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Connections between Speech Sound Production and Literacy Skills

Kelly Farquharson, PhD, CCC-SLP

Moderated by:
Amy Hansen, MA, CCC-SLP, Managing Editor, SpeechPathology.com

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- Must be logged in for full time requirement
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  - Within **7 days** for live webinar; within **30 days** of registration for recorded/text/podcast formats
- Two opportunities to pass the exam

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Connections Between Speech Sound Production and Literacy Skills

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Disclosures

- Financial: SpeechPathology.com has compensated me for today's presentation. I am a faculty member at Florida State University and receive a salary for that job.
- Nonfinancial: No nonfinancial disclosures

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- Kelly.Farquharson@cci.fsu.edu
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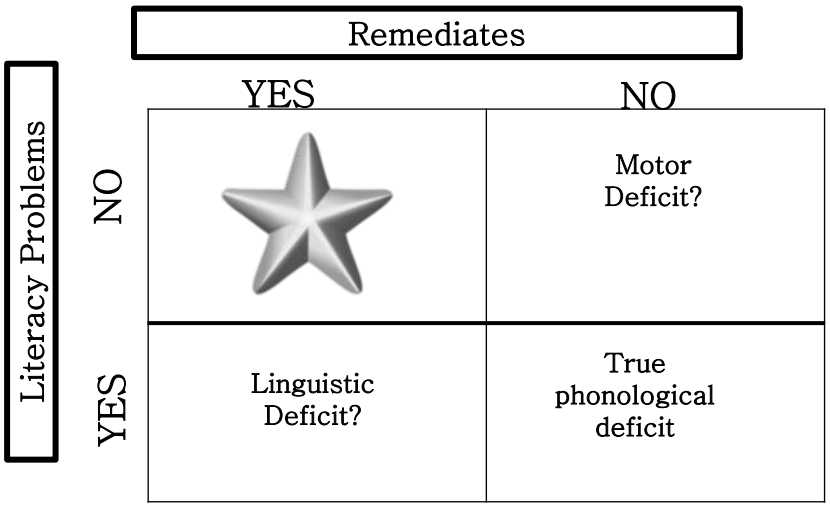
- Facebook: www.facebook.com/literacyspeech
- Twitter: @literacyspeech
- Instagram: @classlab_FSU

Learning Outcomes

After this course, participants will be able to:

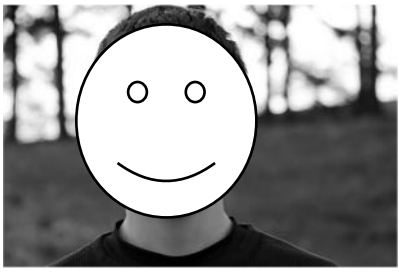
- Describe the phonological relations between speech sound production, decoding, and spelling
- Explain the SLP's role in literacy
- Discuss the importance of early identification and intervention for speech sound disorders

Observation from a school-based SLP: Subgroups of SSD????



What is Reading?

Who is reading?



The Simple View of Reading

(Catts, Hogan, & Fey, 2003; Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)

Reading

The Simple View of Reading

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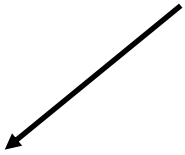
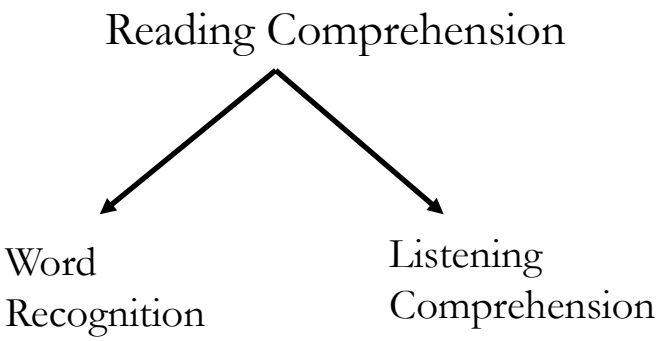
Reading

