



Exploration of Articulation in Relation to Reading Decoding for Children with Hearing Impairments

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Introduction

Sample

Procedures

Discussion

• Literacy is an important outcome for children with hearing impairments (HI), yet research indicates poorer performance compared to children with normal hearing.

• Although there is no single universal definition of literacy, there is an understood agreement that literacy involves a higher level thinking. It is often viewed as the ability to use "...printed and written information to function in society, achieve one's goals, and to develop one's knowledge" (Kirsch & Jungbult, 1986). The demands for more advanced, higher level achievement in literacy are necessary to enter a competitive workforce, more than previous decades (RAND, 2002).

• The Simple View of Reading (Hoover & Gough, 1990) is a widely accepted theoretical model of reading that suggests reading comprehension (RC) is the product of decoding (D) and linguistic comprehension (LC). Decoding refers to the ability to follow phonological rules of print by demonstrating knowledge of phonics.

• Children who have HI may struggle with decoding due to limited experience or skill with phonological and phonemic awareness when compared to children who have typical hearing. Speech intelligibility and articulatory skills may provide insight to the phonological representations of children with HI (Johnson & Goswami, 2010), and thereby, may be determiners of decoding.

• Discrete or binary coding procedures have been used in prior research to provide detailed inventories of articulation accuracy (Dillon et al. 2004; Sehgal et al. 1998). Phonological information from articulatory cues may assist in understanding the development of phonological representations by children with HI.

• The purpose of this study was: (1) to describe binary articulation skills for place, manner, and voicing of consonant sounds; and (2) examine relationships between articulation, language, and reading comprehension, testing the following three different hypotheses regarding articulation skills as a proxy variable for decoding:

- Ho1: BBTOP Raw Score
- Ho2: Total Binary Scoring for Manner, Place, Voicing
- Ho3: Individual Binary Scoring for Manner, Place, Voicing

Table 1. Descriptive data by group and across the sample

| | Total Comm. (n = 12) | Oral Only (n = 6) | Entire Sample (N = 18) |
|--|-------------------------|----------------------|---------------------------|
| Age in Years | 11.64 (1.39) | 11.55 (1.86) | 11.62 (1.51) |
| Female : Male | 8 : 4 | 3 : 3 | 11 : 7 |
| Mother's Ed in Years | 13.73 (2.72) | 11.60 (1.67) | 13.06 (2.59) |
| Pure Tone Averages | | | |
| Low (250 & 500Hz) | 21.42 (7.24) | 40.17 (24.01) | 27.67 (16.92) |
| Standard (500, 1000, 2000Hz) | 23.33 (6.81) | 52.17 (27.74) | 32.94 (21.26) |
| High (2 & 4 KHz)* | 25.50 (8.71) | 65.17 (33.86) | 38.72 (27.51) |
| Test of Silent Reading Efficiency and Comprehension (TOSREC) <small>(Wagner et al. 2010)</small> | | | |
| Raw Score | 12.75 (11.50) | 9.50 (7.79) | 11.67 (10.29) |
| Index Score | 74.25 (16.61) | 70.33 (13.71) | 72.94 (15.41) |
| Peabody Picture Vocabulary Test (PPVT-4) <small>Fourth Edition (Dunn & Dunn, 2007)</small> | | | |
| Standard Score | 84.58 (24.43) | 67.17 (15.43) | 78.78 (22.97) |
| Bankson-Bernthal Test of Phonology (BBTOP) <small>(Bankson & Bernthal, 1990)</small> | | | |
| Raw Score (out of 80) | 51.75 (22.11) | 39.67 (27.78) | 47.72 (24.64) |
| Proportion of words Modeled | 0.34 (0.36) | 3.67 (7.89) | 1.45 (4.58) |

* p < .05

• Children with hearing impairments in grades 3 through 6 were invited to participate in this study and completed a two day assessment battery that including reading, language, articulation, and writing measures. Results from the TOSREC, PPVT-4, and BBTOP were included for analysis in the current study.

