Braille Oral Reading Fluency – The Role of Phonological Processing

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Outline

1. Overview of the larger study and goals
2. Overview of Reading Development/Reading Disability
3. Results
4. Discussion
5. Instructional Implications
Overview of Larger Study

- Data from 18 high-school students
  - Academically achieving: expect diploma by age 21
  - No additional disabilities
  - Used braille as primary literacy medium
  - Located in CA or BC
  - 9 female
  - Average age 15.6 years (min 13, max 21)
  - Average onset 1.6 years (15 congenital, 1, 2, 5)
## Overview of Larger Study

<table>
<thead>
<tr>
<th>Participants</th>
<th>Condition</th>
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<tr>
<td>5</td>
<td>Retinopathy of prematurity (ROP)</td>
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<td>3</td>
<td>Anophthalmia or microphthalmia</td>
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<td>Familial exudative vitreoretinopathy (FEVR)</td>
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</table>
Overview of Larger Study

• Tested on 26 measures
  • 11 math achievement (KeyMath braille)
  • 15 accessibility, exposure, and cognitive measures
  • Including: DIBELS ORF, Complete CTOPP
Overview of Larger Study

KeyMath Math Assessments
- Numeration
- Rational Numbers
- Geometry
- Addition
- Multiplication
- Mental Computation
- Measurement
- Time and Money
- Estimation
- Interpreting Data
- Problem Solving

Accessibility
- Nemeth Code
- Math Notation
- Tactile Graphics

Exposure
- Shape Familiarity
- Math-Related Language

Cognition
- Working Memory
- Fluid Reasoning
- Processing Speed
- Block Design
- General Intelligence
- Mental Rotation
Current Study

• Goals
  1. Is phonological processing (3 subcomponents) a good predictor of Oral Reading Fluency for contracted braille?
  2. If not, what are the important subskills necessary to becoming a fluent reader of contracted braille?
Reading Achievement

- Reading Comprehension
  - Oral Reading Fluency
  - Background Knowledge
    - Decoding Skills
    - Sight Word Vocabulary
    - Phonological Processing
Reading Disability

- “Unexpected difficulty in reading in children and adults who otherwise possess the intelligence, motivation, and schooling considered necessary for accurate and fluent reading” (Shaywitz, 1998 p. 307).

- Search for the core deficit(s)
  - Vocabulary
  - Auditory Processing
  - Working Memory
  - Phonological Processing
Phonological Processing

• Auditory processing skills that are relevant to the phonological nature of language

• Three main subdomains of phonological processing relevant to reading disability:
  • Phonological awareness
  • Phonological memory
  • Rapid automatic naming
Phonological Awareness

- The ability to attend explicitly to the phonological structure of spoken words, rather than just to their meanings and syntactic roles.” (National Research Council, 1999 p. 111).
Phonological Awareness

- Greaney and Reason (1999)
  - Children. Better than expected on PA, worse than expected on ORF, Reading Comp

- Simon and Asensio (1997)
  - Adults. Poor PA and poor ORF/Comprehension, but PA overpredicts ORF

- Gillon and Young (2002)
  - Children. Equally delayed in their reading/PA
Sample Phonological Awareness Tasks

Elision

PRACTICE ITEMS:

a. Say *toothbrush*. Now say *toothbrush* without saying *tooth*.
   Correct Response: *brush*
   If correct say, “That’s right. Let’s try the next one.”
   If incorrect say, “That’s not quite right. *Toothbrush* without saying *tooth* is *brush*.”
   Continue to give correct/incorrect feedback as before. Say, “Let’s try some more.”

b. Say *airplane*. Now say *airplane* without saying *plane*.
c. Say *doughnut*. Now say *doughnut* without saying *dough*.

8. Say *time*. Now say *time* without saying */m*/.
9. Say *tiger*. Now say *tiger* without saying */g*/.
19. Say *split*. Now say *split* without saying */p*/.
20. Say *fixed*. Now say *fixed* without saying */k*/.
Sample Phonological Awareness Tasks

**Blending Words**

<table>
<thead>
<tr>
<th>b. What word do these sounds make?</th>
<th>hãm-á́r</th>
<th>hammer</th>
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<tr>
<td>c. What word do these sounds make?</td>
<td>s-ǔn</td>
<td>sun</td>
</tr>
<tr>
<td>d. What word do these sounds make?</td>
<td>t-ā́k</td>
<td>take</td>
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<tr>
<td>e. What word do these sounds make?</td>
<td>n-ō</td>
<td>no</td>
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<tr>
<td>f. What word do these sounds make?</td>
<td>m-ǎ́́d</td>
<td>mad</td>
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Phonological Memory

- The ability to hold and manipulate verbal information in memory
- Beginning readers
  - Decode each letter
  - Blend letters
  - Compare to lexicon
Phonological Memory

• Tillman (1967)
  • Stronger digit span skills than CA matched sighted, overpredicts IQ

• Smits and Mommers (1976)
  • Stronger digit span skills that CA matched sighted, overpredicts IQ

• No known research comparing these skills to reading outcomes
## Sample Phonological Memory Tasks

### Memory for Digits

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**Total Raw Score**
Sample Phonological Memory Tasks

Nonword Repetition

PRACTICE ITEMS: Say, “I want you to listen to some made-up words on the CD player. After you hear each made-up word, I want you to say it exactly as you heard it and as clearly as you can. Even if it’s hard to say, give it your best try. Listen carefully because I can’t repeat the words. Okay? Let’s try some.” Start CD.