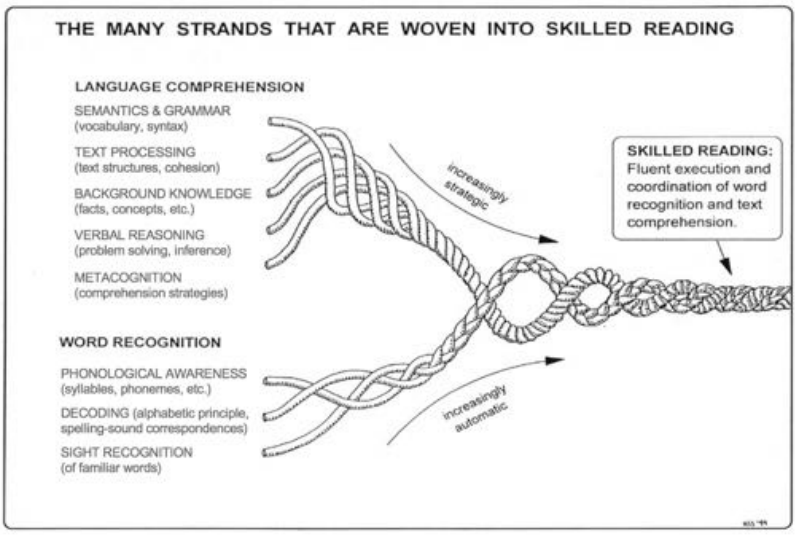


Word
Recognition

The Simple View of Reading

(Catts, Hogan, & Fey, 2003; Catts, Hogan, & Adlof, 2005; Gough & Tunmer, 1986; Hoover & Gough, 1990)





See Scarborough, H. S. in Neuman, S.B. & Dickinson, D. K. (2001). *Handbook of Early Literacy Research*. New York: Guilford Press.

How Does this Apply to Speech Sound Production?

- Speech sound disorders (Pennington, 2006)
  - Articulation
  - Phonology
- Dyslexia
  - Word reading
  - Phonemic decoding

Speech Sound Disorders

"SSD was formerly called *articulation* disorder (which emphasized putative problems in the motor programming of speech) and *phonological* disorder (which emphasized putative problems in the cognitive representations of speech). Since each of these terms made a premature commitment to the underlying processing deficit that causes the speech production problem, the neutral and descriptive term SSD is now preferred."

- Pennington (2006)

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

Children with speech sound disorders are the primary population treated by school-based speech-language pathologists
(ASHA, 2014, 2013, 2012; NIDCD, 1994).

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; Raitano et al., 2010).

50-70% of children with speech sound disorders require some level of special education services through the 12th grade (Felsenfeld, Broen, & McGue, 1994; Shriberg & Kwiatkowski, 1988).

Speech Sound Disorder

- More than half of children with SSD experience difficulties with reading (Bishop & Adams, 1990; Catts, Adlof, Hogan, & Weismer, 2004; Catts, 1986; Catts, 1991; Catts, Fey, Tomblin, & Zhang, 2002; McCardle, Scarborough, & Catts, 2001; Nathan, Stackhouse, Goulandris, & Snowling, 2004; Tomblin, Zhang, Buckwalter, & Catts, 2000).
- 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

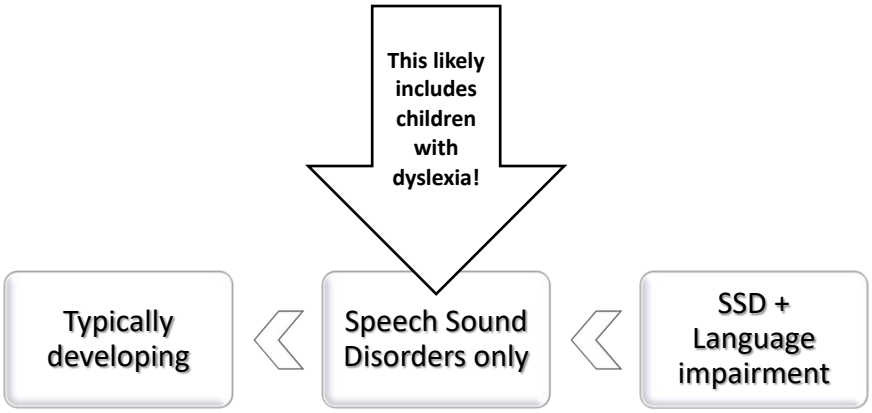
11-13% of children ages
5-7 yea
sound
McSweeney, 1999)

Approximately 10% of children
age
spe
Sound
acquis

18% of 8-year-olds in the UK
have ur
sound e
Peters, 2009)

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

Risk of Reading Difficulties



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)

