by environmental influences, in order to build and maintain the brain”

(Fisher, 2006, p. 270).
References


Evidence from fMRI studies

- Overactivation in left anterior region (Broca's)
- Underactivation in posterior regions (Wernicke's, Angular Gyrus, Occipito-Temporal Lobe)

Neuropsychology of Reading

- fMRI studies
  - Overactivation in left anterior region (Broca's)
  - Underactivation in posterior regions (Wernicke's, Angular Gyrus, Occipito-Temporal Lobe)

Neuropsychology of Reading

- PET studies
  - Evidence that some areas of brain work in isolation of others in dyslexia
  - Anatomical and functional differences in familial studies
    - Anomalies in the cerebellar-frontal circuit associated with problems of rapid automatic naming and reading, but without primary spoken language impairment.
    - Research shows that cerebellum, known for its role in coordinating motor activity, plays a role in integrating perceptual and cognitive processes, including reading.
- Unimodal
  - visual letter
  - auditory speech sound
- Bimodal
  - congruent (letter = sound)
  - incongruent (letter ≠ sound)
- Attention control trials in which children were asked to press a button

Figure 3.9. Arrows point to distorted lamination of cerebral cortex in the brain of an individual with dyslexia (from Nelson, 2010, courtesy of Albert M. Galaburda)

fMRI Differences in Intermodal Integration (Blau et al., 2010)

- Compared fMRI results for two groups of children:
  - Dyslexia (n = 18; mean age 9.39 years)
  - Fluent readers (n = 16; mean age 9.43 years)
- “Listen carefully to the speech-sounds and/or view the letters.”
  - Unimodal
    - visual letter
    - auditory speech sound
- Bimodal
  - congruent (letter = sound)
  - incongruent (letter ≠ sound)
- Attention control trials in which children were asked to press a button.
Conclusions:

- "An interrelated network of visual, auditory and heteromodal brain areas contributes to the skilled use of letter-speech sound associations necessary for learning to read."
- "The neural integration of letters and speech sounds in the planum temporale/Heschl sulcus and the neural response to letters in the fusiform gyrus explained almost 40% of the variance in individual reading performance."

Results of fMRI reflecting response to congruent letter/sound combinations

<table>
<thead>
<tr>
<th>FLUENT READERS (N=16)</th>
<th>DYSLEXIC READERS (N=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congruency effect observed in the planum temporale/Heschl sulcus and superior temporal gyrus</td>
<td>Congruency effect absent in dyslexic group</td>
</tr>
<tr>
<td>Clear auditory specific activation in the planum temporale/Heschl sulcus for both groups</td>
<td>Absolute strength of auditory response reduced in dyslexia</td>
</tr>
<tr>
<td>Enhanced unisensory visual response to letters in the fusiform gyrus</td>
<td>Reduced unisensory responses to letters in the fusiform gyrus</td>
</tr>
</tbody>
</table>


Multiple influences on school-age language-learning abilities...

- Individual differences (genetic makeup)
- Familial environment
- Educational environment

Blau et al. (2010)

Brief primer on learning to read and write

Partial sources

ASHA Committee on Reading and Writing, 2001 (position statement, roles and responsibilities, technical report)


Emergent Literacy 0-4 yrs

- Oral language development: receptive & expressive
  - Phonology, vocabulary, and syntax
  - Telling and comprehending stories
- Print awareness
- Book knowledge
- Reading and writing in dramatic play (pretend reading & writing in print-rich environments)
- Social literacy for reading faces, understanding intentions, etc.
- Phonological awareness ("shallow")
- Alphabetic principle
- Scribble writing \(\rightarrow\) letter-like formations \(\rightarrow\) real letters

Early Literacy 4-7 yrs

- Phonemic awareness ("deep") (segmenting/blending/deleting/transposing)
- Phonics (sound-symbol association)
- Word level decoding/invented (phonetic) spelling
- "Glued" to print while reading
- Emerging orthographic and morphological awareness and some mental graphemic representations in spelling (recognize and reproduce chunks)
- Recognize known oral vocabulary in print
- Comprehend content/vocabulary-controlled texts in reading
- Comprehend complex texts read aloud
- Write notes to family, stories, reports, etc.

