PHONOLOGICALLY RICH ARTICULATION THERAPY:
THE FONEMZ APPROACH

Razi Michael Zarchy
B.A., University of California, Los Angeles, 2005

THESIS

Submitted in partial satisfaction of
the requirements for the degree of

MASTER OF SCIENCE

in

SPEECH PATHOLOGY

at

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

SPRING
2011
PHONOLOGICALLY RICH ARTICULATION THERAPY: 
THE FONEMZ APPROACH

A Thesis

by

Razi Michael Zarchy

Approved by:
____________________________, Committee Chair
Ann Blanton, Ph.D.

____________________________, Second Reader
Laureen O’Hanlon, Ph.D.

____________________________, Third Reader
Robert Pieretti, M.S.

____________________________
Date
Student:  Razi Michael Zarchy

I certify that this student has met the requirements for format contained in the University format manual, and that this thesis is suitable for shelving in the Library and credit is to be awarded for the thesis.

__________________________, Department Chair
Laureen O’Hanlon, Ph.D.        Date

Department of Speech Pathology and Audiology
Abstract

of

PHONOLOGICALLY RICH ARTICULATION THERAPY:
THE FONEMZ APPROACH

by

Razi Michael Zarchy

The purpose of this study was to examine the efficacy of FONEMZ, a visual interactive cueing system used to teach phoneme production to children with communication disorders. A single-subject ABCA multiple-baseline research design was used to compare the FONEMZ approach to traditional articulation therapy. Two subjects, both 4 years old, were followed for 20 sessions.

Both subjects were identified by standardized testing as having concomitant severe articulation deficiencies and low phonological awareness skills. One subject also had decreased language skills. The other subject had language skills in the average to above average range. Production accuracy of a target phoneme was tracked for each treatment method and phonological awareness was measured with pre- and post-testing. The student with decreased language abilities demonstrated variable accuracy of production of the target phoneme throughout, with some improvement near the end of the FONEMZ therapy and an increase in overall articulation and phonological awareness abilities after the completion of treatment. The student with average language abilities demonstrated a significant increase in accuracy of the target phoneme and one non-target phoneme, with
the most dramatic increase occurring during the FONEMZ therapy, as well as increases in overall articulation and phonological awareness abilities after the completion of treatment. Findings suggest that FONEMZ therapy may be a more effective therapy strategy than traditional articulation therapy for children with average language abilities. Results also indicate directions for further research, particularly in the area of phonological awareness.

_________________________, Committee Chair
Ann Blanton, Ph.D.

_________________________
Date
ACKNOWLEDGMENTS

I would like to thank my advisors and mentors, Sandy Kaul and Dr. Laureen O’Hanlon, for bringing me into the “FONEMZ Project” from my first day in ACSL and sharing their endless passion for research and the search for knowledge. I would also like to thank Dr. Robert Pieretti, for his guidance, encouragement, and expertise in the fields of phonology, literacy, and completion of seemingly insurmountable writing tasks.

Thank you to Dr. Ann Blanton for her help through the Human Subjects process. Thank you to my parents, Susan and Bill Zarchy, and my brother, Daniel Zarchy, for their love and support through my long educational process. Thank you to my husband, Bryan Dunnican, for sticking with me through the years of hard work and for being by my side to keep me going every day. Thank you to my friends for being my sounding board and making sure I have fun in the process. Thank you to Melisa McCampbell, Kelly Dodge, and Lori Nelson for their previous work on the FONEMZ project that helped get it all established in the first place.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Acknowledgments</th>
<th>vi</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Tables</td>
<td>ix</td>
</tr>
<tr>
<td>List of Figures</td>
<td>x</td>
</tr>
</tbody>
</table>

## Chapter

1. BACKGROUND ........................................................................................................... 1
2. REVIEW OF THE LITERATURE .................................................................................. 3
   - Overview of the FONEMZ Approach .................................................................... 3
   - Universal Design for Learning ......................................................................... 6
   - Forging Links Between the Fundamental Features of Language ....................... 9
     - Speech Perception and Phonemic Categories .............................................. 9
     - Phonemic Awareness and Articulation ..................................................... 12
     - Phonological Awareness and Literacy ..................................................... 14
     - Visuals and Memory .................................................................................... 16
     - Symbols and Language Development ....................................................... 18
     - FONEMZ and Orthography ............................................................................ 19
     - Puppets and Therapy ................................................................................... 20
3. METHODOLOGY ....................................................................................................... 24
   - Research Design ............................................................................................ 24
   - Participants .................................................................................................... 27
LIST OF TABLES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Universal Design for Learning</td>
<td>7</td>
</tr>
<tr>
<td>2.</td>
<td>Jay and Al’s target and non-target error phonemes</td>
<td>25</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td>Jay’s words correctly articulated</td>
<td>Al’s words correctly articulated</td>
</tr>
<tr>
<td>34</td>
<td>37</td>
</tr>
</tbody>
</table>
Chapter 1

BACKGROUND

Phonology is one of the systems of language along with syntax, semantics, pragmatics, and morphology. Peña-Brooks and Hegde define phonology as the “study of speech sounds, sound patterns, and the rules used to create words with those sounds,” (2007, p. 573). Articulation, or the physical formation of sounds, is a part of phonology in that it entails the combining of sounds in order to make words. An articulation disorder is the use of mild to moderate sound distortions or substitutions that generally do not affect the meaning of the intended word(s). In contrast, a phonological disorder generally results in the neutralization of phonemic contrasts, and thus affects meaning. Such disorders can usually be described according to the patterns of sound errors in the client’s speech output. Poor intelligibility and/or a limited phoneme inventory may be indications of a phonological disorder (Peña-Brooks and Hegde, 2007).

Between 6 and 8 million people in the United States have some form of language impairment (National Institute on Deafness and Other Communication Disorders, 2010). These individuals often have co-morbid academic difficulties that limit their success in school (Felsenfeld, Broen, & McGue, 1992, 1994; Felsenfeld, McGue, & Broen, 1995). The first 6 months of life are the most crucial period for language development, so exposure to a language-rich environment must begin as early as possible to encourage
later language competence. There is evidence for a critical period of normalization in the sound system, after which a plateau of learning may take place. This plateau may occur around age 8:5 (years:months) (Shriberg, Gruber, & Kwiatkowski, 1994; Shriberg, Kwiatkowski, & Gruber, 1994).

In an effort to continuously improve efficacy of speech and language therapy techniques, evidence based practice is a central focus of speech-language pathology. Evidence based practice (EBP) is a framework for clinical decision-making with a goal of high-quality client services. It brings together clinical expertise, best current evidence from peer-reviewed research, and client values (American Speech-Language-Hearing Association [ASHA], 2011). While many studies include large groups of clients including an experimental group and a control group, single-subject design has also been shown to have distinct advantages. Specifically, single-subject studies document patterns of acquisition and generalization for individual clients (Geirut, 2001). Thus, a single-subject design was selected for this study to answer the following research question(s):

1. Does the FONEMZ approach improve articulation more effectively than traditional articulation methods do?

2. Does the FONEMZ approach simultaneously increase pre-literacy skills, particularly phonological awareness skills?
Overview of the FONEMZ approach

FONEMZ (pronounced “phone-eemz” or /ˈfonimz/) is a visual interactive therapy approach that is used to teach articulation, phonemic awareness, and literacy skills to subjects aged 9 months to adulthood. It was developed by a speech-language pathologist named Sandy Kaul and copyrighted in 2007 (Kaul, 2007). Since the research we will discuss compares the efficacy of the FONEMZ approach to traditional articulation therapy methods, it is necessary for the reader to have an understanding of both traditional articulation therapy and FONEMZ.