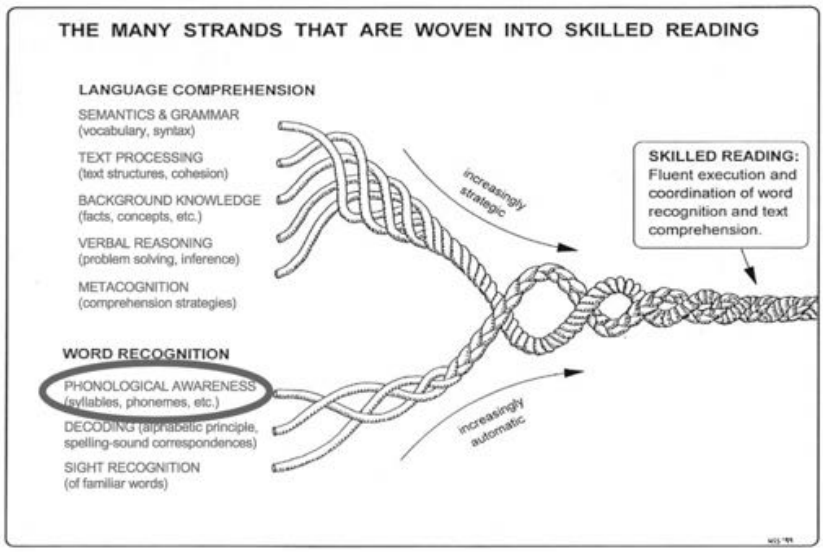
Dyslexia is...

- 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

What is Phonological Awareness?

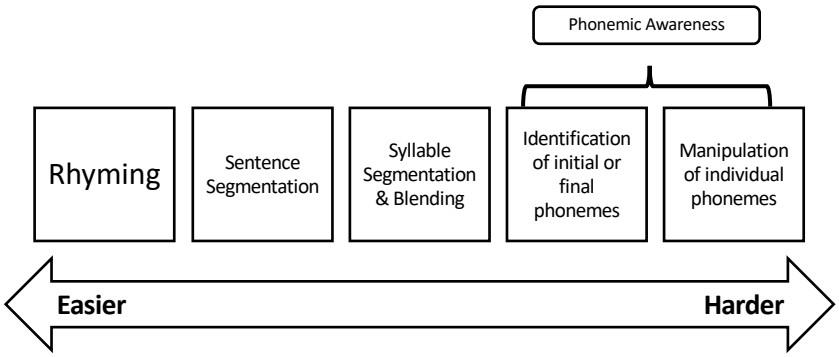


See Scarborough, H. S. in Neuman, S.B. & Dickinson, D. K. (2001). *Handbook of Early Literacy Research*. New York: Guilford Press.

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 (Hogan, Catts, & Little, 2005)
  - Good phonological awareness = good readers
  - Poor phonological awareness = poor readers

Phonological Awareness Continuum



Phonological Awareness

Test Your Segmentation Skills

Directions: Reverse the sequence of speech sounds and write the word.

1. teach: **cheat**
2. sigh: _____
3. cuts: _____
4. speak: _____
5. jab: _____
6. scene: _____
7. might: _____
8. tax: _____
9. caught: _____

Borrowed with permission from Barbara Hodson

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 & Mann, 2011; Lewis et al., 2011; Lewis & Freebairn, 1992; Peterson, Pennington, Shriberg, & Boada, 2009; Raitano, Pennington, Tunick, Boada, & Shriberg, 2004; 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 persistent errors at age 8 (Roulstone et al., 2009)

PA & SSD – Relations over time

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 & Hull, 2012)

PA & SSD – Relations over time

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, 2007)
- 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 Indicators

- Problems in oral language and speech sound development are primary signs of risk for reading disorder
- Nathan, Stackhouse, Goulandris, & Snowling (2004); Pennington (2005); Raitano, Pennington, Tunick, Boada, and Shriberg (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

(Catts, 1986; 1989; Dodd, et al., 1995; Magusson & Naucler, 1990, Larrivee & Catts, 1999; Leitao & Fletcher, 2004)

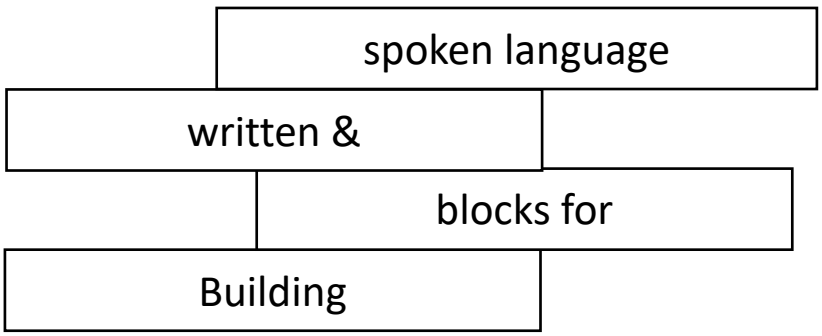
Not Early Signs of Dyslexia

- Reversing letters when writing
  - This is typical until ~2nd grade
- Common errors on long words
  - æmɪnəl/ ænɪməl
  - pəskɛri/ spəgɛri

