Using a Motor Learning Treatment with Phonologically-Disordered Children

Steven L. Skelton, Ph.D.
Danielle N. Resciniti, M.A.

Department of Communicative Disorders & Deaf Studies
California State University, Fresno
Introduction

What are some of the desired outcomes of phonologic treatment?

- Increases in the phonemic inventory.
- Increased distribution of phoneme usage.
- Generalization of target sound(s) to nonteaching settings.
- Generalization across phonemes (changes in untaught phonemes).

Sequence of practice tasks

- Speech sound treatments sequence practice tasks starting with presumed easy teaching tasks and progressing to harder tasks.
- Many phonologic treatment programs sequenced teaching tasks based on response length (e.g., syllables, words, sentences) and response mode (e.g., imitative and nonimitative).
Concurrent Treatment

The concurrent teaching sequence (Concurrent Treatment) included the following elements (Skelton, 1997, 2004; Skelton & Funk, 2004):

- (1) teaching the full range of presumed easy-to-hard teaching tasks (shorter to longer response lengths for imitative and nonimitative responses) and all of the target speech sounds within each treatment session, and
- (2) presenting the teaching targets and tasks intermixed in random order.
- The randomized order was changed each session, there would be no single teaching sequence and no single sequence of presumed easy and hard tasks over the treatment phase.

Previous research in Concurrent Treatment

Skelton (2004)

Four seven-year-old participants with /θ/ for /s/ misarticulations were taught /s/ via the Concurrent Treatment teaching sequence.

- Data from a multiple-baseline-across-subjects design showed that all four participants had increases from 0% -2% during baselines to 75%-97% correct productions in the first teaching session.
- The four participants reached the 80% correct criterion in the second teaching session.
- The data on generalization to untaught tasks from both treatments suggest that the range of tasks taught was associated with the extent of generalization across task types.
As with Skelton (2004), only a single speech sound was targeted for treatment. With the application of treatment, the participants increased correct productions from 0%-2% (baseline) to 47-56% correct in the first teaching session. Participants reached 80% correct production by their second, third, or fifth session. They completed treatment with greater than 80% correct productions. Probes showed generalization to untaught tasks for all three participants, with the final probe showing at least 85% correct productions.

Skelton and Funk (2004)  
Concurrent Treatment was used with three preschool-aged children presenting multiple misarticulations.

Skelton & Kerber (2005)  
Treatment of Multiple Sounds with Concurrent Treatment

Four children with phonologic disorder.
Each taught 4 sounds related to a phonologic pattern.
All four children acquired their sounds targets.
Across-phoneme generalization to untaught sounds in the pattern (for the three children who received generalization probes).

Research Questions

Purpose of the current study
As with Skelton and Kerber (2005), will the participants acquire their four target speech sounds?
As with Skelton and Kerber (2005), will the participants show generalization across taught and untaught phonemes?
Will participants show generalization to nonteaching settings?
The Participants

Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>4 yrs., 2 mos.</td>
<td>5 yrs., 5 mos.</td>
<td>5 yrs., 10 mos.</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td><strong>Goldman-Fristoe (SS)</strong></td>
<td>69</td>
<td>42</td>
<td>54</td>
</tr>
<tr>
<td><strong>CELF-P</strong></td>
<td>Normal Range</td>
<td>Normal Range</td>
<td>Normal Range</td>
</tr>
<tr>
<td><strong>Phonological Processes</strong></td>
<td>Stopping, Cluster Reduction, Final Consonant Deletion</td>
<td>Stopping, Cluster Reduction, Final Consonant Deletion</td>
<td>Stopping, Cluster Reduction</td>
</tr>
<tr>
<td><strong>Target Sounds</strong></td>
<td>/v, j, 6/</td>
<td>/v, j, 6, x/</td>
<td>/v, j, 6, x/</td>
</tr>
</tbody>
</table>

*Target sound /z/ could not be established.

Methods
Selection of Targets

Four targets were selected with maximum difference.

- All three participants presented with the process of Stopping of Fricatives.
- Four target sounds selected from fricatives class
- Phonemes were selected to by maximally-different in place and voicing (Williams, 2003).
- Untaught fricatives were probed for generalization.

<table>
<thead>
<tr>
<th>Taught Sounds</th>
<th>Untaught Sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>/v, θ, J/ and /z/*</td>
<td>/f, ħ, ʒ/ and /s/</td>
</tr>
</tbody>
</table>

*participant 1 did not complete establishment for /z/.

Teaching Tasks

Target phonemes, response lengths, and response modes were combined to create 28 types of practice tasks.

<table>
<thead>
<tr>
<th>Response Mode</th>
<th>Response Length</th>
<th>Target 1</th>
<th>Target 2</th>
<th>Target 3</th>
<th>Target 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imitation</td>
<td>Words</td>
<td>Task 1</td>
<td>Task 2</td>
<td>Task 3</td>
<td>Task 4</td>
</tr>
<tr>
<td></td>
<td>Phrases</td>
<td>Task 5</td>
<td>Task 6</td>
<td>Task 7</td>
<td>Task 8</td>
</tr>
<tr>
<td></td>
<td>Sentences</td>
<td>Task 9</td>
<td>Task 10</td>
<td>Task 11</td>
<td>Task 12</td>
</tr>
<tr>
<td>Evoked (nonimitation)</td>
<td>Words</td>
<td>Task 13</td>
<td>Task 14</td>
<td>Task 15</td>
<td>Task 16</td>
</tr>
<tr>
<td></td>
<td>Phrases</td>
<td>Task 17</td>
<td>Task 18</td>
<td>Task 19</td>
<td>Task 20</td>
</tr>
<tr>
<td></td>
<td>Sentences</td>
<td>Task 21</td>
<td>Task 22</td>
<td>Task 23</td>
<td>Task 24</td>
</tr>
<tr>
<td></td>
<td>Story-telling</td>
<td>Task 25</td>
<td>Task 26</td>
<td>Task 27</td>
<td>Task 28</td>
</tr>
</tbody>
</table>