The traditional articulation therapy used in this study consisted of tactile and kinesthetic stimulation for phonetic placement including hand prompts on the face, tongue depressors, and toothettes. Auditory bombardment included the clinician’s repetition of the target sound in various environments (isolation, syllables, and words). This was frequently associated with the subject’s attempted imitation of the clinician’s productions. External manipulatives (such as pinwheels, feathers, and other objects that could be easily moved with the expiration of air) were used to train oral airflow in fricatives. Token reinforcement was used to keep the subjects’ attention during these activities.
A FONEMZ kit consists of manipulable symbols that have a distinct color and shape for each of the 40 main phonemes of General American English. In order to be used in a variety of activities with subjects of all ages, the shapes are made in pairs out of felt, flat magnets, and cardstock. Kits made prior to 2011 contain cardstock symbols, while future productions will contain magnets for increased durability.

The name used to identify each symbol is the actual phonetic production, or sound, of the phoneme (e.g., /k/) as opposed to the commonly used names of the letters that may make that sound (e.g., “kay”). Some of the symbols themselves partially resemble their corresponding letters, some resemble the shape of the mouth during the production of the sound, and some resemble the International Phonetic Alphabet (IPA) symbol for the sound. The FONEMZ symbols were designed to be dissociated from the letters of the alphabet in order to eliminate any confusion that new readers may have when presented with letter names and letter sounds at the same time (S. Kaul, personal communication, March 1, 2009).

FONEMZ uses a simple bottom-up approach. This means that no other information or knowledge is needed before beginning instruction. FONEMZ therapy can take an endless number of directions in terms of session structure. The felt FONEMZ symbols can be stuck to clothing or crumpled up and placed in pockets or containers. They can also be placed on a felt board to match or discuss whether the FONEMZ are the same or different, to create a shape resembling the vowel quadrilateral, or to lay out in a straight line left to right to build words. The cardstock or magnetic FONEMZ can be fanned out like a hand of cards for the client to select the next one, or placed in a pocket.
chart or on a white board to create consonant-vowel (CV) and vowel-consonant (VC) syllables and words. All of the symbols can be hidden around the room for the client to find and bring back to the clinician, then produce the target phoneme in as many repetitions as the clinician chooses. With young learners, the clinician may have them feed the felt symbols to a puppet or produce the target phonemes with the puppet as an audience. This is only a partial list of activities available when using FONEMZ symbols.

Phonemic awareness is the ability to hear a difference between unique speech sounds (Wren, 2001). In contrast, phonics can be defined as a system of teaching reading that is based on the acquisition of letter-sound correspondences designed for beginning readers (NRP, 2000). The FONEMZ approach bridges the gap between articulation, phonemic awareness, and phonics by targeting articulation and supporting the developing phonological system, including phonological awareness, through the use of the unique visual cueing system. The clinician first teaches the client to associate each sound with a distinct symbol, then uses the mastered symbols to blend and segment words. In the FONEMZ approach, when the client begins to understand how words can be built using FONEMZ, then the clinician teaches him or her which letters correspond to each FONEMZ symbol, providing a transition into traditional orthography. In addition, each letter or combination of letters can be color-coded to match the corresponding FONEMZ symbol (e.g., /i/, as in bee, is yellow. Every sound combination that says the phoneme /i/: “ee, ea, y,” etc., would be colored yellow).
Universal Design for Learning

The concept of Universal Design came from the field of architectural design as a result of federal legislation requiring buildings and other structures to have universal access for individuals with disabilities. As the Delaware State Department of Education described, the result of this legislation was that architects started to design buildings with accessibility included in the initial design, rather than retrofitting standing structures (DSDE, 2004). When using this principle, the Universal Design for Learning is a “strategy to eliminate barriers that students may encounter to learning,” (DSDE, p. 3). The term Universal Design for Learning (UDL) was coined by the Center for Accessing Special Technologies (CAST, 2011). UDL includes the concepts of Universally Designed Instruction (UDI), universally designed curriculum (UDC), and Universal Design in Assessment (UDA), the alliance of which promotes the idea that every element of the educational process should be designed for access by all students.

There are many benefits to Universal Design:

- Cost: UDL is good for teachers because planning ahead saves time and money in the long run.
- Provision of Access to All: The UDL approach promotes a more inclusive environment for all students.
- Student Engagement: UDL is good for students because it reduces frustration previously experienced with using inflexible print materials.
• Legal Compliance: UDL helps with legal compliance to the Americans with Disabilities Act and the Individuals with Disabilities Education Act, which require information and activities to be accessible and usable by individuals with disabilities (DSDE, p. 6-8).

There has also been a case made for the integration of new technologies in the classroom to ensure UDL principles of academic achievement for all students. However, UDL is not limited to technology. It simply means to incorporate solutions according to the principles of providing students with multiple means of representation, expression, and engagement (Rose & Meyer, 2000, 2002, 2006). These principles target the following three brain networks, respectively: recognition networks (the “what” of learning), strategic networks (the “how” of learning), and affective networks (the “why” of learning) (CAST, 2011). FONEMZ therapy follows these UDL principles by targeting all three of the brain networks that CAST described.

<table>
<thead>
<tr>
<th>Principle</th>
<th>Brain Networks</th>
<th>Learning Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple means of representation</td>
<td>Recognition networks</td>
<td>The “what” of learning</td>
</tr>
<tr>
<td>Multiple means of expression</td>
<td>Strategic networks</td>
<td>The “how” of learning</td>
</tr>
<tr>
<td>Multiple means of engagement</td>
<td>Affective networks</td>
<td>The “why” of learning</td>
</tr>
</tbody>
</table>

Table 1. Universal Design for Learning

When targeting recognition networks using the FONEMZ approach, the clinician may manipulate the symbols to play diverse types of games with clients, demonstrating to the client that there are multiple ways to represent each phoneme. For example, the clinician may have the client pull felt FONEMZ symbols out of a container, name them
by producing their corresponding phoneme, then place them on a felt board. Once all of the symbols are on the board, the client may point to each symbol with a pointer and produce each phoneme again for additional repetitions. To demonstrate how the phoneme may be represented on the word level, the clinician may speak a word or show a picture corresponding to a familiar vocabulary word, then ask the client to “build” the word using the FONEMZ symbols, one phoneme at a time. While cleaning up, the client may place each symbol in its correct space in the FONEMZ storage case by matching the spaces in the box to the corresponding diagram and producing each phoneme for additional repetitions. These multiple ways of manipulating, modeling, imitating, and volitionally naming the FONEMZ symbols, as well as discussion of their placement in words, provides clients with a vast number of different ways to interact with and learn to identify each phoneme and its corresponding symbol (S. Kaul, personal communication, March 1, 2009).

When targeting strategic networks, the clinician may allow for multiple ways for the client to express knowledge of phonemes. For example, in a small therapy group, the clinician may ask one client to speak his/her target phoneme (in isolation, syllables, or words, as appropriate,) to others in the group. The clients may also make up sentences containing their target phonemes in order to facilitate generalization and provide multiple opportunities to express their knowledge. An additional way of targeting strategic networks would be to teach self-monitoring skills. As the client spoke an utterance, the clinician could use the FONEMZ symbol of the target phoneme as a visual/tactile cue to remind the client to use correct productions throughout his or her utterance. This would
provide the client with multiple ways of expressing his/her understanding of the differences between phonemes and the correct ways to produce them.

The clinician could target affective networks by finding out about the client’s interests, then catering toward those interests in therapy (Jiménez, Graf, & Rose, 2007). If the client is particularly motivated by motor-based activities, therapy could center around scavenger hunts for the FONEMZ symbols. If the client is motivated by card games, the cardstock/magnet symbols could be used to design a card game. If the client is motivated by learning to read, the cardstock/magnet symbols could be used to build words in a pocket chart. In addition, words relevant to the child’s interests (and containing target phonemes) could be used in therapy in order to keep the client’s attention. For example, if a client loves cars and the target phoneme is /k/, the clinician could ask the client to find the first sound in “car,” then practice producing /k/. As the difficulty level increases, the clinician could teach the client to build car-related words with the FONEMZ symbols.