PA & Phonological Representations

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

Phonological Representations



Phonological Representations

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

Weak Phonological Representations

Strong Phonological Representations

/b/

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

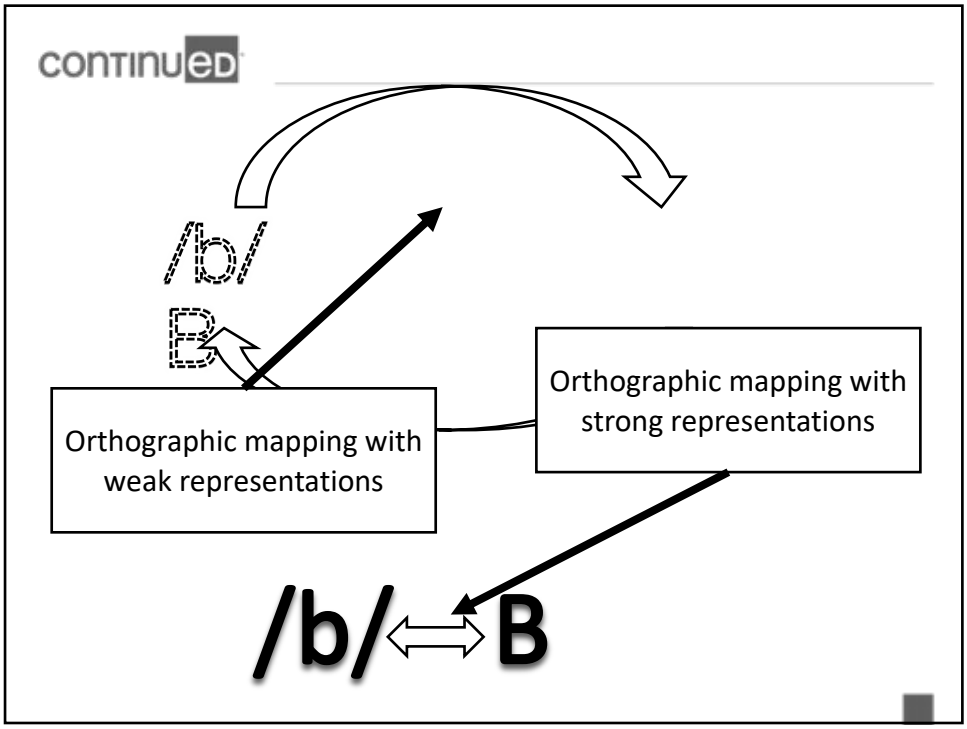
- The storage of orthographic information in long term memory (Apel, 2011)
- Provides information regarding how to represent spoken language in written form.

Weak Orthographic Representations

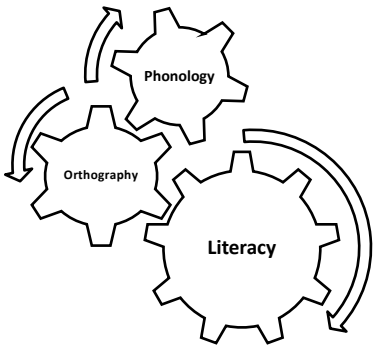
Strong Orthographic Representations

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)

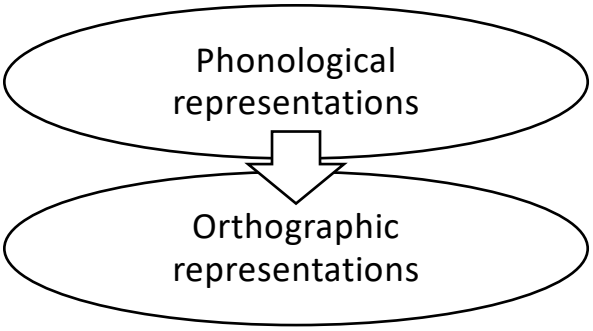


Self-teaching hypothesis

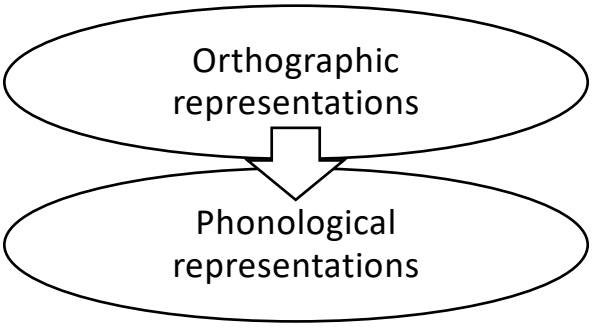


Share, 1995

PONY = BOLOGNA



COUGH=THROUGH= ROUGH = THOUGH



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?

