2001

Individual Phonological Awareness Intervention for Children with Phonetically-Based Reading Difficulties

Kara E. Hilgenberg
Eastern Illinois University

THESIS/FIELD EXPERIENCE PAPER REPRODUCTION CERTIFICATE

TO: Graduate Degree Candidates (who have written formal theses)

SUBJECT: Permission to Reproduce Theses

The University Library is receiving a number of request from other institutions asking permission to reproduce dissertations for inclusion in their library holdings. Although no copyright laws are involved, we feel that professional courtesy demands that permission be obtained from the author before we allow these to be copied.

PLEASE SIGN ONE OF THE FOLLOWING STATEMENTS:

Booth Library of Eastern Illinois University has my permission to lend my thesis to a reputable college or university for the purpose of copying it for inclusion in that institution's library or research holdings.

3-23-01
Date

I respectfully request Booth Library of Eastern Illinois University **NOT** allow my thesis to be reproduced because:

_____

_____

_____

_____ _____

Author's Signature Date

Individual Phonological Awareness Intervention for Children with
Phonetically-Based Reading Difficulties
(TITLE)

BY

Kara E. Hilgenberg, B.S.

1977 -

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE

IN THE DEPARTMENT OF COMMUNICATION DISORDERS AND SCIENCES,
EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2001
YEAR

I HEREBY RECOMMEND THAT THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

2-9-01
DATE

DATE

2/9/01
DATE

Feb. 9, 2001
DATE

Running Head: Individual Phonological Awareness Intervention

Individual Phonological Awareness Intervention for Children with Phonetically Based Reading Difficulties

by

Kara E. Hilgenberg, B.S.

Eastern Illinois University

ABSTRACT

Many researchers have reported that phonological awareness training is highly related to the acquisition of pre-reading skills (Ball & Blachman, 1991; Lundberg, Frost, & Peterson, 1988) and that phonological awareness should be a part of any good reading curriculum (Adams, 1990; Blachman, 1989). In addition, when phonological awareness is taught in the classroom it has been proven that class averages of phonological awareness skills improve (Blachman, 1991; Barnes, Smitley, & Throneburg, 1998). However, the research also suggests that students with speech and/or language disorders often exhibit poor reading skills (Gillam & Carlile, 1997; Menyuk & Chestnick, 1997). The purpose of the current study was to determine if phoneme awareness and blending/segmenting skills of three first grade children with speech/language disorders improved after individual phonological awareness training. The three subjects were involved in a classroom based phonological awareness program during their kindergarten year, but their scores were greater than one standard deviation below the class mean. During 8 weeks of individual training, the percentage for accuracy of phoneme awareness and blending increased significantly in all three subjects.

ACKNOWLEDGMENTS

First and foremost, I would like sincerely thank Dr. Rebecca Throneburg, Mrs. Jean Smitley, Dr. Mary Anne Hanner, and Dr. Christine McCormick for their assistance in completing this thesis. Once again, I would like to thank Dr. Throneburg and Mrs. Smitley for their perseverance and commitment to yet another research project. The many, many hours you have contributed are greatly appreciated. I would also like to thank Jamie Labuda for her assistance in the treatment and data collection for this project.

Most importantly, I would like to thank my parents for their support throughout my educational program. Their love and encouragement manifested in me a desire for learning and the perseverance needed to help me achieve this goal. This experience has been a rewarding one and I am thankful to everyone who helped make it possible.

TABLE OF CONTENTS

ABSTRACT ii

ACKNOWLEDGMENTS iii

LIST OF TABLES vi

LIST OF FIGURES vii

CHAPTER

I. INTRODUCTION 1

II.REVIEW OF THE LITERATURE 4
Overview 4
Reading Development 4
Phonological Awareness 5
Phonological Awareness and Reading Ability 8
Phonological Awareness Training in the Classroom by Teachers 9
Students with Speech and/or Language Disorders 11
Phonological Awareness: Intervention for Children with Speech-Language Disorders 13
Phonological Awareness Training for Children with Phonetically Based Reading Difficulties 17
Summary and Statement of Objectives 21

III. METHODS 25
Subjects 25
Design and Procedure 29
Behavior I: Phoneme Awareness 30
Response Measure 30
Experimental Conditions 30
Baseline 30
Treatment 31
Behavior II: Blending and Segmenting 34
Response Measure 34
Experimental Conditions 36
Baseline 36
Treatment 36
Assessment 38
Reliability 38

IV. RESULTS 39
Behavior I: Phoneme Awareness 39
Behavior II: Blending and Segmenting 42
Phonological Awareness Test 47

V. DISCUSSION 51
Summary of Results 51
Interpretation/Explanation of Results 52
Relation to Past Studies/Research 55
Practical Implications 57
Limitations of the Study 58
Future Research 58

REFERENCES 55

APPENDIX A 71

LIST OF TABLES

Table		Page
1.	Standard Scores/Percentiles for Subject A	27
2.	Standard Scores/Percentiles for Subject B	28
3.	Standard Scores/Percentiles for Subject C	29
4.	Staggered Baseline Measures for Behavior I	31
5.	Format of Treatment Segment (2 per session) for Behavior I	32
6.	Order of Treatment Tasks for Behavior II	36

LIST OF FIGURES

Figure		Page
1.	Phonological Awareness Skills and Approximate Age of Development	7
2.	Percent accuracy for Subject A for Behavior I: Phoneme Awareness	40
3.	Percent accuracy for Subject B for Behavior I: Phoneme Awareness	40
4.	Percent accuracy for Subject C for Behavior I: Phoneme Awareness	41
5.	Percent accuracy of real and pseudo word blending and segmenting for Subject A	44
6.	Percent accuracy of real and pseudo word blending and segmenting for Subject B	45
7.	Percent accuracy of real and pseudo word blending and Blending/Segmenting for Subject C	46
8.	Pre- and post-test scores for the three subjects on the PAT	48
9.	Scores for all subjects from portions of the graphemes and decoding subtests of the PAT	49

CHAPTER I

Introduction

The role of linguistic awareness in oral and written language development has generated a great deal of interest among educators and others who work with children with language disabilities. The study of linguistic awareness is particularly important in educational research because of its relationship to reading acquisition (Warrick Rubin, & Rowe-Walsh, 1993). Although there are numerous theories concerning the development of reading skills, the relationship between phonological awareness and reading skills has been well documented by a number of researchers (Ball & Blachman, 1991; Lundberg, Frost, & Peterson, 1988).

Phonological awareness involves the ability to reflect on and manipulate the sounds of an utterance without regard to word meaning. Many tasks such as rhyme production, isolation of sounds, sound segmentation, and sound blending are used to assess phonological awareness skills in children. According to researchers, information from these phonological awareness tasks can largely predict a child's future reading ability (Lundberg, Olofsson, & Wall, 1980; Swank & Catts, 1994). Catts, Fey, Zhang, and Tomblin (1998) reported that approximately 70% of poor readers exhibit poor phonological awareness skills.

More than 30 studies in the last 20 years have documented the effectiveness of phonological awareness training. In nearly half of these studies, phonological awareness training was provided by the classroom teacher (Blachman, 1991; Bradley & Bryant, 1983). Collectively these studies suggested that class performance means improved on measures of reading following phonological awareness training.

Numerous studies have indicated that phonological awareness training improves classroom averages of "normal" learners. However, considerable debate continues as to the best method to teach children who are at risk for reading difficulties due to poor phonological awareness skills. The American Speech-Language-Hearing Association (ASHA) has recently stated that speech-language pathologists have unique knowledge and skills to address phonological awareness and written language in children who are not succeeding in literacy. In the past there have been frequent recommendations by educators to teach these children using sight word or visually based approaches that minimally involve the children's limited phonological abilities. Some authors have reported that it is quite difficult to teach phonetic reading skills to children with phonologically based reading difficulties (Lovett, Warren-Chaplin, Ransby & Borden, 1990; Lyon, 1985; Snowling & Hulme, 1989); while other researchers have reported significant success in building functional alphabetic reading skills in children with phonologically based reading difficulties (Alexander, Anderson, Heilman, Voeller, & Torgesen, 1991; Brown & Felton, 1990, Lovett, et al., 1994).

Traditional programs in phonological awareness have emphasized the acoustic/auditory properties of phonemes and have included activities such as listening for sounds in words, segmenting and blending sounds, and letter/sound correspondence. On the other hand, researchers such as Lindamood have suggested that by helping children discover the articulatory positions, movements and feel associated with phonemes, children experience a deeper level of phonological processing than when training involves auditory awareness only. Alexander et al.

(1991) reported that the Lindamood Auditory Discrimination in Depth Program (ADD) improved phonological awareness skills of children between the ages of 7:9 and 12:9. Kennedy and Backman (1993) questioned the effectiveness of the ADD program and found that ten students with severe learning disabilities (age 11-17) who received the ADD plus a comprehensive remedial program, performed similarly to a group of children with severe learning disabilities who received only a remedial program.

Speech-language pathologists have substantial knowledge about acoustic and motoric aspects of phoneme production. ASHA (2000) has suggested that speech-language pathologists should play a role in the prevention and remediation of language-based reading difficulties.

Although speech-language pathologists can collaborate with classroom teachers to provide effective phonological awareness for the class as a whole (Barnes, Smitley, & Throneburg, 1998), it is important for speech-language pathologists to treat children individually who did not succeed in classroom phonological awareness training (Swank & Catts, 1994).

The purpose of the present study was to evaluate the effectiveness of individual phonological awareness training for three children who received phonological awareness training in their classroom during kindergarten, but evidenced minimal phonological awareness skills in initial sounds, phoneme-grapheme knowledge, and invented spelling. A multiple baselines across subjects evaluated the effectiveness of individual phonological awareness training for phoneme-grapheme and phoneme blending skills.