Forging Links Between the Fundamental Features of Language

*Speech Perception and Phonemic Categories*

The DIVA (Directions into Velocities of Articulators) model, as described in Shiller, Rvachew, and Brosseau-Lapré (2010), was developed to investigate why children with speech disorders make specific errors and slow progress in therapy. This model is based on the principle that words are represented as a sequence of segments and
that these segments are represented as spatio-temporal auditory goal regions (Perkell et al., 2000). The model accounts for speech production development as the acquisition of three types of neurological mapping: phoneme-to-auditory mapping, auditory-to-articulatory directional mapping, and articulator-to-auditory mapping. As a result, the goal of a speaker is to produce specific auditory goals that the listener will perceive as the desired phoneme sequence, rather than producing a specific sequence of articulatory gestures. As a listener hears spoken language, incoming stimuli are compared and matched to these auditory goal regions in order to determine which phonemes have been heard. (Kuhl, 1992). This means that acoustic patterns near the center of a phonetic category are perceived as similar, which accounts for the ability of allophonic variations of a phoneme to be perceived as the same phoneme. For example, the sound /t/ as represented by the letter “t” in the words “toy,” “train,” and “little” is perceived as the same phoneme, even though all three are pronounced slightly differently in General American English.

In Shiller et al.’s (2010) review of the literature, they found that children with speech disorders had some phonological knowledge of the target contrasts, but they used nonstandard and unreliable acoustic cues to differentiate the contrasting phonemes. As a result, their processing of acoustic-phonetic characteristics of the speech input led to inappropriate auditory goal regions for each phoneme. This led to Shiller et al.’s own findings, which demonstrated that when a child attempted to produce sibilants correctly with respect to achieving acoustic outcomes, rather than producing specific sequences of articulatory movements, his misarticulations were due to incorrectly specified auditory
goal regions for these phonemes, instead of being due to incorrect attempts to achieve appropriate vocal tract configurations.

Phonological processing can be defined as using phonological information to process oral and written language (Wagner et al., 1997). If an individual has phonological processing difficulties, s/he may face problems with phonological input (auditory processing), and/or phonological output (speech) (Hodson & Paden, 1991). It has also been demonstrated that speech perception abilities are a strong concurrent correlate of phonological awareness skills (McBride-Chang, 1995; Nittrouer, 1996; Nittrouer & Burton, 2005). Phonological awareness can be defined as “the ability to attend to and make judgments about the general sound structure of language,” (Schuele & Boudreau, 2008, p. 6). Phonemic awareness is the field within phonological awareness relating to the level of individual sounds in the structure of language. Wren (2001) adds that this process has little to do with the letters of the alphabet. Finally, Wren links the term to the written word in the alphabetic principle: “…Phoneme awareness is what is necessary for the child to understand that the letters in written words represent the phonemes in spoken words,” (p. 5). Compared to other phonological awareness skills such as onset-rime skills, phonemic awareness has the distinction of being the best predictor of early reading skill (Hulme et al., 2002).

Snellings, van der Leij, Blok, and de Jong, (2010) found that reading-disabled children’s phonological skills contained less distinct phonemic categories than normal readers. As stated above, the distinction of these phonemic categories is essential to literacy. As such, a FONEMZ symbol may provide a visual representation of such
phonemic categories, without the complications of English orthography. FONEMZ contains an inherent focus on the sound system with a unique visual focus. The visual symbol provides something concrete to mark the sound in memory. These distinct symbols provide an anchor for the abstract, fleeting phonemes in language, aiding with discriminating one sound from another in multiple modalities. They may also clarify the auditory goal regions of the phonemic categories, aiding in clearing up the incorrectly specified phonemes in the child’s phonological memory codes and assigning them to memory in a correct manner. As described in the section on DIVA above, the FONEMZ symbols may be used in auditory discrimination activities, where the clinician produces a phoneme (or syllable/word containing a phoneme) and the client selects the correct FONEMZ symbol. Another activity includes building words by producing the word, then having the client figure out which FONEMZ symbols correspond to the phonemes in the word, then blending the phonemes together to make the whole word. Additional activities may also be designed to manipulate the FONEMZ symbols to teach improved speech perception and phonemic awareness.

**Phonemic Awareness and Articulation**

Phonemic awareness and articulation are directly linked (Roberts, 2005). The articulatory gestures of speech are the motor patterns of the speech production organs that correspond loosely to individual segments in speech. Liberman (1999) demonstrated that articulation actually has a greater impact on young children’s perception of speech than do the sounds associated with those gestures. If a child cannot articulate sounds
accurately, their perception of the sounds that they hear produced by other people may be inaccurate as well. Mann & Foy (2007) found that children who did not master the earliest eight sounds and had certain production errors were more likely to have deficient phonological awareness. However, training in articulation has been shown to concurrently increase phonemic awareness (Roberts, 2005). Inversely, Kamhi (2006) found that children with speech delays can benefit from training in phonemic awareness because it may lead to improved articulation. Training in articulatory exercises and increased awareness of each individual phoneme, paired with auditory phonological training, was shown to increase the skills of children with dyslexia, as evidenced by Joly-Puttuz, Mercier, Leynaud, and Habib (2008). This combination of articulatory and auditory training was demonstrated to be more efficacious than auditory training alone in increasing phonological awareness and decoding.

Both articulation and phonemic awareness appear to be fundamental to academic achievement and literacy. Severe articulation errors, phonological processes, and language impairments may be symptoms of a weaker underlying phonological system. For example, Forrest, Elbert, and Dinnsen (2000) discovered that sounds that are unspecified in a child’s phonological system are produced with greater variation than more fully specified sounds. Children with weaker phonological systems characterized by these variable sound substitution patterns tend to have more difficulty with acquiring new phonemes and generalizing their use. In another study, Roberts, Rescorla, Giroux, and Stevens (1998) found that the phonological systems of children with expressive specific language impairments (SLI-E) were both delayed and less systematic than those
of typically developing children. The children with SLI-E scored below age level on measures of intelligibility such as the rate of verbalizations and fully intelligible utterances.

Because of such co-occurring deficits, many therapy approaches have been developed to work on these skills for diverse populations (e.g., Allor, Gansle & Denny, 2006). Targeting phonology itself is often more effective in such cases. (Hodson & Paden, 1991). The FONEMZ approach recognizes this and attempts to target articulation explicitly in a phonologically rich environment. By allowing students to produce phonemes through interaction with the individual FONEMZ that represent them, phonemic awareness develops. This is evident when a child labels various FONEMZ volitionally and combines them with other phonemes to form a consonant-plus-vowel, vowel-plus-consonant, or word-level combination. This is consistent with Forrest et al.’s (2000) assertion that concepts develop from interaction in multiple modalities such as “auditory, kinesthetic, tactile, and visual perception,” (p. 528), as well as real-time correspondence with the articulatory movements.

**Phonological Awareness and Literacy**

Early success in school is closely linked to success in the language arts, specifically reading and reading comprehension. However, in children with early speech and language problems, 40-100% have persistent language problems and 50-75% have academic problems (Lewis et al., 2000). By the time a child reaches elementary school, there are essential language skills that he or she must acquire in order to facilitate normal
development of literacy. Pre-school phonological awareness abilities relate directly to future reading and writing achievement (Wagner et al., 1997). In fact, skills requiring phonological awareness turned out to be the most powerful predictors of later reading and writing skills in a study by Lundberg et al. (1980).