If correct say, “That’s right. Now try the next word.”
If incorrect say, “That’s not quite right. The word was _______. Let’s try another word.”

a. ral (rål)
b. sart (särt)
c. ballop (bäl-ōp)
Rapid Automatic Naming (RAN)

- More loosely defined
- Letters only?
  - Numbers? Colors? Objects?
Rapid Automatic Naming (RAN)

- Bliss, Kujala, and Hamalainen (2004)
  - Adults. Rapid naming for braille letters for adults who are blind indistinguishable as rapid naming for print letters for sighted adults

- Kikuchi, Yamashita, Sagawa, and Wake (1979)
  - More opportunities for reversal errors than in printed English

  - Knowledge/familiarity with braille letters correlated with phonological awareness
Sample RAN Tasks

Rapid Letter Naming

s t n a k c t s c
k a n c k t a n s
T i m e _ _ _ _ _
E r r o r s _ _ _ _ _
t k c s n a t c n
k a s n c k s t a
## Sample RAN Tasks

### Rapid Digit Naming

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Time ______

Errors ______
Assessment of Reading Disability in Sighted Population

- Most widely used assessment tools include subtest(s) in all three domains
- Caveat: 3 areas of phonological processing are predictive of RD in alphabetic languages
  - Syllabic (Japanese Kana)
  - Logographic (Mandarin)
Braille

• Alphabetic
• Syllabic
• Logographic

[Diagram with Braille symbols and English text examples]

Whole-word Contractions

Partial-word Contractions

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Assessment of Reading Disability Among Braille Readers

- ???

- Not just important for the sake if diagnosing/SpEd eligibility
  - Need to understand what’s going wrong for kids who are struggling to learn to read so we know where to intervene
Measures

• DIBELS Oral Reading Fluency (ORF) - braille
  • 2 passages
  • Score = correct words per minute
  • All participants used sixth grade level passage (contracted)

• CTOPPP (Comprehensive Test of Phonological Processing) Core Battery
  • Phonological Awareness (Elision, Blending Words)
  • Phonological Memory (Memory for Digits, Nonword Repetition)
  • Rapid Automatic Naming (Letters, Digits)*
CTOPP Validity with Sighted Students

- CTOPP Composites vs. the Woodcock Reading Mastery Test-Revised (WRMT-R)
  - after one year in kindergarten: .71 for Phonological Awareness, .42 for Phonological Memory, and .66 for Rapid Naming
  - assessed after first grade, showed better values: .80, .52, and .70 respectively

- Among adults, CTOPP vs. ORF
  - .70 for RAN, .57 for Phonological Awareness, .59 for Phonological Memory
Results – Phonological Awareness

Phonological Awareness Composite vs DIBELS ORF

$r = .444$
$p = .056$
Results – Phonological Memory

Phonological Memory Composite vs DIBELS ORF

$r = .388$

$p = .100$
Results – Rapid Automatic Naming

Rapid Automatic Naming Composite vs DIBELS ORF

\[ r = -0.500 \]
\[ p = 0.029 \]
Stepwise Regression and Model Selection

- **Stepwise Regression**
  - regression models in which the choice and ordering of predictive variables in the model is carried out by an automatic procedure

- Best predictive model includes RAN only
Shared Variance

Phonological Awareness vs Phonological Memory

\[ r = .638 \]
\[ p = 0.003 \]
Shared Variance

RAN vs Phonological Awareness

$r = -.380$
$p = 0.09$
Shared Variance

RAN vs Phonological Memory

$r = -.319$
$p = 0.09$
Discussion

• Phonological Awareness, Phonological Memory, and Rapid Automatic Naming are all more weakly correlated with Oral Reading Fluency in our sample than among previously reported sighted samples.
Discussion

• Weak and non-statistically significant correlations between phonological awareness/phonological memory and oral reading fluency
  • Not that they’re not important, but they do not capture the “core” underlying skill of contracted braille reading as they do for reading printed English or other alphabetic languages
Discussion

• Moderate correlation between Rapid Automatic Naming and Oral Reading Fluency

• Best model for predicting Oral Reading Fluency included only Rapid Automatic Naming
  • Captures the importance of speeded symbol recognition in contracted braille reading
  • Likely need RAN tasks that measure symbol recognition in a more complex/subtle way
Instructional Considerations

• Phonological awareness/memory likely quite important for students learning uncontracted braille (either first or only)

• If a student is struggling to master uncontracted braille, it likely IS due to phonological awareness/memory

• If a student is struggling to master contracted braille, it’s likely due to other factors
  • “Visual” memory/sight words
Instructional Considerations

• Psychoeducational assessment
  • Be sure when your students are assessed as part of initial or triennial assessments, psychologist is aware of limitations of their instruments for braille reading students
  • Need to consult with school psychologists with a deep knowledge of this population
  • TVI will probably have a better understanding of underlying skill deficits when children are struggling to learn to read
Questions/Comments?
Thank you!

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Results and slides at:
www.valeriemorash.com