What SLPs need to know about LITERACY and Phonological Disorders

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Disclosures
• Financial: OSSPEAC has compensated me for today’s presentation. I am a faculty member at Emerson College and receive a salary for that job.

• Nonfinancial: I am the director of the Children’s Literacy and Speech Sound (CLaSS) Lab, faculty at Emerson College, and the President of the Massachusetts Speech, Language, and Hearing Association

Learning Objectives
• Identify the role of phonological representations
• Discuss the risk factors and outcomes for children with persistent or remediated speech sound disorders as well as those with dyslexia
• Discuss the SLPs role in facilitating literacy skills for children with speech sound disorder and those with dyslexia
Children’s Literacy and Speech Sound (CLaSS) lab

• www.classlab.emerson.edu
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Observation from a school-based SLP:
Subgroups of SSD???

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<th>Remediates</th>
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<td>Motor Deficit?</td>
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<tr>
<td>Linguistic Deficit?</td>
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<tr>
<td>True phonological deficit</td>
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</table>

What is reading?
The Simple View of Reading
(Catts, Hogan, & Fey, 2003; Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)

Reading Comprehension

Word Recognition

Listening Comprehension

The many strands that are woven into skilled reading

Language Comprehension

Semantics & Grammar

Text Processing (text structure, cohesion)

Background Knowledge

Visual Processing

Metacognition

Word Recognition

Phonological Awareness

Decoding Strategies (whole word, phoneme, etc.)

How does this apply to phonological impairments?

Who are they?

- Speech sound disorders
  - Articulation
  - Phonology
- Dyslexia
  - Word reading
  - Phonemic decoding

Speech sound disorders are characterized by a delay in the acquisition of appropriate speech sounds (Lewis, Freebairn, Hansen, Steinh, Stein, Taylor, & Iyengar, 2006).

Speech sound disorders can impact academic, linguistic, vocational, and socio-emotional skills in children and adolescents (Hwang & Molthaler-Bays, 2015; Lewis, Freebairn, Hansen, Iyengar, & Taylor, 2006).

Even once the speech sound disorder has been remediated through speech therapy services (Anthony, et al., 2007; Farquharson, 2015; Overby, Trainin, Smit, Bernthal, & Nelson, 2012; Retano et al., 2010).

Speech Sound Disorder

- More than half of children with SSD experience difficulties with reading (Shriberg & Kwiatkowski, 1988). Deficits in the phonological system often result in difficulty acquiring phonological awareness (PA) skills, a necessary pre-requisite for reading success (Larrivee & Catts, 1999).
Prevalence of SSD

11-13% of children ages 5-7 years have a speech sound disorder (Shriberg, Tomblin, & McSweeney, 1999)

Approximately 10% of children ages 9-11 have a persistent speech sound disorder (Shriberg, 2002; Shriberg, Tomblin, & McSweeney, 1999; Wren, Roulstone, & Miller, 2011)

1.4% of college freshmen have persisting speech sound errors (Culton, 1986)

18% of 8-year-olds in the UK have unresolved speech sound errors (Roulstone, Miller, Wren, & Peters, 2009)

Risk of Reading Difficulties

Typically developing Speech Sound Disorders only SSD + Language impairment

Dyslexia is...

• A language-based problem
• A phonological processing disorder
• Neurobiological in origin
• Present from birth
• Usually experienced for life
Dyslexia is...

• A spectrum disorder than can range from annoyance to severe limitation
• More common than any other kind of learning disability
• Responsive to expert, informed instruction (Moats, 2008)

Dyslexia is...

• Characterized by weaknesses in word reading, phonemic decoding, and spelling
• Surprising, because this weakness exists in the presence of normal intelligence
• Present in adults who have compensated but are poor spellers, are slow readers, and have difficulty with novel and complex phonological forms

Dyslexia is NOT...