CHAPTER II

Review of the Literature

Overview

Several areas of literature have been reviewed and included in the present chapter. The chapter begins with definitions of reading and its components as well as two theories regarding the development of decoding skills. Phonological awareness, its importance to decoding, and it's development is then presented. Children with speech and language disorders are at a high risk for difficulties with phonological awareness skills. A review of studies investigating the incidence of reading difficulties in children with speech-language disorders and phonological awareness intervention with these children is presented. Finally intervention studies for children with phonetically-based reading difficulties are discussed with the inclusion of programs that contain emphasis on the articulatory features and voicing of phonemes.

Reading Development

Reading can be defined as the process by which meaning is constructed from printed symbols. Gough and his colleagues (Gough & Tunmer, 1986; Hoover & Gough, 1990) have proposed that reading ability is directly related to children's single word decoding and comprehension skills. Decoding refers to the word recognition process that transforms print to words. Word recognition can occur through a direct visual route (i.e., visual, orthographic) or an indirect phonetic route using sound-symbol correspondence. Comprehension is the process by which words, sentences and discourses are interpreted (Catts & Kamhi, 1999).

Although the development of single word decoding is still being debated, there are two theories that are frequently discussed. Chall (1983) proposed three

AGE	SKILL	EXAMPLE
3 years	▪ Recite known rhymes ▪ Produce rhyme by pattern ▪ Recognize alliteration	▪ Jack and Jill ▪ "cat" and "hat" ▪ "Mommy and Michele" begin with the same sound
4 years	▪ Segment syllables ▪ Count syllables (50% of 4-year-olds can do this)	▪ "cowboy" can be divided (clapped) into cow and boy
5 years	▪ Count syllables in words (90% of 5-year-olds can do this) ▪ Count phonemes within words (fewer than 50% of 5-year-olds can do this)	▪ "sunny" has two syllables ▪ "cat" has three phonemes
6 years	▪ Match initial consonants in words ▪ Blend two to three phonemes ▪ Count phonemes within words (70% of 6-year-olds can do this) ▪ Identify rhyming words ▪ Divide words by onset and rime	▪ "shoe" and "sheep" begin with the same first sound ▪ /d/ /o/ /g/ form the word "dog" ▪ "pit" rhymes with "mit" ▪ "stop" can be divided into /st/ /op/
7 years	▪ Blend phonemes to form words ▪ Segment 3 to 4 phonemes within words ▪ Spell phonetically ▪ Delete phonemes from words	▪ What is "spin" without /s/?

Figure 1. Phonological Awareness Skills and Approximate Ages of Development

Though these skills develop without difficulty for approximately 80% of children, the remaining 20% are confused by the system (Lyon, 1985).

There is a strong consensus among professionals who study reading and reading disability that instruction in phonological awareness is an important part of

stages children must go through to become fluent word decoders. The first is the logographic stage in which children make associations between words or graphics with no knowledge of letter sound relationships. The alphabetic stage is the second stage in which children realize that letters stand for abstract linguistic concepts and that written language is made up of letters and corresponding sounds. Phonological awareness is crucial for mastery of the alphabetic stage. The final stage is the orthographic stage in which decoding new words occurs by analyzing larger pieces of the word (such as syllables) and decoding familiar words becomes automatic. Children learn letter combinations and meanings and can read words without sounding out each letter.

Researchers have discussed another theory called the Self-Teaching Hypothesis (Share, 1995; Share & Stanovich, 1995). The premise is that children decode words using sound-symbol knowledge and the indirect phonetic route in the beginning stages of reading. Children use a "self-teaching mechanism" to allow them to acquire detailed orthographic representations. These representations give children the ability to visually recognize words quickly and accurately. Therefore, words that are read frequently become processed orthographically, whereas less common words require sound-by-sound decoding for a longer period of time.

Phonological Awareness

Learning to decode words requires formal instruction as well as explicit knowledge of the phonological aspects of speech. Phonological awareness involves the ability to reflect on and manipulate the sounds of the utterance without regard to word meaning. This is a skill that children must develop in order to make sense of an

alphabetic script. "When learning to read or spell, children must learn that the sounds (phonemes) in a word can be represented by letters (graphemes). When spelling a new word, children have to be able to segment the word into its sounds before they can attach the appropriate letters, and when reading an unfamiliar word, they have to be able to decode the printed letters back to sounds" (Stackhouse, 1997). Many tasks are commonly used to assess phonological awareness skills such as recognition of rhyme, rhyme production, isolation of a beginning, medial, or final sound, sound segmentation, identifying the number of syllables or sounds in a word, sound-to-word matching, word-to-word matching, syllable and sound blending, sound deletion, specifying which phoneme has been deleted, sound substitution, and sound exchange (Ball & Blachman, 1991; Lewkowicz, 1980; Robertson & Salter, 1997).

According to Goldsworthy (1996), Perfetti (1991), and Stackhouse (1997), phonological awareness skills generally develop in a similar pattern for children. This begins with reciting rhymes at approximately age three, and progresses to blending phonemes to form words at approximately age seven. Figure 1 lists information presented by Goldworthy (1996) which illustrates phonological awareness skills and the approximate age that the skills develop.

any good reading curriculum (Adams, 1990; Blachman, 1989). This consensus is derived not only from longitudinal-correlational research showing causal relationships between individual differences in phonemic awareness and subsequent reading growth (Lewis & Freebairn, 1992; Wagner, Torgesen, & Rashotte; 1994), but also from demonstrations that training in phonological awareness produces a positive effect on reading growth (Ball & Blachman, 1991; Bradley & Bryant, 1985; Lundberg, Frost, & Peterson, 1988).

Phonological Awareness and Reading Ability

Children labeled as reading disabled often exhibit difficulties with phonological awareness skills and/or listening comprehension. Catts, Fey, Zhang & Tomblin (1998), found that approximately 35% of poor readers have good listening comprehension, but display word recognition deficits (and poor phonological awareness). Consequently, these students have difficulty with reading comprehension because they are slow or inaccurate decoders and are sometimes referred to as dyslexic. Approximately 37% of poor readers exhibit both poor listening comprehension and poor phonological awareness/word recognition and are referred to as language learning disabled. These students typically have difficulty with reading comprehension because of deficits in decoding and listening comprehension. Therefore, more than 70% of poor readers have poor phonological awareness skills.

Several authors in the past two decades have focused on the relationship between early phonological awareness and later reading ability (Ehri, 1979; Fox & Routh, 1980; Helfgott, 1976; Liberman, 1983; Stanovich, 1986). For example,

Lundberg, Olofsson, and Wall (1980) predicted the reading ability of children in kindergarten with 70% accuracy from phonological awareness data attained during the children's preschool years. Swank and Catts (1994) predicted the decoding ability of 54 first grade children at the end of the year by evaluating the children's phonological awareness skills at the beginning of their first grade year. Deletion, organization, blending, and segmentation were good indicators of poor and good decoders, however, deletion was considered the most effective indicator with 88% accuracy. Finally, Wagner, et al.(1994) found that children in the lowest 20th percentile in phonological awareness in first grade were 3 1/2 grade levels below their peers in decoding by 5th grade.

Phonological Awareness Training in the Classroom by Teachers

According to Troia (1999), more than 30 studies (Bentin & Leshem, 1993; Lie, 1991; Kennedy & Backman, 1993) in the last 20 years have documented the effectiveness of phonological awareness training. Twelve of these studies addressed phonological awareness training in the classroom (Blachman,1991; Blachman, Ball, Black, & Tangel, 1994; Bradley & Bryant, 1983, 1985; Kozminsky & Kozminsky, 1995; Lundberg, Frost, & Petersen, 1988; McGuiness, McGuiness, & Donohue, 1995). Other examples of classroom-based phonological awareness training include Bradley and Bryant (1983, 1985), who divided 65 kindergarten children into four equal groups by IQ, age, sex, and sound categorization ability. The first group learned to categorize words by common sound; the second group by common sounds and corresponding plastic letters; the third group categorized by semantic classifications; and the fourth group was the control group. It was concluded that all

three experimental groups outperformed the control group in the areas of reading and spelling. In addition, the second group, who used both categorization by sound and corresponding plastic letters, exhibited the best results on reading and spelling.

Blachman (1991) investigated the results of phonological awareness training completed by regular education kindergarten teachers. The authors trained teachers and their assistants to provide phonological awareness training in their classrooms. The teachers and assistants provided 84 students with 41 fifteen to twenty minute lessons in letter-sound association. The results indicated that after treatment, the children in the experimental classroom outperformed the control group on measures of phoneme segmentation, letter sound knowledge, and reading.

In a longitudinal study, Lundberg, Frost, and Petersen (1988) evaluated the phonological awareness skills of 235 Danish students. The regular education teachers began providing a phonological awareness training program consisting of daily sessions approximately fifteen to twenty minutes in length to treatment groups of preschool children. The daily sessions lasted for eight months. The results of the post-tests revealed an increase in the experimental group's phonological awareness skills. At first grade, the difference in reading skills between the experimental and control group were marginally different, but by the second grade level, the significance was greater. The researchers concluded that the experimental group significantly benefited from the phonological awareness training and that these benefits were maintained.