Five Critical Components
(National Reading Panel; NCLB)

- Phonemic awareness — the ability to focus on and manipulate the smallest units of sound in spoken language
- Phonics — the relationship between the letters of written language and the sources of spoken language
- Vocabulary development — the stored information about the meaning and pronunciation of words
- Reading fluency — the ability to read accurately, quickly, and with expression
- Reading comprehension — the ability to understand or gain meaning from text

Growing Fluency 8-12 yrs

- "Read to learn"
- Flexible application of word-structure knowledge
- Learn new vocabulary and concepts from print sources
- Use redundancies of language and knowledge of discourse structures to make sense
- Use conventional spelling (except for some challenging spellings)
- Understand & produce complex discourse for many communicative purposes (including social notes)
- Can talk & write about stories, expository, poetry
- Place social value on "chapter books"
- Display full range of writing processes

Literate, Critical Thinking
(adolescent-adult)

- Read and write original texts in multiple genres critically and selectively
- Grasp multiple layers of meaning (figurative, abstract)
- Aware of etymology (word roots and origins, e.g., Greek, Latin) and use it for learning new vocabulary and spelling
- Master writing processes (ongoing)
- Apply full range of executive skills to controlling and guiding what, when, how much to read and write (e.g., deciding what not to read)
- Aware of author/audience role and multiple points of view

Evidence that Instruction can change brain patterns

Partial sources


Phonological-based treatment resulted in heightened activation in the left posterior occipito-temporal region, related to improved fluent reading.


Reading intervention (targeting phonemic and morphemic awareness, alphabetic principle, fluency, reading comprehension) changed fMRI activation patterns for 10 children with dyslexia, bringing them closer to patterns for 10 normal readers.


After receiving treatment focused on morphological units, abnormally active frontal lobe involvement was replaced with findings of no difference between groups for boys and girls from 9 to 12 years dyslexia compared with matched controls.


Oral language impairment
Dyslexia
One condition or two?
Implications for Assessment and Treatment

Comprehension
(sentence/discourse level)
- Idea/message/intention
- Analyze sentences & relations

Decoding
(sound/word level)
- Recognize as meaningful
- Analyze (print/spelling &) phonology

Transcription
(sound/word/letter level)
- Synthesize words in speech
- Represent in print

Speaking
Writing
- Formulation
(sentence/discourse level)
- Idea/message/intention
- Synthesize sentences

Listening
Reading
- Handwriting
- Spelling
- Transcription
- Synthesize words in speech
- Represent in print

Language is Reciprocal and Interactive Across Modalities

- Thinking
- Writing
- Reading
- Speaking
- Listening
A “Simple Model” of Reading

- Reading decoding
  - Sound/word level knowledge
    - Vocabulary knowledge
    - Graphophonemic & orthographic knowledge
  - Focus on form
- Reading comprehension
  - Sentence/discourse level knowledge
    - Syntactic knowledge
    - Discourse and macrostructure knowledge
  - Includes vocabulary knowledge as well
  - Focus on making sense
  - Relies on accurate decoding


References


“Simple model” of language-learning disabilities—with two dimensions

- “Simple view of reading” (Gough & Tunmer, 1986)
  - Fundamental task: Discover how print maps on to existing spoken language
  - Word recognition (D) x Oral language comprehension (C) = Reading comprehension (R)
- “Simple view of reading redux” (Tunmer & Chapman, 2012)
  - Need to relax the concept of independent components
  - Evidence that a component of C (vocabulary) contributes directly to variance in D
- Two dimensions explain relationship between dyslexia and SLI (Bishop & Snowling, 2004; Catts, Adlof, Hogan, & Weismer, 2005)
- Relatively pure phonologically based problems
- Nonphonological language skills


Pattern observed?