• Characterized or diagnosed by seeing letters backwards
• Indicative of “gifted” status
• A disorder that cannot be diagnosed until 3rd grade
• A visual problem
• Responsive to colored lenses and/or eye tracking exercises
Phonological processing deficit

- This phonological processing deficit seen across a variety of languages
  - French (Sprenger-Charolles et al., 2000)
  - Greek (Porpodas, 1999)
  - German (Wimmer et al., 1999)

- Manifestation is also different across languages
  - English: word reading
  - Dutch: word reading fluency
  - German: spelling

Oral language deficits

- Phonological processing problems associated with dyslexia can impact other language skills
- Many studies show that subtle oral language deficits are present in children at risk for dyslexia before formal schooling (e.g., Lyytinen et al., 2001; Scarborough, 1990, 1991)

Secondary Consequences (research committee of the IDA, Lyon et al., 2003)

- Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge
Dyslexia Summary

- Classic case is uncommon
- Impairment in phonological processing (not necessarily production)
  - Across the lifespan
- Compensated adults
  - Poor spellers
  - Poor at reading quickly
  - Still have subtle phonological processing deficits

What is phonological awareness?

PHONOLOGICAL AWARENESS
(syllables, phonemes, etc.)

DECODING (alphabetic principle, spelling-sound correspondences)

SIGHT RECOGNITION (of familiar words)


THE MANY STRANDS THAT ARE WOVEN INTO SKILLED READING

LANGUAGE COMPREHENSION
- SEMANTICS & GRAMMAR
- VOCABULARY
- TEXT PROCESSING
- PREDICTING (virtual meanings, inferences)

BACKGROUND KNOWLEDGE
- FACTS, CONCEPTS

VERBAL REASONING
- PROBLEM SOLVING
- INFERENCE

TEXT PROCESSING
- TEXT STRUCTURES
- HYPOTHESIS

METACOGNITION
- COMPREHENSION STRATEGIES

SKILLED READING: Fluent production and coordination of word recognition and text comprehension.
Phonological awareness

• One’s sensitivity to the sound structure of a word
• Measured by rhyming, blending, and deletion tasks
• Research supports causal link between phonological awareness and early reading
  • Good phonological awareness - good readers
  • Poor phonological awareness - poor readers
• The component of reading in which SLPs are most likely to be involved

Phonological Awareness Continuum

- Rhyming
- Sentence Segmentation
- Syllable Segmentation & Blending
- Identification of initial or final phonemes
- Manipulation of individual phonemes

Phonological Awareness

• “Eyes shut”
PA & SSD – Relations over time

Preschool:
- Preschoolers with SSDs are at increased risk for deficits with phonological awareness (Anthony et al., 2011; Bird, Bishop, & Freeman, 1995; Foy & Rutter, 2001; Lewis & Fischman, 1982; Peterson, Pennington, Shriberg, & Boada, 2009; Raitano, Pennington, Tunick, Boada, & Shriberg, 2004; Roulstone, Overby, Trainin, Smit, Bernthal, & Nelson, 2012; Rvachew, Ohberg, Grawburg, & Heyding, 2003).
- Atypical speech sound errors and distortions in preschool are predictive of weak PA skills (Preston & Edwards, 2010).
- This is true even when language is normal (Bird et al., 1995; Overby, Trainin, Smit, Bernthal, & Nelson, 2012; Raitano et al., 2004; Rvachew et al., 2003).
- The proportion of speech sounds in error at age 5 is related to the likelihood of persistant errors at age 8 (Roulstone et al., 2009).

School-aged:
- Children with persistent speech sound disorders (2–5th grade) have markedly weaker PA skills compared to same-age peers (Farquharson, 2012).
- Children with “residual” SSD, ages 8.5–10, exhibit cortical and subcortical differences during phonological processing tasks (Preston, Felsenfeld, Frost, Mencl, Fulbright, Grigorenko, Landi, Seki, & Pugh, 2012).
- Atypical speech sound errors in preschool are predictive of school-age PA abilities; if more than 10% of the child’s speech has atypical errors, the child is likely to have deficits in PA, reading, and spelling (Preston & Edwards, 2012).

Adolescents:
- 10–14 year old children with “residual” speech sound errors (no comorbid diagnoses) have weaker phonological processing skills compared to same-aged peers (Preston & Edwards, 2017).
- Phonological processing (word reading and phonological working memory) skills have been shown to be weak even once the speech sound disorder is remediated (Farquharson, 2015; Raitano, Tunick, Pennington, Boada, & Shriberg, 2004).
How do we use this information?