Task-specific Procedures

- **Word Tasks.** One picture shown to the child.
  - A cloze stimulus, such as “This is a,” was used to evoke a one-word response.
- **Phrase Tasks.** One picture shown to the child.
  - A question was asked with a multiple-part cloze stimulus with the completion placed after a subject, such as for the target word “brush”: “Is this a comb? No, it ____ ____ ____” with the participant providing two-to-four word phrase.
- **Sentence Tasks.** One picture shown to the child.
  - A question was asked with a multiple-part cloze stimulus, such as for the target word “brush”: “Is this a comb? No, ___ ___ ___” with the participant providing complete sentence.
- **Story-Telling Tasks.** Four pictures from one target sound placed in front of the child.
  - Child was either to make up a story using all four pictures or
  - The investigator told a story using the pictures and the child retold it to her.
Materials

- The visual stimuli used were picture cards depicting an object the label of which contained a target phoneme.
- The pictures were colored drawings on a white background that measured 3 x 5 inches.
- There were 10 cards per phoneme for teaching tasks.
- There were three cards for each of the generalization phonemes.

Reinforcement and Error Correction

- **Reinforcement** – Token reinforcement on a continuous schedule. Tokens earned child-preselected prizes.
- **Error correction** – moved to next level if the error persisted.
  - Level 1–Indirect cue: “I didn’t hear [target phoneme].”
  - Level 2–Visual cue only: “Watch my mouth” (presented with a visual cue, but no sound).
  - Level 3–Model correct response: “Say [word] or (phrase) or [sentence].”
  - Level 4–Model with visual cue: “Say [word] or [phrase] or [sentence]” with a visual cue.
- If a correct response had not been elicited by then, treatment was discontinued for that task and then proceeded to the next task on the randomized list.

Basic Treatment Phases

*Each session was 35-40 minutes in length.*

- Establishment Phase
  - Teaching placement position
  - Practice of each sound in a single word (i.e., a total of four words used)
- Concurrent (Randomized-Variable) Practice Phase – during each session there was practice of the 28 tasks in randomized order (a new order was used each session).
Establishment Phase

*Establishing the target sounds via constant-blocked practice of a single word.*

- For each target sound, one word from the teaching set was taught to the child.
- Imitative practice to teach the whole word
  - If needed, the additive segmentation was used.
    - An example is the word "store" for the target /st/. Imitation of /or/, then imitation of /tor/ and finally imitation of /stor/.
  - Placement position of individual target sounds was used, as needed.
- The ending criterion for each of the four target sounds for each of the participants was 80% correct production at word level.
  - Participant 1 reached criterion for establishment within 6 sessions.
  - Participant 2 reached criterion for establishment within 4 sessions.
  - Participant 3 reached criterion for establishment within 3 sessions.

Randomized-Variable Practice Phase

*Randomized-Variable Practice of the four target sounds*

- Prior to each session, the tasks were randomized by computer and printed out on a score sheet.
  - The 28 practice tasks were randomized and intermixed.
- The teaching session followed that session’s randomized order of tasks.
- Each participant received at least one presentation of all tasks and, if time allowed, two presentations.
- Criterion for completion of treatment was set at 80% correct productions per session for all target teaching sounds, across three consecutive sessions.

Generalization Probes

*Three stimulus words were used per sound probed.*

- Probes of *taught* sounds to nonteaching stimuli.
  - In single words
  - In story-telling tasks.
- Probes of *untaught* sounds to nonteaching stimuli.
  - In single words
  - In story-telling tasks.
- Probes of *taught* sounds in nonteaching settings.
  - In conversational speech.
Results

Treatment Results
Participants reached teaching criterion (all target sounds at or above 80% correct over 3 consecutive sessions).
- Participant 1 by the 19th RV session.
- Participant 2 by the 13th RV session
- Participant 3 by the 10th RV session

Generalization Probes
Participant 1

Note: Probe at session 7 was after establishment phase. Subsequent probes were during or at the end of random-variable practice.
Generalization Probes

Participant 2

Note: Probe at session 7 was after establishment phase. Subsequent probes were during or at the end of random-variable practice.

Generalization Probes

Participant 3

Note: Probe at session 7 was after establishment phase. Subsequent probes were during or at the end of random-variable practice.

Generalization Probes

Probes in nonteaching settings

Note: Probes 1 and 2 were taken during random-variable practice. Probe 3 was taken at the completion of treatment.
Discussion

Returning to our Questions

- As with Skelton and Kerber (2005), will the participants acquire their four target speech sounds? *If the target sounds were established, all target sounds were taught to criterion.*
- As with Skelton and Kerber (2005), will the participants show generalization across taught and untaught phonemes? *Yes, though percent correct productions were less than seen in the previous study.*
- Will participants show generalization to nonteaching settings? *Two participants showed generalization across settings. The third participant showed minimal generalization at the end of the study.*

Conclusions

- For teaching target sounds – treatment efficacy demonstrated across all participants as in previous studies.
- Once targets were established, participants successfully acquired the sounds.
- Probes of generalization taken after establishment but before random-variable practice, showed no generalization to story-telling tasks (most complex task). Two participants had no generalization to word probes and one had minimal change. *This suggest that randomized variable practice, not just establishment, was needed for generalization to occur.*
- Generalization across untaught phonemes demonstrated across the three participants probed.
- Generalization to nonteaching settings was see for two of the three participants as in Skelton (2004).
References