- Sound/Word Ability
  - Pronouncing
  - Decoding
  - Spelling
- Sentence/Discourse Ability
  - Good listening skills & sentence formulation?
  - Low reading decoding & fluency & spelling?
  - High in both?
  - Low in both?
- High sound/word skills and phonics reading?
  - Low comprehension in listening and reading?

Sound/Word Level
- Pronouncing
- Decoding
- Spelling

Sentence/Discourse Level
- Comprehension
- Formulation
- Narrative Expository

Social Skills
- Play
- Nonverbal
- Nonliteral
- Theory of Mind

Typical Language
- Normal

Language Imp. SLI or NLI
- Below

Comprehension Deficit
- Normal

Social Communication Dis
- Normal

Dyslexia/ Dysgraphia
- Below

Autism Spectrum Disorder
- Normal

Expository low

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Data from Mashburn & Myers (2010)

Overlap in Speech-Language and Reading Services for Kdg and Grade 1

Evidence for relationships shifting over time in types of reading disorders

Problem: Older struggling readers who might have been identified earlier

Are SLI and Dyslexia Distinct Disorders?

International Dyslexia Association

- Dyslexia is a language-based learning disability.
- Dyslexia refers to a cluster of symptoms, which result in people having difficulties with specific language skills, particularly reading.
- Students with dyslexia usually experience difficulties with other language skills such as spelling, writing, and pronouncing words.
- Dyslexia affects individuals throughout their lives; however, its impact can change at different stages in a person’s life.
### Dyslexia

**LEARNING PROFILE**
- First signs in Kdg or 1st grade
  - Naming letters
  - Associating sounds with them
- No preschool history of problems in oral language milestones or primary oral language disability
- Impaired accuracy and/or rate in lists or passage context
  - Word decoding (pseudowords)
  - Word reading (real words), and/or
  - Word spelling (dictation and composing)

**PHENOTYPE PROFILE**
- Impaired phonological coding
- Impaired orthographic coding
- Impaired phonological loop
- Impaired orthographic loop
  - Internal codes for letters and written words
  - Finger sequencing plans
  - Integration of orthographic codes with finger movements for letter and word production

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### Dysgraphia

**LEARNING PROFILE**
- First signs in Kdg or 1st grade
  - Writing letters
  - Associating sounds with them
- No preschool history of problems in oral language milestones or primary oral language disability
- Impaired accuracy and/or rate in lists or passage context
  - Word decoding (pseudowords)
  - Word reading (real words), and/or
  - Word spelling (dictation and composing)

**PHENOTYPE PROFILE**
- Impaired phonological coding
- Impaired orthographic coding
- Impaired phonological loop
- Impaired orthographic loop
  - Internal codes for letters and written words
  - Finger sequencing plans
  - Integration of orthographic codes with finger movements for letter and word production

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### Oral and Written LLD

**DEVELOPMENTAL PROFILE**
- Preschool history of oral language delay
- Persisting oral and written language problems
- All other developmental domains in normal range
- Specific language impairment (SLI) or language learning disability (LLD) occurs in which one or more but not all language skills are impaired

**LEARNING PROFILE**
- Impaired reading comprehension
  - Word level (vocabulary)
- Sentence level (sentence comprehension)
- Text level (factual and inferential questions)
- Following oral and/or silent reading during the school years
- Impaired syntax or other language problems affect written composition
- Same impairments as in dyslexia may occur

**PHENOTYPE PROFILE**
- Impaired morphological coding
- Impaired syntax coding
- Impaired word retrieval
- Impaired listening comprehension
- Same impairments as for dyslexia may occur

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### Language Levels Model

[Diagram of the Language Levels Model]

- **Sentence/Discourse Ability**
- **Predicted Diagnostic Group**
  - **Dyslexia**
  - **Dysgraphia**
  - **Normal Language**

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### A New Test of Integrated Language & Literacy Skills (TILLS)

**LEARNING OBJECTIVES**
- Diagnose disorder (dyslexia; spoken/written)
- Differentiate profiles of strengths and needs
- Guide decisions about what to do next