- Early identification
- Early intervention
- Reduced Risk of Reading disorders

Early Intervention

- Critical because children who start out as poor readers generally continue to be poor readers
- Poor reading achievement quickly leads to a host of negative consequences

Downward Spiral of RD

- Low Motivation
- Negative Expectations
- Limited Practice
- Academic Failure
Early Indicators

Problems in oral language and speech sound development are primary signs of risk for reading disorders.

- Nathan, Stackhouse, Goulandris, & Snowling (2004); Pennington (2005); Rattano, Pennington, Tunick, Reusal, and Strieberg (2004)

Early signs of risk for Dyslexia

- Family history of reading or language impairment
- Difficulty learning the letter names and sounds
- Consistent use of unusual or nondevelopmental errors
- Multisyllabic words especially difficult


Not early signs of dyslexia

- Reversing letters when writing
  - This is typical until 2nd grade
- Common errors on long words
  - *animal*: *animal*
  - *parking*: *spaghetti*
New frontiers in early identification of dyslexia

- Speech discrimination at 3-5 days old
  - Guttorm et al., 2005

- Babbling complexity in infants
  - Farquharson, Hogan, Hoffman, Green, Wang, & Green, (under review); Lambrecht-Smith et al., 2008

Dyslexia resources in Ohio

- International Dyslexia Association (IDA)
  - http://ida.org/
  - http://oh.ida.org/ (Central OH branch)
  - http://noh.ida.org/ (Northern OH branch)
  - http://ohv.ida.org/ (Ohio Valley branch)

- Decoding Dyslexia
  - http://decodingdyslexiaoh.org/
  - https://www.facebook.com/DecodingDyslexiaOH/
  - #saydyslexia

PA & phonological representations

- Testing phonological awareness is a robust measure of underlying phonological representations
Phonological Representations

- How phonological information – like speech sounds – is stored in long term memory

Phonological Reps + SSD

- Underdeveloped in children with SSD (Catts & Larivee, 1999)
- May be difficult to access for children with SSD because working memory resources are limited
- May be the reason why some children with speech sound disorders experience difficulties with literacy and some do not.

How could this affect reading?

- Learning decoding skills
  - Letter sound correspondence
- Learning sight words
What is a sight word?

• The sight of the word immediately activates its pronunciation and meaning in memory
• To build sight words in memory, orthographic mapping, is required
• What is needed for orthographic mapping?

(Ehri, 2014)

Orthographic Representations

• The storage of orthographic information in long term memory (Apel, 2011).
• Provides information regarding how to represent spoken language in written form.

Orthographic Mappings

• Mappings from phonology to orthography occur early on in reading development.
• Parallel connections between orthography and phonology
  • Phonological awareness appears to provide extra support.
    (Nilsen & Bourassa, 2008)
SSD and mapping

- Children with SSD often struggle to make the translation between phonology and orthography (Sutherland & Gillon, 2005).
- Long-term difficulties even after the sound is remediated (Farquharson, 2015; Felsenfeld et al.)
- How will we know if there are strong phonological representations?

SSD and Literacy

- Children with SSD were found to have poorer performance on the following tasks:
  - Phonological processing
  - Phonological learning
  - Phonological awareness
  - Word recognition
  - Letter knowledge**

* (Carroll & Snowling, 2004)

Does Working Memory play a role?
Deficits in phonological representations (Raitano, Pennington, Tunick, Boada, & Shriberg, 2004)

Deficits in acquiring phonological awareness (Catts & Lissner, 1999)

Deficits in literacy skills (Hatton, Pennington, Tunick, Boada, & Shriberg, 2004)

Baddeley Working Memory Model

Central Executive

• Allocates attentional resources to the appropriate subsystems (i.e., phonological loop or visual-spatial sketchpad)

• (Baddeley, 1992; Reisberg, 2003)
Visual Spatial Sketchpad

• Stores visually presented information, such as pictures or words

Phonological Loop

• Stores auditorily presented information, such as speech sounds

“...most involved in language processing and development”
(Sh gode, 2006, p. 146)

Has a positive relationship with speech and language acquisition
(Adams & Gathercole, 2000)

Phonological Loop and SSD

• 12-year old with remediated SSD had poor WM
  • Speidel (1993)
  • Preschoolers with low WM had more speech errors than preschoolers with high WM
  • Nonword repetition
  • Adams and Gathercole (2005)
  • Preschoolers with SSD had poor WM
  • Nonword repetition
  • Munson, Edwards, & Beckman (2005)
Research Question

Are there differences in the working memory skills of school-aged children with persistent SSD and typically developing children?