Students can greatly benefit from the regular classroom teacher presenting phonological awareness. However, Louisa Moats (Wingert, 1999) and others believe

that the complexity of phonological awareness has been underestimated and classroom teachers are "woefully undertrained" to teach phonological awareness in the classroom. Furthermore, Swank and Catts (1994) and Catts, et al. (1998) suggest that the unique background speech-language pathologists possess allows them to work independently or with other professionals in teaching phonological awareness programs, and therefore, they should become more involved with reading skills for students on their caseload. The American Speech-Language-Hearing Association (ASHA) developed an Ad Hoc Committee on Reading and Written Language Disorders in 1999, that stated that listening, speaking, and reading are integrated skills that are difficult to separate for analysis. They further stated that speech-language pathologists have the unique knowledge and skills to assist with programs such as classroom phonological awareness training.

Students with Speech and/or Language Disorders

Several studies have revealed that children with language disorders often exhibit poor reading skills (Aram, Ekelman, & Nation, 1984; Gillam & Carlile, 1997; Menyuk & Chestnick, 1997). Similarly, a number of studies have indicated that students with speech and language disorders have poor phonological awareness skills. For example, approximately 90% of children with language impairments demonstrate some degree of reading impairment (Stark et al., 1984). Research also indicates that children with semantic-syntactic deficits (language impairments) are at a higher risk for reading disabilities than are children with problems limited to articulation or phonology (Bishop & Adams, 1990; Hall & Tomblin, 1978; Levi, Capozzi, Fabrizi, & Sechi, 1982).

Clarke-Klein (1991) reported that children with severe speech-sound disorders did more poorly on tests of phonological awareness and had a greater number of phonological deviations than children in a control group. Bird, Bishop, and Freeman (1995), found that speech-language impaired children had difficulty with phonological awareness tasks, even when no speech output was required. Results of recent studies indicate that children with expressive phonological impairments perform less well than their expressively phonologically normal peers on phonological awareness tasks (Apel, Sheilds, & Perrin, 1992; Dominick, Hodson, Coffman, & Winne; 1993).

Boudreau and Hedberg (1999) compared the early literacy skills of preschool children with specific language impairment and their typically developing peers. They found that the children with specific language impairment performed more poorly on measures that are strongly correlated with later reading achievement such as rhyming and letter name/sound. The language impaired children also exhibited difficulty with print concepts and retelling oral narratives.

In a study by Bishop and Adams (1990), the language and literacy skills of 83 children were assessed. The subjects were 8.5 years old and had language development impairments by the age of four. A battery of 11 tests was given to the children at age 4 and again at the conclusion of the study at age 8.5. The results indicated that if language development was normal by the age of 5.5, the children learned to read at a normal age. However, if the language impairments were present after age 5.5, many of the children experienced difficulty later in literacy.

Hall and Tomblin (1978) performed a follow-up study of 36 subjects 13-20 years after their initial contact, to obtain information concerning the children's previous and current communication abilities, and their educational, social, and occupational status. Of the 36 subjects, 18 were language impaired and 18 were articulation impaired. The results from a parent questionnaire indicated many differences between the language impaired children and the articulation impaired children. Nine of the parents of the language impaired children believed that their son or daughter continued to have problems with articulation and language while only one of the parents of the articulation impaired children believed that their child had persistent problems with articulation. Parents were also asked to report their child's level of formal education. It was found that fewer language impaired children pursued postsecondary education. The Iowa Test of Basic Skills was used as a measure of academic performance. The researchers determined that again, the articulation impaired students scored better than the language impaired students. These results indicate that children with language impairments have limitations in educational achievement. The researchers also stated that the speech-language pathologist should be concerned with learning about the impact of language deficits on children's academic performance.

Bishop and Adams (1990) conducted a longitudinal investigation of speech-language impaired children and reported that mean length utterance at 4.5 and 5.5 years of age was a good predictor of reading achievement at age eight. Catts (1993) found that standardized measures of receptive and expressive language abilities,

measures of phonological awareness, and rapid automatized naming were observed to be associated with reading outcome.

Phonological Awareness: Intervention for Children with Speech-Language Disorders

van Kleeck, Gillam, and McFadden (1998) provided phonological awareness training to preschoolers with speech-language disorders in a classroom setting. The study consisted of 16 children with speech and/or language disorders and normal cognitive skills divided into two groups. Rhyming and phoneme awareness training were provided in a SLP teach method in which graduate student clinicians in speech-language pathology and classroom teachers certified in speech-language pathology guided training in the classroom. Following intervention, children who participated in the training tested above the 95% confidence level of the control group on phoneme awareness skills. The results of the post-test compared to pre-test scores supported the usefulness of phonological awareness training. Their findings also suggest that speech-language pathologists should teach children with speech and/or language disorders about phonological awareness as early as possible.

Gillon (2000) investigated gains made by ninety-one, five to seven year old children from New Zealand, who demonstrated early reading delay. Sixty-one of the ninety-one children had spoken language impairments (i.e., expressive phonological difficulties and some delayed semantic and syntactic development) and thirty of the ninety-one children had normal developing speech. The children with speech/language impairments were divided into three groups: experimental intervention, traditional intervention, and minimal intervention. The 30 normally developing children participated in their usual classroom literacy program and served

as a control group. The results of the study indicated that by the end of treatment, children who received phonological awareness intervention (experimental intervention) reached levels of performance similar to students in the control group in the areas of phonological awareness, reading ability, and speech production.

Harbers, Paden, and Halle (1999) provided intervention for four pre-school aged children with phonological impairments. Both production of the sounds and feature awareness were components of the intervention program. Feature awareness required the subjects to answer yes/no questions about syllable shapes (e.g., does /sto/ begin with two sounds, does /po/ begin with two sounds, is /p/ the last sound in step) and phoneme characteristics (e.g., is /k/ a long hissy sound). Results indicated that production performance did not always parallel the rate and degree of change in awareness. The results of this study suggested that feature awareness in addition to production should be considered for intervention of phonological impairments.

Korkman and Peltomaa (1993) studied a preventative treatment for preschool children with language impairments who were at risk for reading difficulties. Twenty-six male students were provided with classroom treatment including phonemic awareness and preliminary grapheme-phoneme conversions on a two-letter syllable level by either a speech-language pathologist, preschool teacher, or psychologist. Results indicated that at the end of the treatment groups' first grade year, reading, spelling, and language skills were significantly greater than the control group.

In a study by Warrick, Rubin, and Rowe-Walsh (1993) 14 language-delayed kindergarten children participated in a structured training program while another

group of 14 language-delayed students and 14 normally developing students served as control groups. The program consisted of two 20-minute sessions per week for eight weeks. The fourteen subjects were divided into two instructional groups that were taught by the same experimenter. The sessions were conducted in the same pattern throughout the training. The first five minutes usually consisted of a song that reviewed previous goals and introduced the children to new goals. The next 10 minutes addressed phoneme awareness skills. The final five minutes were spent reviewing the target skills in an attempt to promote carryover. The researchers began training at the level of syllable awareness, and included initial phoneme segmentation (ffffish), rhyming, and phoneme segmentation (using blocks to represent each phoneme). Results indicated that the children with language-delays who participated in the training program made significant gains on manipulations, while the two control groups did not make significant gains between the pre and post-test measures of phonological awareness tasks. A one-year follow-up was conducted and indicated that the normally developing students and the language-delayed students who received training scored significantly greater than the language-delayed students who did not receive training. The tasks tested on the one-year follow-up were manipulations, rhyming, and segmentation. The results of the one-year follow-up revealed that the concentrated focus on phoneme awareness in kindergarten assisted children with language delays in future academic success.

Barnes, Smitley, and Throneburg (1998) evaluated the effectiveness of phonological awareness training using collaborative and consultative service delivery models in kindergarten classrooms. The results indicated that the students who

participated in the collaborative model showed a 45.6 point gain between the pre- and post-test scores on the Phonological Awareness Test, while the consultative group showed a 29.0 point gain, and the control group showed only a 13.9 point gain. The five students in the collaborative group who were diagnosed with speech-language impairments showed a mean gain of 33.1 points. The four students in the consultative group with speech and/or language impairments increased their score between the pre- and post-test by 20 points.

Phonological Awareness Training for Children with Phonetically Based Reading Difficulties

Numerous studies (Bradley & Bryant, 1983, 1985; Blachman, 1991; Ball & Blachman, 1988, 1991; Lundberg, Frost, & Petersen, 1988) have indicated that phonological awareness training improves classroom averages for phonological awareness and reading skills when training is provided in the classroom and most children are "normal" learners. However, there remains considerable debate as to the best method to teach children who are at risk for reading difficulties due to poor phonological awareness skills. In the past there have been frequent recommendations to teach these children using sight word or visually based approaches that minimally involve the children's limited phonological abilities.

Recent theories of reading development such as the Self-Teaching Hypothesis suggest that phonetic reading skills are critical to overall reading development. Some authors have reported that it is quite difficult to teach phonetic reading skills to children with phonologically based reading difficulties (Lovett, Warren-Chaplin, Ransby & Borden, 1990; Lyon, 1995; Snowling & Hulme, 1989) while other

researchers have reported significant success in building functional alphabetic reading skills in children with phonologically based reading difficulties (Alexander, Anderson, Heilman, Voeller, & Torgesen, 1991; Brown & Fetton, 1990; Lovett et al., 1994).

Lovett et al. (1994) provided 35 hours of phonological awareness training to a group of nine year old children with phonological based reading difficulties. The children were taught in small groups of two children each. Results indicated that the greatest improvement in generalized reading skills occurred with direct instruction, practice "sounding out" words, and focus on segmenting and blending.

Traditional programs in phonological awareness have emphasized the acoustic/auditory properties of phonemes and have included activities such as listening for sounds in words, segmenting and blending sounds, and letter sound correspondence. Individual phonemes, however, are not perceptually salient acoustically and sounds within words are strongly influenced by surrounding phonemes. Given the difficulty that many readers have with dividing words into individual phonemes, some authors have suggested additional information such as motoric cues may be helpful in phoneme perception and identification. Researchers such as Lindamood have stated that by helping children discover the articulatory positions, movements and feel associated with phonemes, that children experience a deeper level of phonological processing than training that involves auditory awareness only. Becoming aware of the place and manner of articulation assists children in anchoring the phonemes' identities (Damon, 1998).