**DEVELOPMENTAL PROFILE**
- **LEARNING PROFILE**
- **PHENOTYPE PROFILE**

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*References*
TILLS Language Levels x Modalities Model

<table>
<thead>
<tr>
<th>Modality</th>
<th>Sound/Word Level</th>
<th>Sentence/Discourse Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening</td>
<td>1. Vocabulary awareness</td>
<td>6. Listening comprehension</td>
</tr>
<tr>
<td></td>
<td>2. Phonemic awareness</td>
<td>8. Following directions</td>
</tr>
<tr>
<td>Speaking</td>
<td>4. Nonword repetition</td>
<td>7. Reading comprehension</td>
</tr>
<tr>
<td></td>
<td>10. Nonword reading</td>
<td>11. Reading fluency</td>
</tr>
<tr>
<td>Reading</td>
<td>5. Nonword spelling</td>
<td>12a. Written exp word score</td>
</tr>
<tr>
<td></td>
<td>13a. Written exp sentence combining score</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>14. Digits forward</td>
<td>15. Digits backward</td>
</tr>
<tr>
<td>Memory</td>
<td></td>
<td>9. Delayed story retelling</td>
</tr>
</tbody>
</table>


1. Vocabulary Awareness

- "Here are three words. Let's read them together."
- "dog–cat–bone"
- Say, "Tell me two words that go together."
- Then ask, "Why?"

2. Phonemic Awareness

- Say, "I am going to say a pretend word that is not a real word. Your job is to say the word back to me, but without the first sound. Let's practice."
- "If the word is bip, and we take away the first sound, bip becomes [hesitate]... ip."
- "If the word is stig, and we take away the first sound, stig becomes... tig."
  (coach as necessary)

3. Story Retelling

Select the age-appropriate story and say, "I'm going to read you a story. Listen carefully. Your job is to tell the story back to me just like I tell it to you. I can only read it once. Any questions?" (Read the age-appropriate story, starting with its title, with a natural rate and tone.)

4. Nonword Repetition

Say, "I am going to play a voice recording for you. The person on the recording will say a pretend word that is not a real word. You will only hear the word once. Listen carefully so you can say the word just like the person you hear." Start the CD.

5. Nonword Spelling

Say, "I am going to play a voice recording for you. The person on the recording will say a pretend word that is not a real word. You will only hear the word once. Listen carefully so you can say the word just like the person you hear." Start the CD.
6. Listening Comprehension

Say, “I’m going to read some very short stories. Your job is to listen and pay careful attention. Then I’ll ask you some questions about the story. Tell me ‘yes’ if you are sure the answer is ‘yes.’ Tell me ‘no’ if you are sure the answer is ‘no.’ If the story doesn’t clearly tell you the answer, tell me ‘maybe.’

7. Reading Comprehension

Say, “Now, it’s your turn to read some short stories and answer the questions in your Student Book. Circle yes if you are sure the answer is ‘yes.’ Circle no if you are sure the answer is ‘no.’ If the story doesn’t clearly tell you the answer, circle maybe. You may choose to hold the blank card under each line as you read it. You can read silently or out loud, whichever is easier for you.”

8. Following Directions

Cover up the first practice item in the Student Book with the card stock. Say, “I’m going to give you some directions to follow with your pencil in your Student Book. Listen carefully because I can only say them once. When I say ‘Go,’ move the card and use your pencil to follow the directions.”

9. Delayed Story Retelling

Turn to the age-appropriate story and say, “Remember the story [Tommy the Trickster/The Rubber Raft]? Tell me the story again. Try to remember as much as you can. Start now.”

10. Nonword Reading

Say, “Here are some words for you to read out loud.” [Indicate practice words on page # of Stimulus Book.] These are pretend words that are not real words, but they are like real words. Your job is to read these words out loud. My job is to write what you say, so wait until I say ‘Next’ before you read the next word.”