Does Working Memory Play a Role?

Working Memory

Deficits in phonological representations

(Anthony et al., 2011; Storkel, Maekawa, Hoover, 2010)

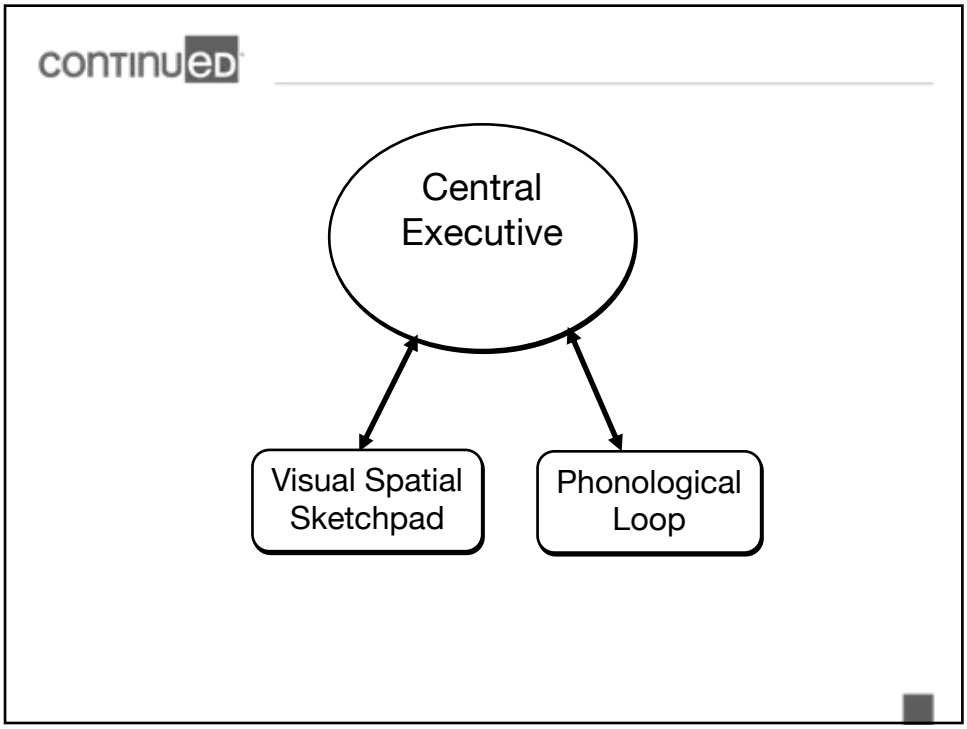
Deficits in acquiring phonological awareness

(Catts & Larivee, 1999)

Deficits in literacy skills

(Raitano, 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, 2010)

Visual Spatial Sketchpad

- Stores visually presented information, such as pictures or words

Phonological Loop

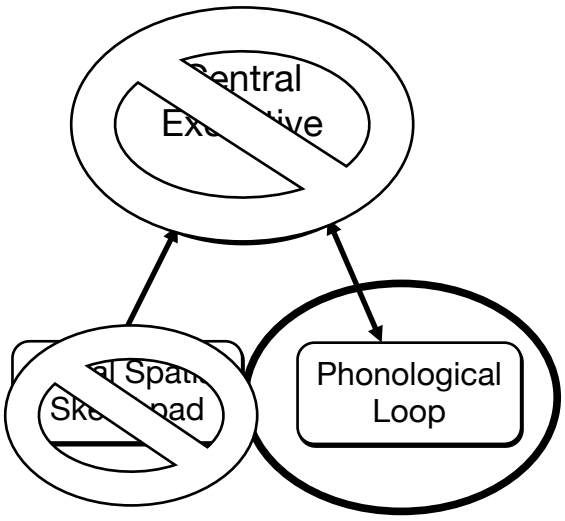
- Stores auditorily presented information, such as speech

"...most involved in language processing and development"
(Hartmann, 2008, p. 1216)

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

Farquharson, Hogan, & Bernthal (2017)

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



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

Assessment Implications

- Test phonological awareness in all SSD evaluations
- Possibly add a non-word 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

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

References

- Please see “Farquharson_references” for a complete list of references

Additional Resources

- Florida Center for Reading Research
- National Center on Intensive Intervention
- International Dyslexia Association
- Decoding Dyslexia (national and state-based chapters)
- Facebook group: Clinical Research for SLPs
  - Search #week9 for a discussion I lead
  - Search #week16 for a discussion on dyslexia lead by Dr. Tiffany Hogan

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Thank you!

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