A study by Skjelfjord (1976) illustrated the effectiveness articulatory training has on expediting phonological awareness. The subjects consisted of Norwegian preschoolers approximately six years old. The phonological awareness program followed a particular format in which the children listened to a story and then were asked to "feel" how a particular phoneme was articulated. The children were then provided a picture and by "feeling" the word in their mouths, determined if the original phoneme was present in that word. Finally, they were asked to determine if that sound was found in the initial, medial, or final position of the word. The lessons lasted approximately 10-20 minutes daily until all 27 Norwegian phonemes were learned. Pretest results indicated little ability to analyze the words into phonemes (e.g., students incorrectly believed that /kæ/, rather than /k/, was the first sound in cat). However, after one week of training, the phoneme-size responses (/k/, /æ/, /t/ are the sounds in cat) rose to 63%. By the end of training, the percentages of analytic and nonanalytic responses (random guesses) were 95% and 1%. In addition, the researchers believed that the students learned the strategy of feeling the segments of words as they did nearly as well at finding taught as untaught phonemes. The researchers also added that this type of training had limitations. In isolation, phonemes have ideal placement, however, in reality, phonemic context can impact the placement. Therefore, while articulatory training is valuable, by itself it is not practical and effective.

The Auditory Discrimination in Depth (ADD) program (Lindamood & Lindamood, 1975) engages students in "systematic and reflective exploration of the articulatory features and voicing of the phonemes (Damon, 1998, p. 287)." This

program has "been shown to accelerate reading growth dramatically." In fact, Howard (1988) documented children who received the Lindamood program in kindergarten and first grade, had higher word attack and reading scores in subsequent grades than children who did not receive the program.

Alexander, et al. (1991) evaluated the effectiveness of the ADD program in remediating decoding deficits in severe dyslexics. Ten subjects, age 7:9 to 12:9 years, who scored substantially below their anticipated level on the Lindamood Auditory Conceptualization Test (Lindamood & Lindamood, 1979) were provided with training in the ADD program. Training consisted of one hour sessions four times weekly for seven subjects and four hours per day for six weeks for the remaining three subjects. The purpose of the program was to increase oral and phonological awareness. In the oral training, a multisensory approach was used. The students identified, classified, and labeled oral motor characteristics of the sounds using feedback from the ear, eye, and mouth. After the students became aware of the articulatory features of each phoneme, they were introduced to the corresponding alphabet symbol. These phonological awareness skills included tracking and representing sequences of speech sounds. Results indicated that the program produced significant gains on reading and word attack scores to attain performance levels considered in the average range.

In a study by Kennedy and Backman (1993), ten students with severe learning disabilities were provided the ADD program and a comprehensive remedial program. Ten other students were matched on Verbal IQ, chronological age (11-17 years), reading, spelling, and phonological awareness abilities and served as the control

group. The control group received the remedial program, but did not receive the ADD program. The remedial program developed by the school was tailored to suit each student's needs. However, it often focused on encoding and decoding written symbols. Children learned spelling, sound-symbol relation, linguistic awareness (letter, syllables, affixes), word recognition, and microuniting (breaking down tasks into the most basic elements). The students who used the ADD program were guided by an instructor through the various levels of the program. An educational consultant and a teacher who had been trained through the Lindamood-Bell Learning Processes Centre in California and the SLP trained the teachers to be instructors. The experimental group received the ADD program for 50 minutes, three times a week for six weeks. Results indicate that all of the students with learning disabilities made significant gains on standardized reading and spelling measures. However, the group who received both the ADD program and the comprehensive remedial program did not make significantly more gains than the group who received only the comprehensive remedial program.

Summary and Statement of Objectives

Phonological awareness skills are strongly related to children's ability to decode words for reading. A great deal of research has proven group means in reading scores increase when phonological awareness is taught to a class. Several authors such as Torgesen and Davis (1996) have suggested that there is a great deal of individual variation in response to group training in phonological awareness. For example, Lundberg, Frost, and Peterson (1988) reported impressive gains in their large scale study of phonological awareness training with Danish children, however

children in the lowest quartile on pretest measures of phonological awareness did not benefit very much from training. Torgesen and colleagues (1992) found that 30% of a sample of at-risk kindergarten children showed no reliable growth in phonological awareness skills following an 8-week training program that had a significant impact on both the phonological awareness and reading skills of the majority of children in the group.

Speech-language pathologists have substantial knowledge about the acoustic and motoric aspects of phoneme production. ASHA (2000) suggested that speech-language pathologists should play a role in the prevention and remediation of language-based reading difficulties. Although speech-language pathologists can collaborate with classroom teachers to provide effective phonological awareness lessons for classes as a whole (Barnes, et al., 1998), it is important for speech-language pathologists to treat children individually who did not succeed in classroom phonological awareness training (Swank & Catts; 1994).

There remains considerable debate as to the best method to teach children who are at risk for reading difficulties due to poor phonological awareness skills. In the past there have been frequent recommendations to teach these children using sight word or visually based approaches that minimally involve the children's limited phonological abilities. Other researchers have reported significant success in building functional alphabetic reading skills in children with phonologically based reading difficulties (Alexander, Anderson, Heilman, Voeller, &Torgesen, 1991; Brown & Fetton, 1990, Lovett et al., 1994).

Traditional programs in phonological awareness have emphasized the acoustic/auditory properties of phonemes and have included activities such as listening for sounds in words, segmenting and blending sounds, and often letter sound correspondence. Individual phonemes, however, are not perceptually salient acoustically and sounds within words are strongly influenced by surrounding phonemes. Given the difficulty that many readers have with dividing words into individual phonemes, some authors have suggested additional information such as motoric cues may be helpful in phoneme perception and identification. Researchers such as Lindamood have stated that by helping children discover the articulatory positions, movements and feel associated with phonemes, that children experience a deeper level of phonological processing than training that involves auditory awareness only. Becoming aware of the place and manner of articulation assists children in anchoring the phonemes' identities (Damon, 1998).

Studies have revealed gains in phonological awareness in using programs such as the ADD program (Lindamood &Lindamood, 1975) which engage students in exploration of the articulatory features and voicing of phonemes for groups of normally developing kindergarten and first grade children (Howard, 1988). The Lindamood program has also improved the reading skills of a group of 7-12 year old children with dyslexia.

The purpose of the present study was to determine the effects of individual phonological awareness training emphasizing both auditory and motoric properties of phonemes with three children who did not make substantial gains in a classroom phonological awareness program. The individual phonological awareness contained

two parts, (1) phoneme awareness and letter/sound training, and (2) phoneme blending and segmenting. The specific research questions were as follows:

1. Does the correct production of individual sounds given the written letter significantly improve with individual phonological awareness training emphasizing the acoustic and motoric properties of phonemes for three subjects with poor phonological awareness skills after one academic year of classroom based phonological awareness training?
2. Does the accuracy of single word decoding significantly improve with individual blending and segmenting training emphasizing the acoustic and motoric properties of phonemes for three subjects with poor phonological awareness skills after one academic year of classroom based phonological awareness training?
3. Does the accuracy of single word writing significantly improve with individual blending and segmenting training emphasizing the acoustic and motoric properties of phonemes for three subjects with poor phonological awareness skills after one academic year of classroom based phonological awareness training?

CHAPTER III

Methods

Subjects

Three kindergarten children ranging in age from 6:4 to 6:10 participated in the study. The subjects were selected from kindergartners who attended Mark Twain Elementary School in Charleston, Illinois during the 1999-2000 school year. Four kindergarten classrooms participated in a group phonological awareness training program. The collaborative training program in each classroom was taught by two graduate students, one speech-language pathologist, and the classroom teacher. The phonological awareness training occurred for approximately 45 minutes once per week for 24 weeks. The first semester of training consisted of skills above the level of the phoneme such as word awareness, syllable counting and blending, and rhyme judgment and production. The second semester consisted of skills at the phoneme level such as alliteration, initial, medial, and final sound identification, and phoneme blending. The kindergarten classrooms at Mark Twain do not follow a standard reading curriculum. Of the four classrooms that participated, three of the teachers used a letter of the week while the fourth teacher emphasized phonological awareness skills and the sounds of our language (rather than the letters) throughout the week.

The subjects for this study were chosen from the four classrooms that had received classroom phonological awareness training. Six students were referred by the classroom teachers as being significantly below average in classroom pre-reading skills Each of the six students scored at least two standard deviations below the class mean (i.e., below 50; total possible = 112 points; class mean = 86 points; and

standard deviation = 18) on the Phonological Awareness Literacy Screening (PALS) (Invernizzi & Meier, 1997) when it was administered to all children at the end of the school year. Letters were sent to the parents of these six children and three parents responded with interest in the summer individual phonological awareness program. The program was free of charge, but the parents were asked to commit to bringing their child to therapy three days a week for the 50-minute sessions.

All subjects were native English speakers, showed evidence of normal visual, auditory, and motor abilities. All three subjects were diagnosed with speech or language delays and received pull-out therapy for the speech or language deficit, but not for phonological awareness. Subject A exhibited an articulation delay, Subject B exhibited a language delay, and Subject C exhibited a language processing disorder. The subjects were given a battery of tests and were baselined on their phoneme awareness skills.