11. Reading Fluency

Say, “Here are some facts that tell a story. First, read the title out loud.” If the student cannot read the title, discontinue the subtest. If the student can read the title, even nonfluently, say “Now read the facts.”
12. Written Expression

- Say, “Here’s another story. It has facts about a little dog. [Read the facts of the Little Dog story from the stimulus book.] It’s okay, but it sounds choppy. Here is an example of how you could put the facts together to make it sound less choppy and more interesting. [Read the rewritten story on p. 7 of the Student Book out loud to the student.] Now it’s your turn to put the facts for your story together in a way that sounds better.”

Discourse Score: % content units included                         A: 16/20 = 80%      B: 12/20 = 60%
Sentence Combining Score (SCS): Content Units/T-units    A: 16/11 = 1.45   B: 12/11 = 1.09
Word Score: % words correct A: 69/70 = 99%      B: 41/49 = 84%

Based on work with Cheryl Scott, Sally Andersen, Michelle Maagalski

13. Social Communication

Say, “This activity is about acting a scene, like from a show on TV or a movie. Your job is to be an actor.” (Ask if the student ever watches movies, plays, or television shows and knows what an actor is.) Say, “I’ll give you a really short scene. Then I’ll ask you to tell me what one of the people would say. This is important—you should say it how the person would say it in the scene. Remember, you’re the actor! Let’s try one. I’ll do the first one to show you.”

14. Digit Span Forward
15. Digit Span Backward

14. Say, “I am going to say some numbers. Listen to the numbers, and when I finish, you say them back to me exactly the same way.”
15. “This time, when I read the numbers to you, I want you to listen carefully and say them back to me in backward order.”

Test of Integrated Language and Literacy Skills™—Student Rating Scale (TILLS™-SRS)

Preliminary Analyses

- Pilot and standardization studies
- Exploratory Factor Analysis (EFA)
- Sensitivity-Specificity with Receiver Operator Curve (ROC) Analysis
- Group comparisons by subtest
- Individual case profiles
**Preliminary Results**

**Standardization Studies**
- Normative Study
- Discrimination Study
- Special Populations Study
- Tryout 1. (n = 50) Trim subtests that don’t work
  - Tests added to increase construct & content validity
- Tryout 2. (n = 150) Tryout scoring; remove items
- Tryout 3. (n = 34, LD & TD high school)
- Tryout 4. (n = 513, national sample)
  - LLD based on < 85 CELF-4 CLS as “gold standard” for sensitivity / specificity
- Tryout 5. (n = 249 Michigan)
  - FILA Study “Formal & Informal Language Assessment”
- Beta Trial (n = 118, national sample; TL & LLD)
  - Large scale pilot
  - Expert consultation and pilot of Social Communication (Acting a Scene)

**Current Demographics (Jan 2014)**

<table>
<thead>
<tr>
<th></th>
<th>NL</th>
<th>LLD-SW</th>
<th>LLD-W</th>
<th>LLR</th>
<th>D/HH</th>
<th>ASD</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>899</td>
<td>115</td>
<td>86</td>
<td>165</td>
<td>24</td>
<td>23</td>
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<tr>
<td>Age Months</td>
<td>14 (5)</td>
<td>126</td>
<td>137</td>
<td>122</td>
<td>136</td>
<td>133</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>52.3%</td>
<td>38.5%</td>
<td>48.3%</td>
<td>52.2%</td>
<td>44%</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

- White: 76.9%
- Black: 9.2%
- Hispanic: 8.4%
- Asian: 4.2%
- Other: 1.5%

Supported by a grant from the U.S. Dept of Ed, Institute for Education Sciences (IES); does not imply endorsement.