Many of these children with early speech and language problems will be diagnosed with language-based reading disabilities. For example, Peterson, Pennington, Shriberg, and Boada (2009) found results consistent with a multiple-deficit account. This account detailed that children with speech-sound disorders have higher rates of categorical reading disabilities. However, children’s broad language function at age 5-6 predicted literacy outcome at 7-9 even more strongly than did persistence of speech errors. This multiple-deficit account includes phonological awareness, syntax, and non-verbal IQ as explanations for variance in literacy outcomes. It is also consistent with Lewis et al.’s findings that children with only phonological disorders have better outcomes than children with phonological disorders and additional language problems. When acquiring phonemic awareness skills, it is harder for disabled readers than for normal readers, but even they can improve their phonemic awareness with training (National Reading Panel [NRP], 2000). Greater success in phonemic awareness, and therefore, decoding, (Lewis et al., 2000) may allow more time and focus on reading comprehension for both groups of children, but particularly for those with language-based learning disabilities, who tend to have greater difficulty with comprehension (Mather & Gregg, 2006, as cited in Johnson, Humphrey, Mellard, Woods, and Swanson, 2010).
Since remediation of speech-sound disorders and low phonological/phonemic awareness skills is crucial to literacy development, FONEMZ may offer a unique contribution to this process due to its structured method of targeting specific phonemes in a phonologically rich environment. Also, because FONEMZ is a bottom-up program in which no prior client knowledge is necessary for its use, it is also appropriate to use with clients who have multiple language deficits.

**Visuals and Memory**

Much of the research that has been conducted on the use of visual aids in the remediation of articulation disorders and phonemic awareness has focused on the visibility of other people’s speech (e.g., Teinonen, Aslin, Alku & Csibra, 2008) or on visible methods of biofeedback during speech (e.g., Ruscello, 1995), not on the use of symbols to represent spoken sounds. However, research does support incorporating a visual aspect to speech and language training. The two neural systems for language and images are reinforcing and interrelated (Menard, Kosslyn, Thompson, Alpert, & Rauch, 1996). The association of sounds with images may be beneficial to the establishment of accurate phonologically-based memory codes because many people rely on imagery for long-term memory retrieval (Kosslyn, 1976), indicating that such visual memory codes may assist in the retrieval of correct phonemes at the rapid pace of everyday speech. Other researchers have emphasized that children with specific language impairments (SLI) have particular difficulty with the rapid auditory transitions in speech perception, and that the root of SLI is this specific deficit (e.g., Tallal et al., 1996; Wright, et al.,
Norrix et al. (2007) suggested that children with SLI might be able to use visual information to support auditory processing, since the auditory component may be weaker than normal. For example, children with SLI recall more auditory digit sequences when visual information is added (Quail, Williams, & Leitao, 2009).

When studying whether or not color enhances the recognition of natural scenes, Spence, Wong, Rusan, and Rastegar (2006) found that it makes a substantial difference. This was because of the encoding-specificity principle, which asserts that “memory is enhanced when the same information available at encoding is also available at retrieval,” (1). Color also provides an associative link between memory encoding of object shape and object name (Lloyd-Jones & Nakabayashi, 2009). As such, the fact that FONEMZ symbols are always the same color may improve the client’s discrimination between visually similar symbols and encoding in long-term memory. Visual long-term memory can store substantial detail related to a large number of items (Konkle, Brady, Oliva, and Alvarez, 2010), so it may be extremely beneficial for the clinician to take advantage of the visual modality when working with clients with auditory deficits. When the client is ready to transition into English orthography, the letters may be written in the same color as the familiar FONEMZ symbol in order to ease the transition and provide visual continuity.

Symbols and Language Development
The use of symbols is a defining characteristic of human cognition. The definition of an external, artifactual symbol is “any entity that someone intends to stand for something other than itself,” (DeLoache, 1995, p. 109). The goal of DeLoache’s research was to understand young children’s development of comprehension and use of symbols, particularly using scale models. She discussed three factors crucial to young children’s use of symbols: salience (characteristics of the symbol itself), iconicity (the symbol-referent relationship), and instruction (the social context).

These symbolic factors may also apply to speech and language development. For example, a young child's brain seeks out patterns as speech and language develop. When attempting to speak, the child attempts to match this speech to the same ideal representations. The work of Elizabeth Bates and her colleagues, beginning with The Emergence of Symbols (Bates et al., 1979) discussed the fact that simplistic productions precede accurate productions, but both carry the same symbolic meaning. Early in language development, the utterance “na-na!” may be used to request everything. Once language has developed further, simple phoneme substitutions take place, such as “ta” for “car.” To the child, these simpler utterances carry the same symbolic meaning as the adult versions of the utterances, demonstrating an attempt at establishing the iconicity, or symbol-referent relationship between the utterance and its meaning, even as the phonological system continues to develop increasingly accurate salience, or phonological characteristics. This development takes place in a number of different types of instruction, or social contexts, including direct intervention if necessary.
The FONEMZ approach provides a social context specifically designed to strengthen the client’s understanding of symbols by providing meaningful contrasts (establishing iconicity) between phonemes in a developing phonological system. This grapheme-phoneme knowledge is essential for learning to read words in English (Ehri & Metsala, 1998). There are about 40 distinctive phonemes in English, but many more ways to spell each of these phonemes. The use of the 40 visual, three-dimensional FONEMZ with 1:1 sound-symbol correspondence may make the bridge to English orthography and the alphabetic principle much easier.

**FONEMZ and Orthography**

As described by Lundberg (2009), the alphabetic system is based on phonemes that are elusive, abstract, and difficult for children to perceive due to complex processes of co-articulation. A child must take a critical step from implicit to explicit control of these phonemes in order to become literate. Once this control, previously referred to in this document as phonemic awareness, has been established, the stage has been set for the transition into literacy.

The FONEMZ symbols mirror the phonological and oral language symbol development that DeLoache noted in early childhood: a more simplistic symbol precedes the accurate orthographic symbol. Traditional English orthography is highly inconsistent and complex; for example, it contains multiple spellings (13) for the /u/ phoneme: “oo, u, ue, ough” etc. It also uses a variety of letters, often including more than one letter, to produce many more sounds in English (e.g., “f” and “ph” for /f/, “c,” “s,” and “sc” for /s/,
“c,” “k,” and “ck” for /k/). In contrast, FONEMZ circumvents the variety of letters used to produce the same sound by providing a single symbol for each sound. This allows the child to learn sound-symbol correspondence at a 1:1 ratio before attempting the more complicated orthographic system. This is vastly simpler than the irregular, complex spelling patterns of English. It introduces the use of an alphabetic system in a more rudimentary manner.

If orthographic skills become strong enough, they may actually aid in phoneme detection (Cutler, Treiman, and van Ooijen, 2010). This means that knowing the spelling of a word may help to clarify which sounds the listener hears when the word is spoken aloud. It is not mandatory for orthography to have this effect, but the effect can be induced when spelling is made particularly salient by using irregularly spelled words. When spelling was made salient in Cutler et al.’s study, participants had longer response times when detecting phonemes that had inconsistent spellings (e.g., [f, k, s]) compared to phonemes that are always spelled the same way (e.g., [b, m, t]). For children who struggle with such inconsistencies of standard orthography, FONEMZ may aid in clarifying the pronunciations of written words. It may also be beneficial in providing a tangible visual anchor for the various spellings for each phoneme in speech detection tasks such as those in Cutler et al.’s study.

**Puppets and Therapy**

A clinician’s use of the colorful and manipulable FONEMZ follows the therapeutic approach recommended by Yopp (as cited in Zeece, 2006) for
developmentally appropriate therapy. It particularly follows the recommendation to
make the therapy playful and fun without relying on drill and rote memorization.
Therapy for speech-sound disorders frequently focuses on the ability and willingness of
the client to imitate the clinician’s productions. However, DeThorne, Johnson, Walder,
and Mahurin-Smith (2009) pointed out that many clients do not readily imitate such
productions. They provided 6 evidence-based strategies for eliciting verbal productions
from clients who do not readily imitate. Three of these strategies relate directly to
therapy techniques easily implemented using the FONEMZ approach.