Table 4 presents the summary of standardized test results for Subject A. Subject A exhibited one area of deficit on the Test of Language Development 3rd Ed. (TOLD) (Newcomer & Hammill, 1997). The sentence imitation score was significantly below the mean with a score of 4 (mean = 10). However, the composite score, or spoken language quotient, was within normal limits at 94. Subject A also performed within normal limits on the Peabody Picture Vocabulary Test 3rd Ed. (PPVT) (Dunn & Dunn, 1997). The raw score achieved was 110, percentile rank was 90, and age equivalent was 8-4 while chronological age was 6-4. The third standardized test given was the Goldman-Fristoe Test of Articulation (GFTA) (Goldman & Fristoe, 1986). The number of errors was 16 and percentile rank was 14.

Sounds in error in the initial position were /j/, /ʃ/, and /r/. Sounds in error in the medial position were /r/, /ʤ/, /θ/, and /ð/. The three sounds in error in the final position were /g/, /ʃ/ and /r/. Finally, the Phonological Awareness Test (PAT) (Robertson & Salter, 1997) was administered. The total test score was within normal limits with a standard score of 91. However, the scores on the grapheme and decoding subtests were at least one standard deviation below the mean. Appendix A summarizes results for each subtest on each standardized test. Baseline scores were also attained for phoneme awareness. Subject A correctly produced /b, f, l, p, s, t, æ / and incorrectly produced /g, m, n, I, ʌ/.

Table 1

Standard Scores/Percentiles for Subject A

	TOLD	PPVT	GFTA	PAT
Standard Score/Percentile	94	119	14[a]	91

[a] One standard deviation or greater below mean.

Table 2 presents the summary of standardized test results for Subject B. Subject B was given the TOLD, which revealed a spoken language quotient of 80 which is significantly below the mean. Subtest with significant deficits included relational vocabulary, oral vocabulary, sentence imitation, and grammatic completion. On the PPVT, Subject B achieved a standard score of 85, percentile rank of 39, and

age equivalent of 8-4 while chronological age was 6-9. Subject B did not make any errors on the GFTA. Finally, the PAT total score revealed below average phonological awareness skills. Specific subtests that were at least one standard deviation below the mean included: rhyming, isolation, graphemes, and decoding. Appendix A summarizes results for each subtest on each standardized test. On the phoneme awareness, Subject B correctly produced the phonemes /m, n, p, s, t,/ and incorrectly produced /b, f, g, l, æ, I, ʌ/ when given the written grapheme.

Table 2

Standard Scores/Percentiles for Subject B

	TOLD	PPVT	GFTA	PAT
Standard Scores/Percentiles	80[a]	96	99	82[a]

[a] One standard deviation or greater below mean.

The TOLD scores for Subject C revealed a normal spoken language quotient of 94 (See Table 3). Sentence imitation and grammatic completion were the two subtests which were below average. On the PPVT, Subject C achieved a standard score of 94, percentile rank of 34, and age equivalent of 6-6 while chronological age was 6-10. Subject C made only 3 errors on the GFTA (final /ŋ/ and initial and medial /θ/) which was in the 59th percentile. The PAT scores revealed a delay in phonological awareness skills. The standard score was 78 and four subtests were at

least one standard deviation below the mean. The four subtests which showed delays were isolation, blending, graphemes, and decoding. Appendix A summarizes results for each subtest on each standardized test. On phoneme awareness, Subject C correctly produced the phonemes /b, f, m, p, s, t, æ/ and incorrectly produced /g, l, n, I, ʌ/ when given the written grapheme.

Table 3

Standard Scores/Percentiles for Subject C

	TOLD	PPVT	GFTA	PAT
Standard Scores/Percentiles	94	94	59[a]	78[a]

[a] One standard deviation or greater below mean.

Design and Procedure

A multiple baseline across behaviors design was used to determine the effects of individual phonological awareness training incorporating articulation and acoustic properties of sounds. Subjects were seen 3 times weekly for 40-minute sessions for 8 weeks. Each 40-minute session was divided equally into 20-minute segments with data collected after each segment for a total meeting time of approximately 50 minutes. Subjects received a two-part phonological awareness training program consisting of (1) phoneme awareness, and (2) phoneme blending.

Behavior I: Phoneme Awareness

Response Measure

The dependent variable was correct production of the sound when given the letter. Twelve phoneme/grapheme associations were taught (b, f, g, l, m, n, p, s, t, æ, I, ʌ). All twelve phonemes were presented in random order for data collection at the end of each therapy segment. There was a possibility of three points awarded for each phoneme. One point each was awarded for accuracy of the place, manner, and voicing of articulation. The percent accuracy was calculated by dividing the number of points scored by each subject by the total number of points. One point was awarded for each correct place, manner, and/or voicing of the phoneme for a total of three points per consonant phoneme. Each vowel was given a point value of 2 if correct and 0 if incorrect. The number of correct points was divided by the total, which was 33 points ([3 points x 9 consonant phonemes] + [2 points x 3 vowels] = 33). A percent accuracy of at least 95% and clinician judgement of mastery was required before the child could begin the phoneme blending/segmenting portion of the program.

Experimental Conditions

Baseline. Baseline data were collected after each segment. Baselining of phoneme awareness knowledge was staggered and occurred over 7 to 13 segments for the three subjects (See Table 4). No phonological awareness training was provided while baseline measures were being obtained. Standardized assessments were administered during this period.

Table 4

Staggered Baseline Measures for Behavior I

	Number of Segments (20 min.)								
	1st	7th	8th	9th	10th	11th	12th	13th	>13th
Subject A	B	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**
Subject B	B	B	B	B	B	**T**	**T**	**T**	**T**
Subject C	B	B	B	B	B	B	B	**T**	**T**

B = baseline information for Phase I

T = treatment session

Treatment: Phoneme Awareness. Twelve phonemes were chosen for this task: nine consonants /b, f, g, l, m, n, p, s, t/; and three vowels /æ/ (as in "apple"), / I/ (as in "if"), and /ʌ/ (as in "umbrella"). Phonemes were taught in the same order for all three subjects. The phonemes did not follow a particular order other than treatment began with phonemes that all subjects were familiar with to promote a sense of success. The nine consonant phonemes were presented first with the three vowel sounds last. The order was as follows: p, s, b, n, f, g, l, m, t, æ, I, ʌ. Two phonemes were introduced during each session (one per segment) and phonemes

introduced previously were reviewed. The format of the sessions remained consistent throughout the phoneme awareness training (See Table 5).

Table 5

Format of Treatment Segment (2 per session) for Behavior I

A. Introduction of Sound/Letter
    1. Acoustic properties and description (e.g., lip popper /p/, tip tapper /t/)
    2. Articulatory postures
    3. Sound/Letter
B. Read book which contains the target sound
C. Write the letter while saying the sound
D. Auditory discrimination of the phoneme in isolation
E. Sorting of pictures by first sound
F. Listening for target sounds in words
G. Other games to aid in discrimination and identification of sound/letter. (e.g., Memory,
    Go Fish) Sound/letter will be used in isolation and in the initial position of words
H. Baseline/Test

Each segment began with an introduction of a new sound (phoneme) until all phonemes had been introduced once. In the introduction, acoustic properties and articulatory postures were described (as described in Lindamood & Lindamood,

1998). The subject was asked to describe how his/her mouth felt when the targeted phoneme was produced. The clinician incorporated the subject's comments/questions into further description of the phoneme. The clinician modeled correct production and the subject practiced saying and reflecting on the production of the phoneme. The clinician and client also looked in the mirror as the phoneme was produced and discussed the visual articulatory gestures.

Then, the clinician read a book that contained numerous instances of the target phoneme (e.g., My S Sound Box, Moncure, 1979). The clinician asked the subject questions during the book reading about words in the book (e.g., Did you hear any words that began with the /s/ sound?). Next, the corresponding letter was introduced. Using a written model, the subject practiced writing the letter and saying the corresponding sound after the letter was written.

An auditory discrimination task of the target from other phonemes in isolation was performed in which the child indicated when he/she heard the target sound. Visual discrimination was also performed by the clinician silently mouthing the phoneme. Only the nine consonant phonemes were practiced using the visual discrimination. When producing the phonemes, the clinician would mouth the sound clearly so that the articulatory postures were as visible as possible for the subjects. By focusing on the clinician's mouth postures, the subject determined if the target phoneme or a different phoneme was produced.

Next, the subject sorted a stack of picture cards by the initial sound. During the initial treatment segment, the cards were sorted into two stacks. One stack was the target phoneme and the other stack was a non-target phoneme. In the following

segments, this activity also served as a review activity. The stacks consisted of the current target phoneme and previously targeted phonemes.

The next task was listening for the target phoneme within words. The clinician said single words and the subject watched the clinician 's mouth and listened for the position of the phoneme. A train and other visual aids were incorporated for identifying the position of the phoneme within words (e.g., initial, medial, final). In the remaining time, other games such as Go Fish and Memory were used to practice discrimination and identification of the target phoneme and as a review of previously targeted phonemes. After each segment, measurement of phoneme/grapheme association occurred. Feedback regarding the accuracy of the subject's responses was provided at all times throughout the training except for during the baselining and measurement periods.

After all phonemes had been introduced once, the therapy segments were devoted to reviewing phonemes in which the children were still having difficulty. Only the phonemes that children had not mastered were addressed during the review sessions. One phoneme per segment received the primary focus during each review segment. The order for which the phonemes were reintroduced was at the discretion of the clinician. The review sessions followed the same format as the segments in which the phonemes were introduced.