**Seven Groups Based on Existing Classification**
- NL (normal language)
- LLD (language learning disabilities)
- LLR (language literacy risks)
- D/HH (Deaf, Hard-of-Hearing)
- ASD (Autism Spectrum Disorder)

**Pilot Studies and Beta Trial**
- Tryout 1. (n = 50) Trim subtests that don’t work
- Tryout 2. (n = 150) Tryout scoring; remove items
- Tryout 3. (n = 34, LD & TD high school)
  - Expert consultation and pilot of Social Communication (Acting a Scene)
- Tryout 4. (n = 513, national sample)
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  - FILA Study “Formal & Informal Language Assessment”
- Beta Trial (n = 118, national sample; TL & LLD)
  - Large scale pilot
  - Expert consultation and pilot of Social Communication (Acting a Scene)

**Sample by State**

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Preliminary Findings for Total Sample (Summer 2013)  
N = 813

**Maximum Likelihood Exploratory Factor Analysis (EFA)**

- **Factor Reference Structure** (semipartial correlations) 
  - 0.30 < loadings < 0.40 are shown in a lighter color

- **Comparison of group means across subtests – Interpret with caution**
  - Analyzed with z-scores (based on NL group at 1-yr age span) across all ages (6-18 yrs)
  - Caution: Different subtests may define profiles for different ages for the final TILLS
  - Caution: One-way ANOVA on individual subtests does not account for shared variance among subtests

- **Group Comparisons using TILLS Subtest z-score**
  - Means – LLD groups based on school classification
  - *p-values when 2 LLD groups differ significantly*

- **Group Comparisons using TILLS Subtest z-score**
  - Means – LLD groups with ASD group added
Using z-scores based on age in one-year intervals.

For 5 age bands:

**Sensitivity and Specificity**

### Total TILLS Score and Two Composites

**Sound/Word Composite**
- Phonemic Awareness
- Nonword Repetition
- Nonword Spelling
- Nonword Reading
- Reading Fluency
- Written % Wds Correct

**Sentence/Discourse Composite**
- Story Retelling
- Story Comp Qs
- Delayed Story Retelling
- Listening Comprehension
- Reading Comprehension
- Social Communication
- Written % Content Included
- Written Sent Combining Score

### Sensitivity/Specificity for Interim Sample Totals: NL and LLD

- High listening comp & sentence formulation
- Low reading, writing
- High sound/word skills and surface reading
- Low comprehension in depth of knowledge and reasoning

### Implications of Individual Student Profiles for Planning Intervention

- Designing curriculum-based language intervention to address students' needs using their strengths
Pattern observed?

**Sentence/Discourse Ability**
- Good listening comp. & sentence formulation?
- Low reading decoding & fluency & spelling?
- High in both?
- Low in both?

**Sound/Word Ability**
- High sound/word skills and surface reading?
- Low comprehension in listening and reading?
- High in both?
- Low in both?

### 7;10 Girl (2nd Grade)

**Strengths/Needs**

**Strengths**
- Story retell
- Attention and memory
- Nonword repetition
- Listening comprehension
- Social Communication

**Weaknesses**
- Phonemic awareness
- Nonword reading
- Nonword spelling
- Reading fluency
- Reading comprehension
- Written expression

**Needs**
- Word structure study (Spell-links)
  - Phonemic awareness
  - Morphemic awareness
- Reading fluency and comprehension in curricular contexts
- Written expression – writing lab approach
- SLP role – depends on team

**School Classification:** LLD-Written Only

**Differential diagnosis**
Knowing what to do next
Sample reporting template

**Case Examples – A preview**
Word Families
- Orthographic patterns
- Word families
- Analogical strategies

Pattern observed?
- Sentence/Discourse Ability
- Good listening, speech, and sentence formulation?
- Low reading, decoding, and fluency?
- High in both?
- Low in both?
- Sound/Word Ability
- High sound/word skills and surface reading?
- Low comprehension in listening and reading?
- School/Classification: LLD-Spoken & Written

Personal minilesson
- Inflectional morphemes
- Orthographic/morphological patterns

14;3 Male (8th Grade)

14;3 Boy
Grade 8
Strengths/Needs

Strengths
- Reading fluency
- Story retell (relative)

Weaknesses
- Social communication
- Vocabulary awareness
- Listening comprehension
- Reading comprehension
- Written expression
- Sentence combining/
- % words correct
- Nonword spelling