The first of these strategies is to minimize pressure to speak. DeThorne et al.
(2009) detailed experimental evidence in favor of decreasing communicative pressure,
particularly for children with autism and children who are late to talk. Baskett’s group
design (1996, as cited in DeThorne et al., 2009) supported the use of a puppet as a
conversational partner in order to decrease this pressure. DeThorne et al. agreed with
Baskett’s findings and recommended the use of puppets as interactive partners. The two
rationales for DeThorne et al.’s recommendation were that: 1) puppets reduce the power
differential normally present in adult-child relations; and 2) puppets minimize the
pressure of social conventions such as eye contact and conversational turn-taking. They
did note that the same is true whether the child interacts directly with the puppet or
simply observes interactions between the clinician and the puppet. Clinicians can use
such interactions for a number of uses, whether the goal is to model therapy targets or to
provide a comfortable context for the client to complete unfinished carrier phrases.
Puppets can be easily integrated into FONEMZ therapy; in fact, they are often a central
portion of the approach (when appropriate to the client). Puppets are particularly useful when using the felt FONEMZ. The clinician may ask the child to produce the target phoneme and when s/he does, the puppet snatches the felt symbol out of the child’s hand, then places it up on a felt board for later review and manipulation. The puppet may also be used as an additional communication partner to increase repetitions. For example, the child produces the target phonemes with the clinician’s puppet as an audience, or, alternately, lets the clinician’s puppet take a turn by placing the felt symbol on the cloth puppet so the symbol sticks. The manipulability of the FONEMZ symbols and compatibility of the felt symbols with a cloth puppet makes it easy for the puppet to add a relaxed, playful nature to therapy. Puppets with manipulable mouths are particularly useful for this strategy. After the clinician produces the target phoneme and sticks the felt FONEMZ symbol to his or her shirt, the symbol can then be stuck to the cloth puppet for the puppet to imitate the clinician, taking pressure off the client. This give-and-take between the clinician and the puppet may be used to model the process of imitation for a reluctant client.

The second of DeThorne et al.’s strategies that can be easily implemented in FONEMZ therapy is for the clinician to imitate the child. DeThorne et al. maintained that the clinician’s imitations of the child not only produce another low-pressure communicative situation; they also model the process of imitation itself. For a child who does not imitate independently, such modeling may be a way of teaching this important skill for learning spoken language (Masur & Eichorst, 2002, Schwartz & Leonard, 1985, Snow, 1989, as cited in DeThorne et al., 2009).
The third strategy described by DeThorne et al. that is relevant to FONEMZ therapy is to augment sensory feedback for children who are less able to capitalize on it in traditional therapy settings. A puppet with a manipulable mouth may aid in providing additional visual input during phoneme production, in addition to the corresponding FONEMZ symbols. This may also follow the first strategy of reducing the pressure for the child to attend to the articulatory movements of the adult. The very visual nature of the FONEMZ symbols’ distinct color and shape for every phoneme also follows this strategy, as well as the tactile nature of the felt and cardstock/magnet symbols.
Chapter 3

METHODOLOGY

The purpose of this research was to determine whether there was a significant relationship between FONEMZ therapy and increase in articulatory accuracy of phonemes previously produced in error when compared to the results of traditional articulation therapy. The hypothesis was that the most significant improvement in the subjects’ articulation of the target sounds would take place during the period of FONEMZ therapy. An additional hypothesis was that over the course of the study, the subjects’ phonological awareness would improve.

Research Design

A single-subject multiple-baseline ABCA research design was used to compare the effectiveness of traditional articulation therapy and FONEMZ therapy for each of two four-year-old subjects, Jay and Al (whose real names are not being used in this paper). Each session of therapy lasted for 30 minutes. The first “A” section included four baseline sessions focusing on language-based interactive activities in which no articulation therapy was performed. The baseline period was followed by the “B” section: four sessions of traditional articulation therapy, including repeated drill with auditory/verbal presentation. Next, each subject was trained in the use of the FONEMZ
program over eight sessions, which made up the “C” section. The second “A” section had the same format as the first “A” section, focusing on language-based therapy and a withdrawal of any articulation-based therapy. It also occurred over four sessions, using the same assessment instrument (probe) as was used throughout the study.

In choosing the target sound for each subject, many factors were considered, including consistency of error production and developmental appropriateness. Jay was beginning to correctly produce /f/, so that sound was excluded. While /l/ is a slightly later developing sound for his age range, it was considered to be an attainable challenge for him. Two other sounds that were in error (/θ, k/) were chosen as sounds that were not targeted in therapy but were monitored for improvement. Al misarticulated /l/, /k/ and /t/. Because it was considered to be a slightly later-developing phoneme than the others, /l/ was chosen as the target sound. Two other phonemes that each subject misarticulated consistently were monitored for improvement, but not treated. Jay’s non-target error phonemes were /k/ and /θ/, while Al’s were /k/ and /t/.

<table>
<thead>
<tr>
<th></th>
<th>Target phoneme</th>
<th>Non-target error phonemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jay</td>
<td>l</td>
<td>k, θ</td>
</tr>
<tr>
<td>Al</td>
<td>f</td>
<td>k, t</td>
</tr>
</tbody>
</table>

Table 2. Jay and Al’s target and non-target error phonemes

At the end of each therapy session, production accuracy of a target phoneme and two non-target phonemes were probed using picture cards that had the target and non-target phonemes in word-initial position. There were five cards per phoneme, totaling 15
picture cards per probe. During each probe, the cards were presented in a random order. The second part of the probe included the presentation of each of the three FONEMZ symbols corresponding to the subject’s target and non-target phonemes. The subject was asked to identify the FONEMZ symbol.

During baseline, the clinician focused on language therapy, including basic concepts ("same/different", "not", spatial concepts, etc.) and interactive activities involving the development of reciprocal dialogs with shared intent (dollhouse play, book reading, object to picture matching, etc.).

The period of traditional articulation therapy consisted of tactile and kinesthetic stimulation for phonetic placement, auditory bombardment with the subject’s imitation of the clinician’s productions, and use external manipulatives such as pinwheels, feathers, and other objects that could be easily moved with the expiration of air. Token reinforcement was used to keep the subjects’ attention during these activities.

During FONEMZ therapy, the clinician first presented non-target FONEMZ that the subject could produce with consistent accuracy (as opposed to the non-target error phonemes that were monitored for each subject and described in Table 2): the vowels /α, u, i/ and the consonants /b, p, m/, in conjunction with a verbal model of each corresponding phoneme. The subject was in charge of choosing one of the FONEMZ out of a container. He then listened to the clinician’s production as she held the shape near her mouth. After the imitation attempt, he was allowed to feed the shape to a puppet. Next, the subject placed the FONEMZ on the felt board or in the pocket chart for further examination and comparison. At the end of each session, the FONEMZ were sorted into
their proper places in the segmented containers used for storage of the FONEMZ. Whenever possible, the subject was in charge of manipulating the FONEMZ. When the subject was able to volitionally label FONEMZ symbols without a clinician model, the target phoneme was introduced. For example, on day two of FONEMZ therapy, Jay chose the /α/ FONEMZ shape and said /α/ without a model from the therapist. On the third day, he did this with 3 other FONEMZ, so the /l/ FONEMZ shape was introduced. His next goal was to start blending /l/ plus vowel FONEMZ shapes and to associate it with words. Therapy progressed by blending combinations of /l/ with more vowel sounds and blending combinations of various other (non-targeted) CV sounds in order to strengthen the subject’s comprehension of phoneme blending and the construction of words using phonemes.