Behavior II: Blending and Segmenting

Response Measurement

During the blending measurement, children were given note cards with either real or pseudo words written on them. The ten note cards were randomly selected

from a pool of 60 words (60 real and 60 pseudo) that contained only the twelve phonemes targeted in the sound/letter training. The child had an unlimited amount of time to finish the task of blending the phonemes to form words. First the child was given ten note cards consisting of ten consonant, vowel, consonant (CVC) (e.g., bat, tip) real words and then, the child was given ten more note cards containing CVC pseudo words. The clinician held the stack of randomly shuffled cards and turned to the next word following the child's response. The child was required to make an attempt before moving to the next real or pseudo word.

During the segmenting assessment, the child was also given an unlimited amount of time to spell 10 real and 10 pseudo words. The same set of 60 CVC words and pseudo words was provided for the spelling task. The subject was given a lined sheet of paper with the alphabet provided at the top of the paper. The child was instructed to look at the clinician the first time she said the word and write all of the sounds heard in the word presented. Words were read by the clinician without hesitation or emphasis on any sounds. The clinician repeated each word up to three times if requested by the child. The child was encouraged to write an attempt at the word before the next word was presented.

Reading and writing tasks were scored similarly. Points were awarded for each correct phoneme or grapheme in the verbal or written production. There was a possibility of three points awarded for each consonant sound/letter. One point was awarded for each of the place, manner, and voicing of articulation for each consonant phoneme and grapheme. Therefore, each correct consonant had a value of three points (place, manner, voice) and correct vowels had a value of 2 points.

Experimental Conditions

Baseline. Baseline measures for blending and segmenting were taken once each session while baseline and treatment was occurring for phoneme awareness (Behavior I). The baseline period for blending and segmenting skills ended when the subject mastered the letter/sound associations. Treatment for blending and segmenting was then initiated.

Treatment: Blending and Segmenting. Blending and segmenting tasks were incorporated within game activities. Tasks followed an order that increased in difficulty as treatment progressed (See Table 6).

Table 6

Order of Treatment Tasks for Behavior II

A. Auditory Blending
    1. Onset rime with pictures
    2. Onset rime without pictures
B. Phoneme Blending
    1. Three phonemes
    2. Say it/Move it
C. Blending with Letters with three letter tiles
D. Segmenting

Three phoneme words and pseudo words were used in blending activities. The child was asked to look at the clinician for visual cues as she produced the sounds the

first time in each word. The auditory blending activities began with the clinician saying the onset separate from the rime (e.g., s. . . at) and the child was required to blend the onset and rime and choose the word produced from five pictures. Next, onset rime blending was used without pictures. The time spent on this task varied from one therapy session (Subject A) to four sessions (Subject C). Phoneme blending then followed with the clinician producing individual phonemes within three phoneme words with brief intervals of time between sounds the child chose from a set of pictures initially. Subject A spent one therapy session on this task while Subject B and C spent two days. The difficulty of this task was increased over time by removing the picture card choices.

The remaining therapy sessions (2 for Subject A, 1 for Subject B and C) were spent on a blending activity that used letter tiles to form real or pseudo words. In this activity, the clinician laid out three letter tiles and asked the subject to say the sound of each letter and blend the sounds together to guess the word from a choice of pictures. Initially, the clinician frequently repeated all of the sounds in the words after the child identified them. Over time, the clinician repeated less frequently and the picture choices were removed.

Segmenting, as mentioned before, was approached indirectly during the blending exercises. For example, after a subject blended the sounds in a word together, the clinician slowly said the word and moved her finger across a visual cue, such as a train or blocks, to indicate the different positions of phonemes. The child repeated the words and the clinician and/or child moved their fingers across the visual cue as the phonemes were said. When the clinician asked for the initial, medial, or

final phoneme, she pointed to the beginning, middle, or end of the visual cue. After the word was blended, the word was broken down and segmented into sounds. This approach did not allow for an entire session to be devoted to direct instruction of segmenting skills.

Assessment

The PAT was re re-administered post treatment to determine gain in phonological awareness and reading skills.

Reliability

Inter- and intra-rater reliability was determined by rescoring 20% of the data taken as baseline and treatment measures. Reliability was determined on three different portions of the data: Sound/Letter identification; real and pseudo word reading; and real and pseudo word spelling. Intra-rater reliability was determined by each of the two clinicians re-scoring her own original data. A Pearson correlation was used to determine intra-rater reliability. The correlation for both clinicians was greater than 0.99. The original data was then reviewed by a second researcher to establish inter-rater reliability. The correlation between the two researchers' scores was 0.95.

CHAPTER IV

Results

The primary purpose of this study was to determine if phonological awareness skills of three students would significantly improve with individual phonological awareness training. More specifically, this study first targeted phoneme awareness. When these 12 sounds were mastered, decoding and blending skills were targeted.

Behavior I: Phoneme Awareness

Baseline information and data were taken after each twenty minute segment of the 50 minute session in Behavior I. Baseline measures were taken for seven segments (Subject A), 11 segments (Subject B) and 13 segments (Subject C). The measure was the percent accuracy for the 12 targeted phonemes. The percent accuracy was calculated by dividing the number of points scored by each subject by the total number of possible points. One point was awarded for each correct place, manner, and/or voice of the phoneme for a total of three points per consonant phoneme. Each vowel was given a point value of 2 if correct and 0 if incorrect. The number of correct points was divided by the total, which was 33 points ([3 points x 9 consonant phonemes] + [2 points x 3 vowels] = 33).

Results indicated that phoneme awareness training with traditional sound symbol correspondence training was effective in teaching 12 phonemes and their corresponding graphemes for these three subjects. Subject A mastered the 12 phonemes, according to the previously stated criteria in 29 segments. The baseline measures taken during the first seven segments ranged from 54.5% to 63.6% (See Figure 2). The phonemes that Subject A consistently missed during the baseline