Needs – prioritize based on interviews
- Word meaning + structure
  - Study vocabulary within curricular contexts
  - Phonemic awareness
  - Morphemic awareness – derivational
  - Spelling within writing assignments
- Reading comprehension
  - Narrative text
  - Planning and writing stories
  - Exploring social relationships
- Expository text – syntactic paraphrasing
- Written expression – homework

SLP role – yes!
Flight 101
It started off in space. I’m Tom and here is my band of misfits. We’re to protect the colony of Z-6. The colony is pretty peaceful. Sometimes we help other colonies with their troubles. We fly a Mustang xl 117. Sometimes we engaged the enemy in battle at the very ends of the universe. One morning my squad found some pirates firing on a smaller colony. We fired on them. Before they left we got five of them, but this time they fired back, so we attacked them. They lost 11 of the 12 ships; we lost 2 of the 10. We let one of them get away to tell the pirates. That day the colony of Z-6 was sad for the men that died that morning. The colony replaced the men and ship with new recruits and with the new Mustang xl 117. The next day we cleaned our Mustang xl 117s until they shined, loaded them up with fuel and ammo. The pirates attacked the colony so we scrambled the Mustang xl 117. Our squad took the pirates apart. The pirates never messed with the colony of Z-6 or any other colonies again.

THE END

Pattern observed?

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
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<td>Story recall</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
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</table>

13;7 Boy
Grade 7
Strengths/Needs

- Needs – Comprehension/Formulation
- Narrative texts
  - Retelling plot elements in curricular texts
  - Planning and writing stories
  - Highlighting new words – discussing meaning
- Expository texts
  - Outlining key concepts - macrostructure
  - Taking notes
  - Syntactic paraphrasing
- SLP role – yes!

School Classification: LLD-Written Only

Flight 101
It started off in space. I’m Tom and here is my band of misfits. We’re to protect the colony of Z-6. The colony is pretty peaceful. Sometimes we help other colonies with their troubles. We fly a Mustang xl 117. Sometimes we engaged the enemy in battle at the very ends of the universe. One morning my squad found some pirates firing on a smaller colony. We fired on them. Before they left we got five of them, but this time they fired back, so we attacked them. They lost 11 of the 12 ships; we lost 2 of the 10. We let one of them get away to tell the pirates. That day the colony of Z-6 was sad for the men that died that morning. The colony replaced the men and ship with new recruits and with the new Mustang xl 117. The next day we cleaned our Mustang xl 117s until they shined, loaded them up with fuel and ammo. The pirates attacked the colony so we scrambled the Mustang xl 117. Our squad took the pirates apart. The pirates never messed with the colony of Z-6 or any other colonies again.

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- Expository texts
  - Outlining key concepts - macrostructure
  - Taking notes
  - Syntactic paraphrasing
- SLP role – yes!

School Classification: LLD-Written Only
Insufficient evidence to conclude subtypes, except perhaps dyslexia--

- Reading decoding/fluency
- Written transc/Spelling
- Sound/word abilities
- Reading comprehension
- Written composition
- Sentence/discourse abilities
- Listening comprehension
- Spoken expression
- Mathematical problems

The simple model is not so simple
- Individual differences > diagnostic subgroups
- "A problem with all such taxonomies is that they leave some children unclassified and find few pure subtypes" (Bishop & Snowling, 2004, p. 862).

There is some cautious support for using individual profiles based on the Language Levels X Modalities model for differential diagnosis of:
- Dyslexia
- Spoken-Written Language Impairment (LLD)
- Specific Comprehension Deficit (LLD)

These children are probably under-identified.
Should school classification systems be set up to detect these differences?

Not certain, given the:

- Evidence that classification changes over time for individual children
- Blurriness in category boundaries
- Be careful in dismissing young school-age children with SLI if you haven’t done comprehensive assessment
- Clinicians need to consider more than two statistically derived factors to understand a student’s strengths and needs.

Thank you!

Questions? Comments?