Method

Participants

Persistent Speech Sound Disorder
- n = 20 (13 males)
- M age = 112.3 months
- M grade = 3.3
- GFTA M Standard Score = 80.5
- CTOPP M Standard Score = -91.6

Typically Developing
- n = 20 (10 males)
- M age = 113.3 months
- M grade = 3.3
- GFTA M Standard Score = 104.45
- CTOPP M Standard Score = 105.25
All Participants: Inclusionary Criteria

- Monolingual
- Normal hearing
- Normal vision (corrected)
- Normal non-verbal intelligence
  - Reynolds Intellectual Assessment Scales (RIAS)

Experimental Tasks

Phonological Loop Tasks

- Sentence span task
- Nonword repetition task
- Henry Task
Results & Discussion

Results

Research Question

Are there differences in the working memory skills of school-aged children with persistent SSD and typically developing children?

Stop Signal - Stop and Go Accuracy

\[ p < .05 \]
Tasks used for Analysis

- Phonological Loop:
- NWR
- Henry Task
- Sentence Span

Nonword Repetition

Mean Scores on NWR task

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<tr>
<th>TD</th>
<th>PSD</th>
<th>p-value</th>
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Henry Task

Mean Scores on Henry Task

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<table>
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Conclusions

Children with P-SSD appear to have deficits specific to the phonological loop of working memory.

Specifically, children with P-SSD struggle with complex word structures (e.g., multisyllabic words, longer lists of words).

Indicates limited phonological representations as well as limited working memory.

Results Summary

- Children with persistent SSD performed poorer than peers on phonological working memory tasks. BUT
- This relation was mediated by their nonverbal IQ scores (not vocabulary).
- It is not common place to test nonverbal IQ in children with SSD, but it may have predictive value for working memory and literacy skills.
Assessment Implications

- Test phonological awareness in all SSD evaluations
- Possibly add a nonword repetition test (see the Comprehensive Test of Phonological Processing-2nd Edition [CTOPP-2] for a possibility)

Assessment Implications

- Obtain material from classroom teacher that gives information on decoding, phonological awareness, or spelling skills
- Screen early and often; and don’t screen “just” for speech sound production
- Obtain NVIQ if possible

Treatment Implications

- Include phonological awareness
- Try minimal pairs
- Include reference to orthography
Treatment Implications

• Partner with reading specialists and special educators
• Push in to the classroom
• Use curriculum based vocabulary

Clinical Implications

• Children with SSD will likely have poor phonological representations
• SLPs are on the front lines of defense for these children
• Early SSD and language impairments put children at risk for later literacy deficits... EVEN IF the issue has remediated
• Be mindful of the warning signs and open to collaboration or consultation

What about after dismissal?

• http://sig16perspectives.pubmedcentral.gov/Article.aspx?articleid=2240012
Raitano, Pennington, Tunick, Boada, & Shriberg, (2004)

• 3- and 6-year-old children with speech delay (with and without comorbid language impairment), normalized speech, and no history of a speech sound disorder.
• Normalized speech = previous diagnosis of speech sound disorder
  • Poorer phonological awareness compared to typically developing peers.
  • Expressive was resolved, but receptive deficits remained

Felsenfeld, Broen, and McGue (1994)

• Follow up of adults with a history of childhood phonological disorders.
  • Individuals who had struggled with speech production as children continued to struggle with receptive vocabulary and cognitive skills, as measured by formal intelligence testing.
  • Struggled academically throughout high school.
  • Needed at least some sort of remedial help through 12th grade.
  • Did not obtain skilled post-secondary education when compared to adults without a history of SSD.

Farquharson (2015)

• 10 children in fourth- through seventh-grade
  • 5 Remediated SSD (4 males)
  • 5 Typically developing (2 males)
  • Ages: 9:4-13:5
Farquharson (2015)

Table 1. Descriptive Statistics for both Groups across All Measures

<table>
<thead>
<tr>
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<th>R–SSD Group</th>
<th>TD Group</th>
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<tr>
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Language Measures

Literacy Measures
Nonword Repetition

Group Comparison on Cognitive Measures - Nonword Repetition

Thank you!

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