Participants

Clinician and Participant Selection

The clinician for all therapy sessions was Sandy Kaul, MA, CCC-SLP, the creator of the FONEMZ approach. The two subjects chosen for the study, Jay and Al, exhibited severely unintelligible speech and were reported by their classroom teachers and instructional aides to become frustrated during communicative exchanges with family members, teachers and peers. These subjects were selected for this project because of the severity of their speech deficiency and because neither had ever received any previous
speech therapy. All demographic information on these subjects was obtained from the clinician (S. Kaul, personal communication, February 11, 2009).

Jay

At the time of initial assessment, Jay was four years and one month old. His articulation was evaluated using the Arizona Articulation Proficiency Scale, Third Edition (AAPS-3; Fudala, 2000). His phonological awareness was assessed using the Phonological Awareness Literacy Screening – PreK (PALS-PreK; Univ. of Virginia, 2007). Jay’s language was assessed using the Peabody Picture Vocabulary Test, Third Edition (PPVT-III; Dunn & Dunn, 1997), the Preschool Language Scale 4 (PLS-4; Zimmerman, Steiner, & Pond, 2002), and a language sample. He received an AAPS-3 rating score of 67.5, which is classified by that assessment as a severe articulation deficiency characterized by multiple sound substitutions, distortions, and omissions. His speech contained the phonological processes of fronting, final consonant deletion, prevocalic voicing, and consonant simplification. During the course of the assessment, it was noted that Jay displayed difficulties with visual focus and did not appear to process many of the simple directions and requests. The results of the PALS-PreK indicated that his phonological awareness was below that expected for early reading success. He could not identify any of the initial sounds in the words presented or associate sounds with letters of the alphabet; in fact, he scored zero on every subtest of the PALS-PreK. The results for this measure appear in Appendix A. As a baseline item, he was presented with a preliminary array of FONEMZ symbols and, as expected, Jay was unable to identify
any of them because he had never been exposed to them. The PPVT-III and PLS-4 indicated that Jay had significant deficits in both receptive and expressive language. The results of Jay’s standardized tests appear in Appendix A. The language sample, which was compiled during play-based activities and transcribed by the assessing clinician, indicated that Jay frequently produced unintelligible utterances with sentence-like intonation patterns. He also frequently repeated the last one or two words that he had heard. He averaged one intelligible word per utterance, which made comparison to a norm difficult. An average Mean Length of Utterance (MLU) for a student Jay’s age, however, is 4.8 words.

Al

At the time of initial assessment, Al was four years and three months old. His articulation was evaluated using the AAPS-3. His AAPS-3 rating score of was 64, which the test classifies as a severe articulation deficiency characterized by multiple sound substitutions, distortions, and omissions. His speech contained the phonological processes of fronting, final consonant deletion, prevocalic voicing, and consonant simplification. Al’s phonological awareness was assessed using the PALS-PreK. In all but the areas of Beginning Sound Awareness and Rhyme Awareness, Al’s phonological awareness skills were below that expected for early reading success. The results of this measure appear in Appendix B. When presented with a preliminary array of FONEMZ symbols for the baseline, Al was also unable to identify any of them, as expected. Al’s language was assessed using the PPVT-III, the PLS-4, and a language sample. The results of the standardized tests also appear in Appendix B. The PPVT-III and PLS-4
indicated that Al’s receptive and expressive language were in the average to above average range for his age. The language sample, which was compiled during play-based activities and transcribed by the assessing clinician, revealed an MLU of 4.0. An average MLU for a student Al’s age is 5.4 words. However, 25% of Al’s words were judged to be unintelligible.

Procedures

*Materials and Techniques*

During the traditional therapy sessions, therapy included the use of pinwheels, tongue depressors, toothettes, plastic microphones, objects (small dolls, animals and other concrete items), picture cards, auditory bombardment, and attempted repetitions.

When the FONEMZ approach was initiated, subjects were introduced to the FONEMZ shapes using Felt FONEMZ. Four predetermined FONEMZ shapes were chosen by the clinician and placed in a container. All of the phonemes that were chosen were sounds the subject could make. The subject chose one shape at a time from a container. The clinician accepted the chosen shape and held it near her mouth, labeling it as she did so. The shape was placed on the subject’s clothing, with the expectation that he repeat it also. When he did, a puppet ate the shape. The subject was directed to place the shape on a felt board and the process was repeated. When the subject demonstrated the ability to retain the labels (phonemes) that were associated with each shape, the target sounds (FONEMZ) were introduced. FONEMZ were combined in vowel-plus-consonant
(VC) and consonant-plus-vowel (CV) combinations. Fun FONEMZ, a version of the same shapes and colors made out of rigid card stock, were used in numerous activities involving manipulation on a pocket chart. Patterns were revealed, by placing the FONEMZ in a left to right progression on felt boards or pocket charts. Spoken words, objects and pictures were associated with these combinations.

Data Analysis

All of the probes were video-recorded. A DVD was made for each subject with the probes in random order so that judgments could not be affected by preconceptions or expectations for improvement. Six judges watched the DVDs separately, not as a group, and transcribed the subjects’ productions on each of the probe items, with three judges transcribing the videos of all twenty probes for each subject. Judges were undergraduate students in the Speech Pathology and Audiology program at California State University, Sacramento who had successfully completed a course in phonetics designed for speech-language pathology transcription that trained them to transcribe the most accurate phonetic representation of what they heard. They were provided with a list of the 15 words that each subject would say during the probes. The judges were not told which phoneme was the subject’s target. Each time a subject was probed, the pictures of each of the 15 words were presented as a stimulus for the subject, enabling the judges to locate it on the assessment form. The judges were allowed to replay the video as needed to determine the actual production of the subject.
After the judges had completed their transcription of the DVDs, the author scored each of the transcriptions as either correct or incorrect productions based on his knowledge of the probe items presented. This was indicated by either a plus (+) or minus (-). Every production’s score was entered into a spreadsheet as either a one (1) for correct or a zero (0) for incorrect for further analysis using IBM® SPSS® Statistics, an advanced statistical analysis software program.

Reliability

To ensure inter-rater reliability, three judges transcribed the DVDs of each subject’s probes. For intra-rater reliability, the clinician, Sandy Kaul, coded each probe session with a letter of the alphabet, A through T, in a random order. Only the author received a copy of the key. As a result, when the judges transcribed the probes, they did not know when each probe had taken place or whether or not the subject had received any therapy before the time of the probe. When the transcription sheet was scored with + and – for each production, the author did not refer to the key in any way, in order to avoid knowing whether or not therapy had taken place prior to the productions on the transcription sheets.
Chapter 4

RESULTS

Jay

During the baseline period and the period of traditional articulation therapy, Jay produced a range of accuracy across the three phonemes: the target /l/ and non-target error phonemes /k, θ/, with high variability ranging between 0% and approximately 30% accuracy.

Jay began FONEMZ therapy with the introduction of only non-target FONEMZ for two days, during which time he produced a percentage of accuracy below 10% on all three phonemes. The target FONEMZ symbol was introduced on the third day of the FONEMZ period. Jay began to demonstrate variably improved numbers of correct productions on the fifth day of FONEMZ therapy with the target phoneme.

During the period of withdrawal of therapy, Jay continued to display variable accuracy of the target phoneme, with a marked decrease to 0% accuracy on all three phonemes during the last two sessions. The results of Jay’s probes appear below in Figure 1.
ANOVAs were performed on the results of Jay’s probes in order to determine whether or not there were statistically significant differences between various pairings of the variables. Despite Jay’s low scores, there were significant differences ($F = 16.88, p < .0001$) in percentage of accuracy across phonemes, particularly for the target /l/ phoneme used in the initial position in words. The effect of the number of sessions Jay had undergone was not significant ($F = 1.4, p = .161$). Any trends of accuracy over sessions are more visible when looking at the graph of mean percentage accurate over sessions. There was also no significant interaction of phoneme by session ($F = 1.58, p < .058$),
likely due to the high variability across sessions and low scores over sessions. Again, any trends are more apparent in the graph of mean percentage accurate over sessions.