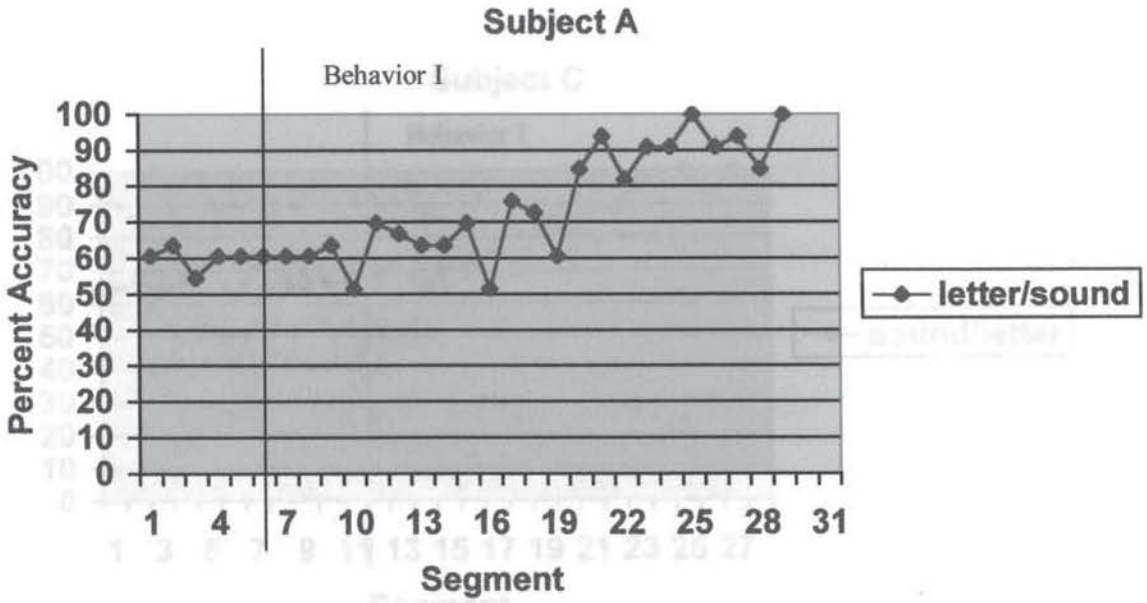

Figure 2. Percent accuracy for Subject A for Behavior I: Phoneme Awareness

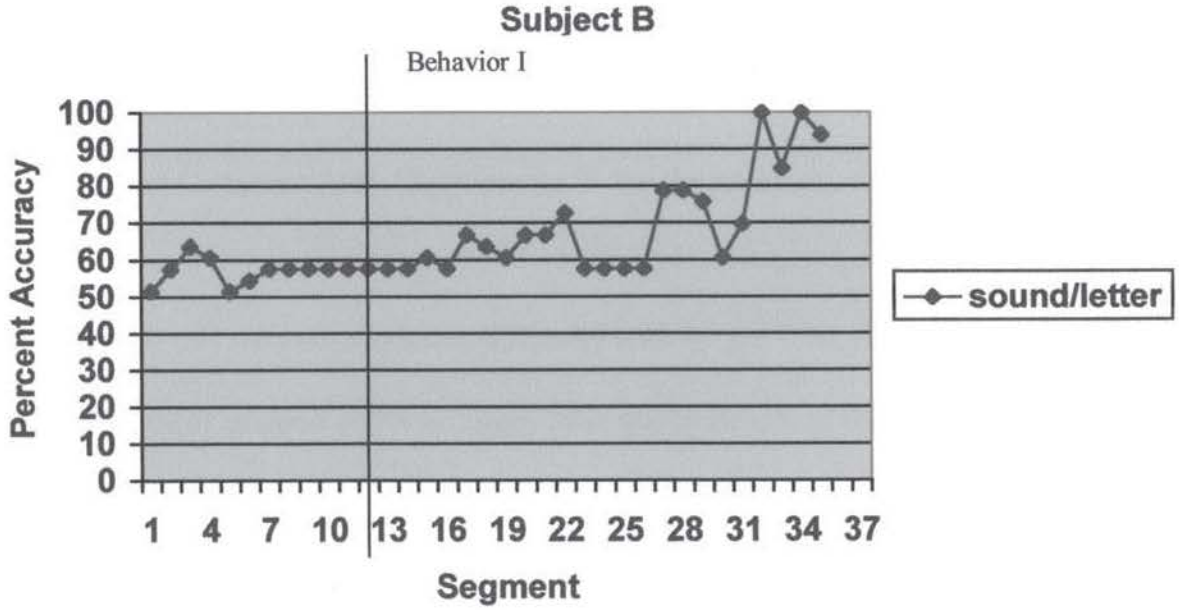

Figure 3. Percent accuracy for Subject B for Behavior I: Phoneme Awareness

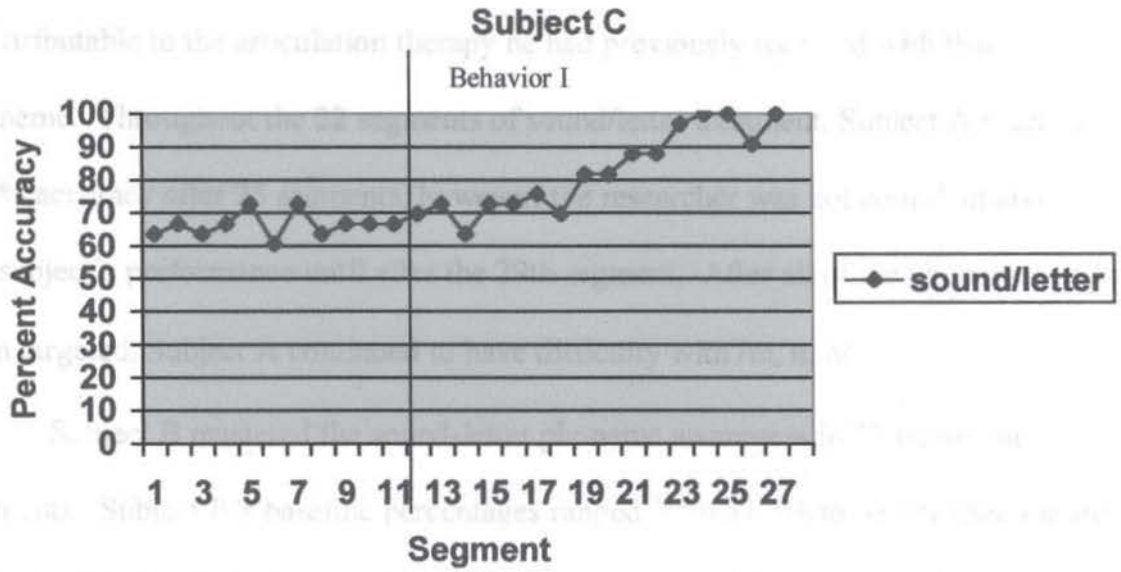

Figure 4. Percent accuracy for Subject C for Behavior I: Phoneme Awareness

period were /g, m, n, I, ʌ /. Interestingly, Subject A was the only subject to correctly give the sound associated with the grapheme /l/ during the baseline period. This may be attributable to the articulation therapy he had previously received with that phoneme. Throughout the 22 segments of sound/letter treatment, Subject A reached 100% accuracy after 25 segments, however, the researcher was not confident about the subject's performance until after the 29th segment. After all of the phonemes had been targeted, Subject A continued to have difficulty with /m, n, ʌ/.

Subject B mastered the sound-letter phoneme awareness in 23 treatment segments. Subject B's baseline percentages ranged from 51.5% to 63.6% (See Figure 3) throughout the 11 baseline segments. The phonemes which were consistently incorrect during the baseline period included /b, f, g, l, æ, I, ʌ/. Subject B originally reached 100% accuracy after the 21st segment. However, it was two more segments before the researcher was confident that the subject had mastered the 12 phoneme-grapheme pairs.

Subject C mastered the 12 phonemes in the shortest time, which was 14 segments. Baseline measures taken for 14 segments and ranged from 60.6% to 72.7% (See Figure 4) and showed consistent difficulty with /f, g, l, I, ʌ/. After treatment began, the subject attained 100% accuracy after the treatment of the final phoneme. However, two additional treatment segments were conducted until the clinician was confident of the subject's phoneme awareness skills.

Behavior II: Blending and Segmenting

Baseline measures for Behavior II were conducted throughout treatment of Behavior I. Therefore, the number of baseline measures differed for each subject

(minimum of 11 measures). The commencement of treatment for Behavior II was staggered due to the requirement of mastery of the12 phonemes previously listed.

Subject A had a baseline period of 13 measures (13 sessions) and 4 sessions of treatment (See Figure 5). Treatment for Behavior II (blending/segmenting) began after the 29th segment. After the first treatment session of blending, the percent correct for all four areas increased by at least 5%. Real word reading scores increased from 0% to 30% after the first treatment session. Real word reading scores continued to rise after the next session and were at 90% accuracy by the end of therapy. Pseudo word reading scores rose from approximately 20% to 40% after the first session of treatment and continued to climb to 97.5% accuracy. Spelling scores of both real and pseudo words fluctuated throughout the baseline period for Subject A. However, the scores averaged approximately 40% and were never above 60%. After treatment began, spelling scores of real words climbed to 85% accuracy and spelling scores of pseudo words climbed to over 70%.

Subject B received four sessions of blending and segmenting treatment. Baseline scores for the four areas tested averaged approximately less than 10% accuracy (See Figure 6). Percent accuracy for the baseline period of reading real and pseudo words ranged from 0% to 11.3% with the exception of one measure which was 35% accuracy on reading pseudo words. After the first treatment session, Subject B's percent accuracy for reading real words rose from 0% to 30% while the percent accuracy for reading pseudo words remained about the same. The percent accuracy scores for the spelling measures showed more fluctuation than in the reading scores. During the baseline period, Subject B's scores for spelling real and pseudo words

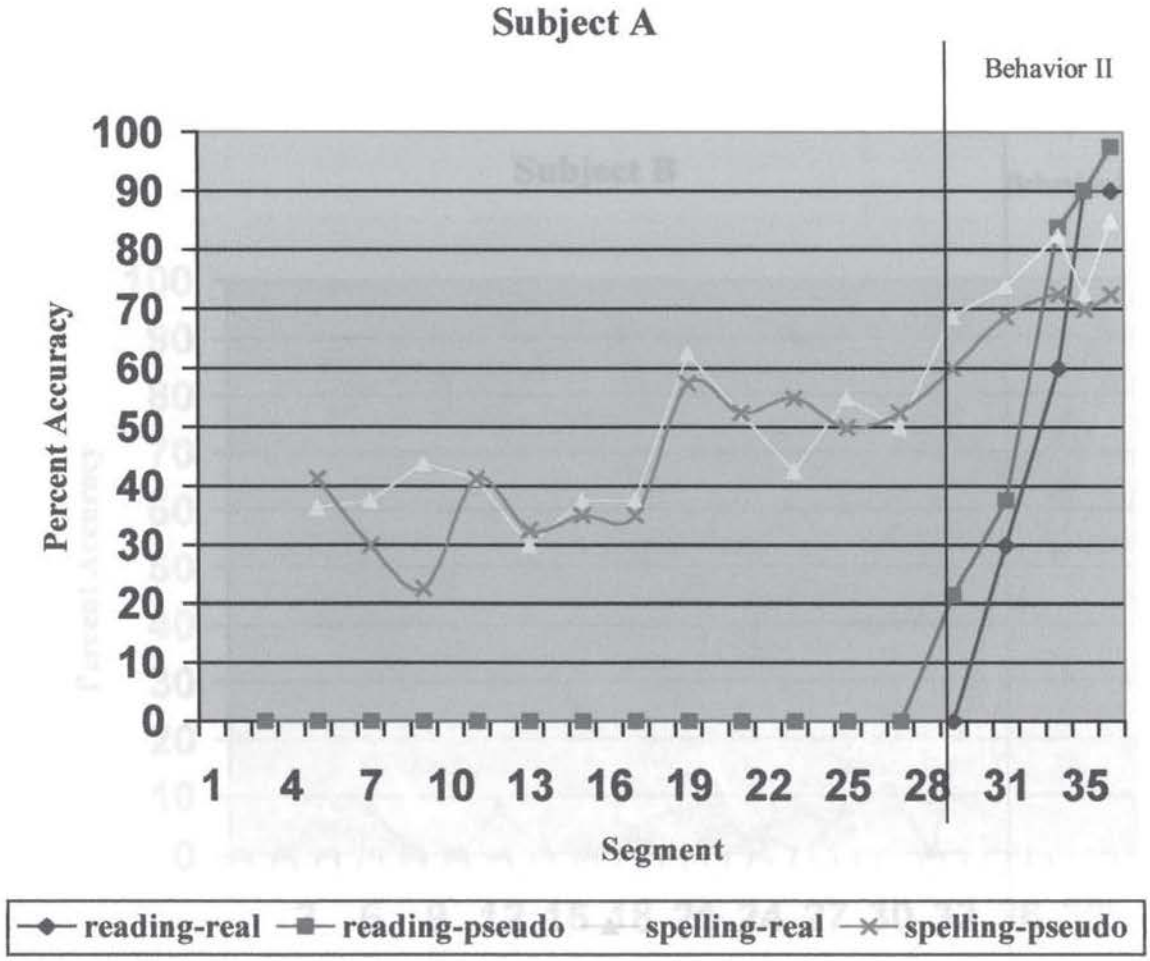

Figure 5. Percent accuracy of real and pseudo word blending and segmenting for Subject A.