• The BBTOP is a criterion referenced standardized test of phonology that includes 80 picture stimuli. Most words were monosyllabic and all English phonemes in all positions were assessed.

• The first author of this study conducted binary articulation coding by phoneme whereby each target phoneme of the BBTOP was scored as 0 or 1 for manner, place, and voicing. Proportions were created for all 579 phoneme scores, and individually for manner, place, and voicing scores.

• This study demonstrated and supports the use of the simple view of reading (Hoover & Gough, 1990) to account for the reading comprehension skills of children with HI in the following ways:

- Age in years was a significant predictor of reading comprehension accounting for approximately 20% of variance in silent reading score.
- Linguistic comprehension, as measured by receptive vocabulary, was a significant predictor of reading comprehension accounting for approximately 50% of variance in silent reading score.
- Decoding was not accounted for by any of the hypothesized measures of articulation gleaned from the BBTOP. Notably, discrete measures of manner, place, and voicing accounted for more variance (7%) than any other measure, though none were statistically significant.
- A larger sample with more variability in articulatory skills may account for significant amounts of variance in predicting comprehension and is a future direction of this work.

Results

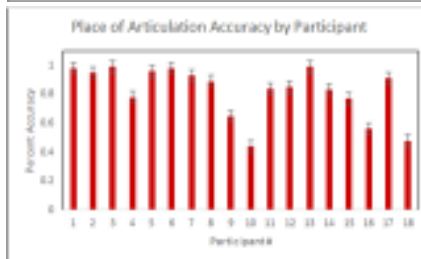


Table 2. Regression table for models of the Simple View of Reading (N = 18)

| Variable | B | SE (B) | β | R-square change | Adjusted R-square |
|--|--------|--------|---------|-----------------|-------------------|
| RC = TOSREC / LC = PPVT-4 / Decoding = BBTOP Hypotheses | | | | | |
| <i>Model for Hypothesis 1**</i> | | | | | |
| Age in Years* | -2.84 | 1.32 | -0.28 | 0.24 | 0.75 |
| PPVT-4** | 0.44 | 0.09 | 0.65 | 0.51 | |
| BBTOP - Raw Score | 0.13 | 0.09 | 0.21 | 0.03 | |
| <i>Model for Hypothesis 2**</i> | | | | | |
| Age in Years* | -2.81 | 1.42 | -0.28 | 0.24 | 0.73 |
| PPVT-4** | 0.48 | 0.09 | 0.71 | 0.51 | |
| BBTOP - Disc Total | 12.46 | 11.49 | 0.15 | 0.02 | |
| <i>Model for Hypothesis 3**</i> | | | | | |
| Age in Years* | -2.90 | 1.36 | -0.28 | 0.24 | 0.75 |
| PPVT-4** | 0.48 | 0.09 | 0.67 | 0.51 | |
| BBTOP - Manner | 130.18 | 99.12 | 1.64 | 0.07 | |
| BBTOP - Place | -23.76 | 51.99 | -0.27 | | |
| BBTOP - Voicing | -98.69 | 61.52 | -1.25 | | |

* p < 0.05; ** p < 0.01

• Clinical Implications and Future Directions of this work include the following:

- Sound and word level language skills continue to be an important target for children with HI to support reading comprehension (ASHA, 2001), this is demonstrated by the variability of individual data observed in this study. Interventions include phonological and phonemic awareness skills.
- Children with HI can clearly develop phonological representations, future research should ascertain how to best support this for children who use hearing technology or not.

Acknowledgements:

- We thank the students, teachers, schools, and programs who took the time to complete this study.
- We thank the research assistants and volunteers who worked on data collection and analysis especially.
- Thanks to the Department of Speech-Language Pathology and the School of Health and Medical Sciences for continued support of the ROW-Lab and this project. ROW-Lab: <http://blogs.shu.edu/row-lab/>
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