During a follow-up assessment, Jay received a score of 75 on the AAPS-3, which was an improvement from his pre-treatment score of 67.5, but placed him in the same diagnostic category of “severe deficiency in articulation” as before the study. His scores on the PALS-PreK, which appear in Appendix A, demonstrated improvement on three of seven subtests, most noticeably in the area of Beginning Sound Awareness.

Al

During the baseline period, Al demonstrated extremely low percentages of accuracy for the target phoneme /f/ and a non-target error phoneme /k/, characterized by 0% accuracy on both phonemes in the first 3 sessions and approximately 8% accuracy on both phonemes in the 4th session. His accuracy on the non-target error phoneme /t/ was extremely variable, ranging from 0% to over 40% accuracy across sessions. During the period of traditional articulation therapy, Al achieved 0% accuracy on the /f, k/ phonemes across all four sessions. He achieved variable performance ranging from 25% to 60% accuracy on the non-target phoneme /t/.

On the first day of FONEMZ therapy, Al generated volitional productions of non-target vowels and consonants with the second presentation of the FONEMZ symbols. Because he demonstrated the ability to independently differentiate and retain these FONEMZ, his target FONEMZ symbol for /f/ was introduced. His performance on the
target phoneme improved markedly during the first 6 FONEMZ sessions, until which time he achieved 100% accuracy on that phoneme. His performance on the /k/ phoneme remained at 0% during this period and his performance on /t/ continued to be highly variable.

During the period of withdrawal of therapy, Al continued to achieve 100% accuracy on the target phoneme /f/. His performance on the non-target phonemes also improved, characterized by a sharp increase in the percentage accuracy of the /k/ phoneme, ending with 60% accuracy on that phoneme in the last session. His performance on /t/ also improved, with 90% accuracy in the second to last session. The results of Al’s probes appear below in Figure 2.

![Figure 2. Al’s words correctly articulated.](image)
ANOVAs were performed on the results of Al’s probes in order to determine whether or not there were statistically significant differences across the variables. There were significant differences (F = 136.93, p < .0001) in percentage of accurate phoneme production, particularly for the target phoneme /f/ and the non-target phoneme /t/. This is characterized by the fact that these two phonemes had significantly more correct productions during the study. The number of sessions of therapy Al had undergone was also significant (F = 24.93, p < .0001). However, the most noteworthy significance was that of the interaction of phoneme by session (F = 7.54, p < .0001). Post Hoc Analyses revealed that the FONEMZ sessions had the most effect on accuracy of productions, particularly for the target phoneme /f/ and the non-target phoneme /t/. It was also noted that Al demonstrated an extreme increase in accuracy of the non-target phoneme /k/ during the period of withdrawal from therapy. This did not create a statistically significant difference for this phoneme across sessions because it occurred so late in the study that it only impacted Al’s scores in 3 sessions.

During follow-up assessment, Al received a score of 79.5 (moderate deficiency in articulation) on the AAPS-3, which demonstrated an improvement from his previous score of 64 (severe deficiency in articulation). Re-evaluation using the PALS-PreK, demonstrated a significant improvement, placing him at or above the range for early reading success in the categories of Upper-Case Recognition, Lower-Case Recognition, Beginning Sound Awareness, Print and Sound Awareness, and Rhyme Awareness. The results for the post-treatment PALS-PreK appear in Appendix B.
Chapter 5

DISCUSSION

This study demonstrated the effect that the FONEMZ approach appeared to have in teaching two subjects with severe articulation disorders and low phonological awareness, one with delayed language (Jay) and one with average to above average language (Al), to produce a target phoneme with a greater frequency of accuracy than was elicited through traditional articulation therapy. The two subjects responded somewhat differently to the study.

The clinical implications of Jay’s improvement extend beyond the numerical results of his probes. He demonstrated variable performance on all three phonemes during the baseline and traditional articulation therapy periods. His accuracy began an upward climb after introduction of the target FONEMZ symbol, but therapy was withdrawn before additional data could be gathered. Jay’s improvement in articulation was relatively slow and continued to progress over time, although this was not part of the investigation. This slow progress, when coupled with his low scores in language and phonological awareness, paralleled the observation of Adams (1990), that a strong language base of word understanding correlates with a “thorough understanding that words can be completely analyzed into a series of phonemes.” It was noted that Jay’s PreK-PALS score in Beginning Sound Awareness, a phonemic awareness skill, increased from 0 to 4 over the course of the twenty-session study (see Appendix A). At the end of
this study, Jay was referred for continuation of FONEMZ therapy to confirm the hypothesis that his articulation and phonological awareness would continue to improve with further therapy of this type. Goals in expressive and receptive language were also recommended.

Al’s accuracy improved significantly upon introduction of the FONEMZ approach. The FONEMZ therapy integrated sound-symbol association and articulation to increase Al’s awareness of his productions of the target sound. During the course of the FONEMZ therapy, Al began to generalize his knowledge to the other error phonemes in the non-target words. It is hypothesized that this occurred because he had acquired the phonemic awareness and self-awareness skills necessary to identify individual phonemes and change his production of them. Al’s improved performance on the PreK-PALS suggests this by demonstrating a marked increase in his Beginning Sound Awareness (100%), which is a skill specifically targeted by the FONEMZ therapy.

Al produced the target words with 100% accuracy on the sixth day of FONEMZ therapy. He continued to produce all five of these words with greater than 80% accuracy through the final day of FONEMZ therapy. It may be speculated that Al could have moved on to a different target phoneme after fewer days of FONEMZ therapy and continued to improve his articulation. However, the target phoneme /d/ was used in all 8 sessions of FONEMZ therapy due to the structure of the study. Further research could investigate the optimal period of time to target a particular phoneme within FONEMZ therapy, dependent on the performance of the subject.
This study concurs with the work of both Roberts (2005) and Kamhi (2006) that together highlight the interrelatedness and reciprocity between articulation and phonemic awareness training. The FONEMZ approach, through introduction of a specific visual aid that mirrors the development of the phonological and oral language symbol development system, appeared to facilitate this process. Both subjects learned to manipulate the FONEMZ symbol that corresponded with their target phoneme, while simultaneously learning to produce that phoneme with increased accuracy and improved phonological awareness skills. Al, who did not demonstrate concomitant receptive and expressive language difficulties, also demonstrated improved literacy skills across a spectrum of subtests designed to measure reading readiness in the area of decoding (see Appendix B).

Clinical Implications

The positive results of this study bode well for the subjects’ potential in acquisition of decoding skills. Hulme et al. (2002) found that phonemic awareness was the best predictor of early reading skill. The FONEMZ therapy appeared to facilitate the subjects’ developing sound-symbol association, familiarizing them with the alphabetic principle described in Schuele & Boudreau (2008), which is an essential skill in the acquisition of literacy. This may be particularly true for those students who do not have concomitant receptive and expressive language difficulties as was apparent with Al. Both subjects consistently assembled sound combinations in a left to right progression, a
necessary component of English literacy. When the subjects’ construction of FONEMZ combinations that depicted real words, e.g. /fud/, was associated with the real letters used to spell "food", the subjects may have also begun to understand the significance of letter identification needed to spell. As seen with Al, alphabet recognition increased significantly (Appendix B). Using FONEMZ, the transition from saying sounds to building sound combinations to building words to connecting the letters to the sounds and spelling words to reading those words, is a natural sequence. In Jay’s case, his concomitant language and phonological disorders and his slow progress in acquiring phonological awareness skills matches Ehri’s (2001, as quoted in Ukrainetz, Ross, and Harm, 2009)’s findings that children with lower language skills make slower progress in phonemic awareness. It is also significant to note that Ukrainetz et al. maintained that it is such children who can benefit most from explicit intervention.

Further Directions: Response to Intervention

Response to Intervention (RTI) is a multi-tiered, problem-solving approach aimed at addressing the learning difficulties of all children in the educational setting (Jackson, Pretti-Frontczak, Harjusola-Webb, Grisham-Brown, & Romani, 2009). The goal of RTI is to embed service delivery within the general education setting in order to target both children in special education and those who are at risk for academic failure. As Jackson et al. (2009) described, RTI’s three tiers are designed to address students’ differing levels of need for services. While evidence has not yet been published on this front, it is
hypothesized that the FONEMZ approach may be effectively integrated into any of these tiers.

Tier 1 targets broad-based standards that are held for all children. The FONEMZ approach, through its focus on the sound system and simplified symbol system designed as an intermediary between phonemic awareness and traditional orthography, may be integrated into a Language Arts curriculum as part of the process of teaching a general education classroom to read. This may be especially useful at the preschool and kindergarten levels, in which students are developing phonological awareness – in particular, phonemic awareness – and may find adding the visual modality, without the confusion of irregular English orthography, to be of use.

The target of Tier 2 interventions is to address the needs of children who require additional practice and support to develop the skills necessary for the broad-based general education standards. FONEMZ may be particularly helpful at the Tier 2 level for children who are struggling with traditional orthography in the later grades and need a simpler visual system as a stepping-stone to increase their phonemic awareness. Also, FONEMZ may be useful for Tier 2 speech sound intervention for children who need assistance discriminating between speech sounds in order to correct their errors. If the speech-sound errors are not severe enough to qualify for pullout therapeutic services, but they could benefit from some intermediary intervention, FONEMZ may be helpful in this situation. The classroom teacher or other personnel could use FONEMZ with the student in order to augment his/her understanding and use of speech sounds. The monitoring of progress in Tier 2 is critical to the success of RTI because lack of progress with Tier 2
interventions may indicate the need for more intensive Tier 3 intervention (Jackson et al.).

Tier 3 focuses on instruction in the underlying prerequisites for broad-based education standards. Tier 3 most commonly manifests itself in intensive, direct services based on a student’s priority needs. This study was an example of the use of FONEMZ in a Tier 3 pullout therapy setting. As demonstrated, FONEMZ may be extremely beneficial in increasing the speech skills of children in need of direct intervention.
APPENDICES
APPENDIX A

Jay’s Test Scores

*Jay’s pre-treatment scores on the PreK PALS*

<table>
<thead>
<tr>
<th>Section</th>
<th>Score</th>
<th>Range – Early Reading Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-Case Recognition</td>
<td>0</td>
<td>12-21</td>
</tr>
<tr>
<td>Lower-Case Recognition</td>
<td>0</td>
<td>9-17</td>
</tr>
<tr>
<td>Letter Sounds</td>
<td>0</td>
<td>4-8</td>
</tr>
<tr>
<td>Beginning Sound Awareness</td>
<td>0</td>
<td>5-8</td>
</tr>
<tr>
<td>Print and Word Awareness</td>
<td>0</td>
<td>7-9</td>
</tr>
<tr>
<td>Rhyme Awareness</td>
<td>0</td>
<td>5-7</td>
</tr>
<tr>
<td>Nursery Rhyme Awareness</td>
<td>0</td>
<td>6-10</td>
</tr>
</tbody>
</table>

*Jay’s pre-treatment scores on the PPVT-III*

<table>
<thead>
<tr>
<th>Standard Score</th>
<th>Percentile</th>
<th>Age Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>78</td>
<td>7</td>
<td>1-9</td>
</tr>
</tbody>
</table>

*Jay’s pre-treatment scores on the PLS-4*

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Standard Score</th>
<th>Percentile</th>
<th>Age Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Comprehension</td>
<td>71</td>
<td>3</td>
<td>2-4</td>
</tr>
<tr>
<td>Expressive Communication</td>
<td>74</td>
<td>4</td>
<td>2-4</td>
</tr>
<tr>
<td>Total Language Score</td>
<td>70</td>
<td>2</td>
<td>2-4</td>
</tr>
</tbody>
</table>
**Jay’s post-treatment scores on the PreK PALS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Score</th>
<th>Range – Early Reading Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-Case Recognition</td>
<td>1</td>
<td>12-21</td>
</tr>
<tr>
<td>Lower-Case Recognition</td>
<td>1</td>
<td>9-17</td>
</tr>
<tr>
<td>Letter Sounds</td>
<td>0</td>
<td>4-8</td>
</tr>
<tr>
<td>Beginning Sound Awareness</td>
<td>4</td>
<td>5-8</td>
</tr>
<tr>
<td>Print and Word Awareness</td>
<td>0</td>
<td>7-9</td>
</tr>
<tr>
<td>Rhyme Awareness</td>
<td>0</td>
<td>5-7</td>
</tr>
<tr>
<td>Nursery Rhyme Awareness</td>
<td>0</td>
<td>6-10</td>
</tr>
</tbody>
</table>
APPENDIX B

Al’s Test Scores

*Al’s pre-treatment scores on the PreK PALS*

<table>
<thead>
<tr>
<th>Section</th>
<th>Score</th>
<th>Range – Early Reading Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-Case Recognition</td>
<td>6</td>
<td>12-21</td>
</tr>
<tr>
<td>Lower-Case Recognition</td>
<td>8</td>
<td>9-17</td>
</tr>
<tr>
<td>Letter Sounds</td>
<td>2</td>
<td>4-8</td>
</tr>
<tr>
<td>Beginning Sound Awareness</td>
<td>5</td>
<td>5-8</td>
</tr>
<tr>
<td>Print and Word Awareness</td>
<td>4</td>
<td>7-9</td>
</tr>
<tr>
<td>Rhyme Awareness</td>
<td>7</td>
<td>5-7</td>
</tr>
<tr>
<td>Nursery Rhyme Awareness</td>
<td>3</td>
<td>6-10</td>
</tr>
</tbody>
</table>

*Al’s pre-treatment score on the PPVT-III*

<table>
<thead>
<tr>
<th>Standard Score</th>
<th>Percentile</th>
<th>Age Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>88</td>
<td>5-8</td>
</tr>
</tbody>
</table>

*Al’s pre-treatment scores on the PLS-4*

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Standard Score</th>
<th>Percentile</th>
<th>Age Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Comprehension</td>
<td>106</td>
<td>66</td>
<td>4-7</td>
</tr>
<tr>
<td>Expressive Communication</td>
<td>118</td>
<td>88</td>
<td>5-5</td>
</tr>
<tr>
<td>Total Language Score</td>
<td>114</td>
<td>82</td>
<td>5-1</td>
</tr>
</tbody>
</table>
### Al’s post-treatment scores on the PreK PALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Score</th>
<th>Range – Early Reading Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper-Case Recognition</td>
<td>23</td>
<td>12-21</td>
</tr>
<tr>
<td>Lower-Case Recognition</td>
<td>20</td>
<td>9-17</td>
</tr>
<tr>
<td>Letter Sounds</td>
<td>3</td>
<td>4-8</td>
</tr>
<tr>
<td>Beginning Sound Awareness</td>
<td>10</td>
<td>5-8</td>
</tr>
<tr>
<td>Print and Word Awareness</td>
<td>7</td>
<td>7-9</td>
</tr>
<tr>
<td>Rhyme Awareness</td>
<td>7</td>
<td>5-7</td>
</tr>
<tr>
<td>Nursery Rhyme Awareness</td>
<td>4</td>
<td>6-10</td>
</tr>
</tbody>
</table>
REFERENCES