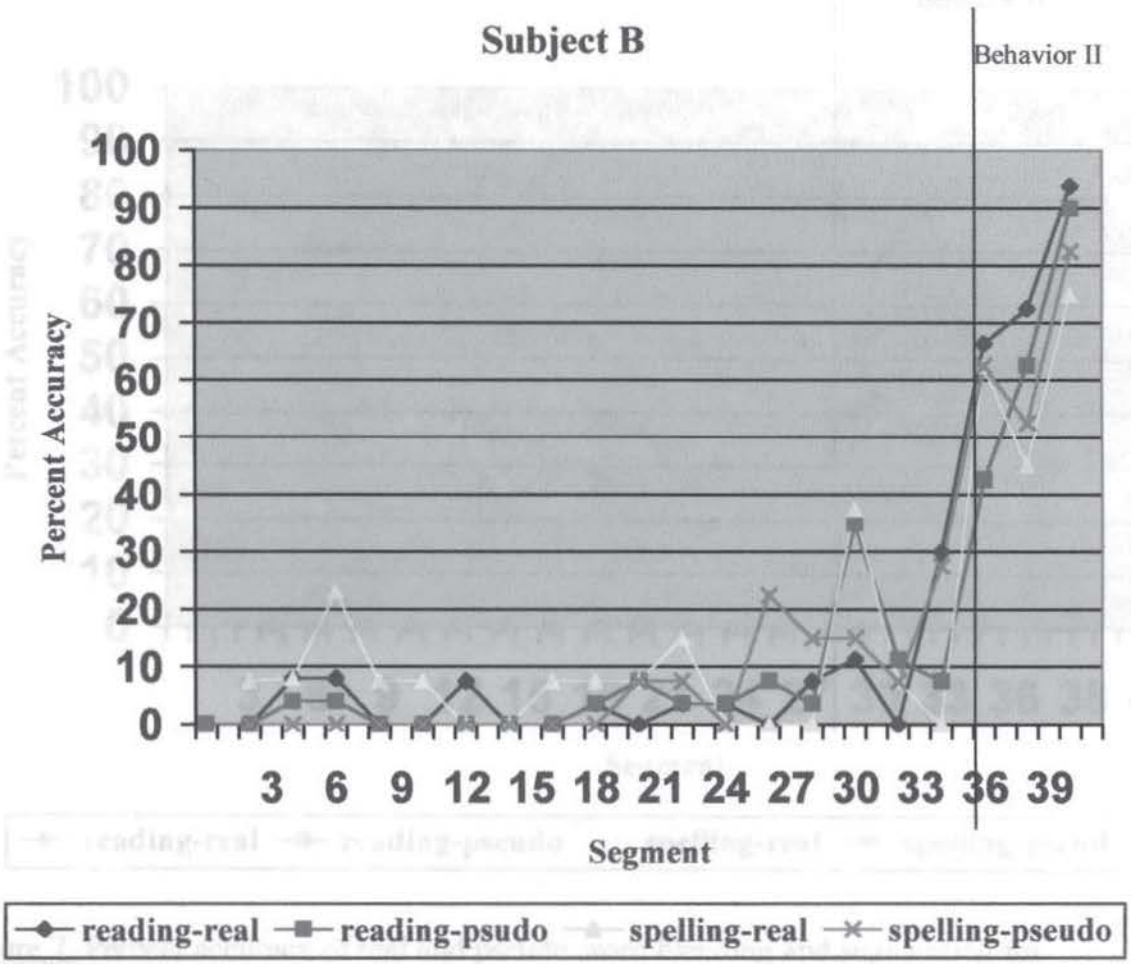

Figure 6. Percent accuracy of real and pseudo word blending and segmenting for Subject B.

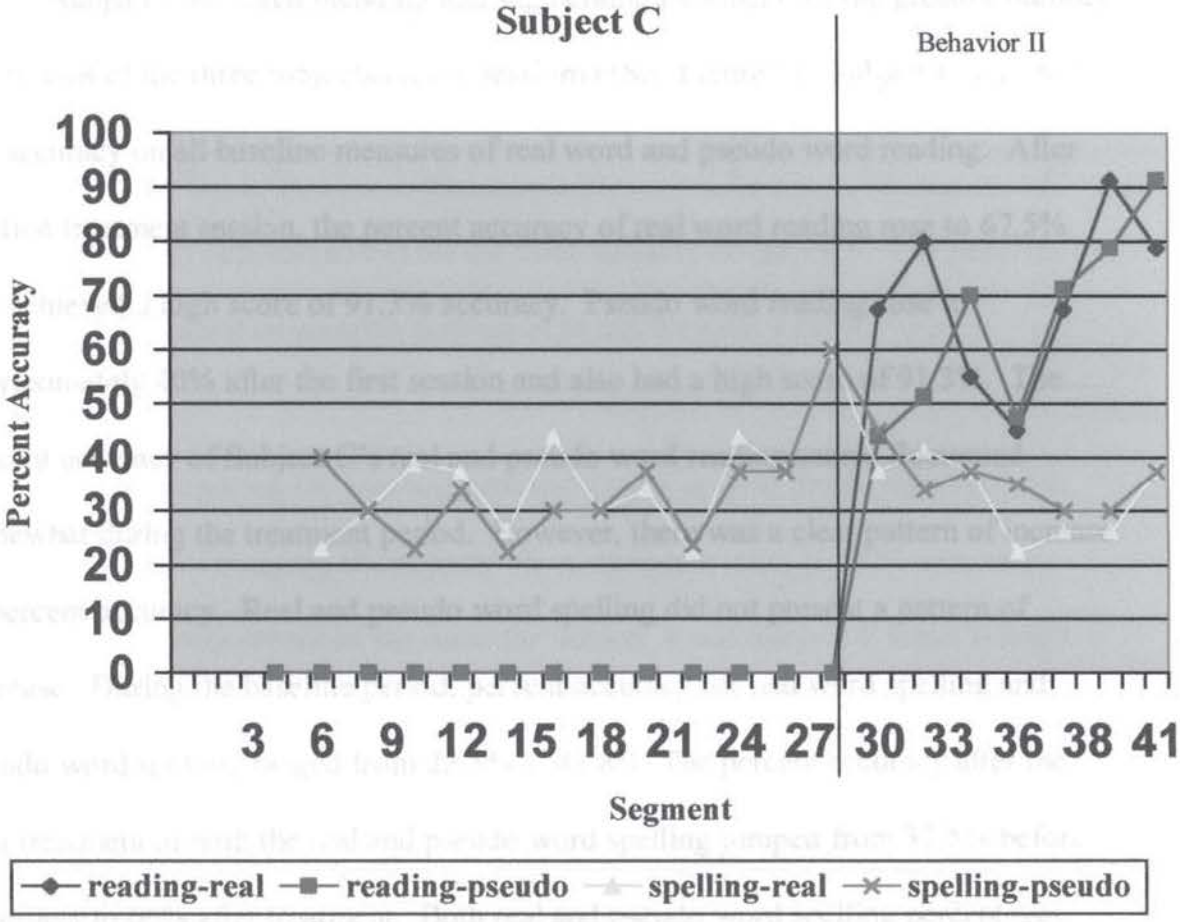

Figure 7. Percent accuracy of real and pseudo word blending and segmenting for Subject C.

were often less than 10%. However, on two occasions each, the percent accuracy for real and pseudo word spelling rose above 20%. Following the first treatment session, the percent accuracy for real word spelling and pseudo word spelling remained approximately the same.

Subject C received blending and segmenting treatment for the greatest number of sessions of the three subjects (seven sessions) (See Figure 7). Subject C achieved 0% accuracy on all baseline measures of real word and pseudo word reading. After the first treatment session, the percent accuracy of real word reading rose to 67.5% and achieved a high score of 91.3% accuracy. Pseudo word reading rose to approximately 40% after the first session and also had a high score of 91.3%. The percent accuracy of Subject C's real and pseudo word reading scores fluctuated somewhat during the treatment period. However, there was a clear pattern of increase in percent accuracy. Real and pseudo word spelling did not present a pattern of increase. During the baseline period, percent accuracy for real word spelling and pseudo word spelling ranged from 22.5% to 43.8%. The percent accuracy after the first treatment of both the real and pseudo word spelling jumped from 37.5% before treatment to 60% after treatment. Both real and pseudo word spelling percentages reached a maximum of 60% accuracy for this portion of treatment.

Phonological Awareness Test

The results from portions of The Phonological Awareness Test (Robertson & Salter, 1997) are summarized in Figure 8.

		Rhyming (20)	Segment-ation (30)	Isolation (30)	Deletion (10)	Substitut-ion (20)	Blending (10)
Subject A	Pre-test	17	20	16	14	3	15
	Post-test	20	20	26	14	5	17
Subject B	Pre-test	14	23	13	11	5	17
	Post-test	20	26	19	17	14	19
Subject C	Pre-test	20	15	7	10	3	9
	Post-test	20	15	13	8	3	14

Figure 8. Pre- and post-test scores for the three subjects on the PAT. The numbers in parenthesis indicate total possible number of points for each subtest.

When comparing the pre- and post test scores, several trends were revealed. First, by the end of training, all subjects' rhyming scores were at 100% accuracy. Segmentation scores remained the same for Subject A and Subject C while Subject B's raw score increased by three points. The isolation subtest required the students to tell the clinician the sound located in the initial/medial/final position of the word. Subject A made the largest gain on this subtest by increasing the raw score from 16 to 26. Subjects B and C both increased their raw scores by six points. The deletion subtest required the subjects to listen to a word and then repeat it, but without a certain part (e.g., say mailbox, but don't say box). Subject B made the greatest gains with a six point raw score increase. Subject A remained the same while Subject C scored two points lower on the post-test. The substitution subtest used manipulatives for the first half and did not use manipulatives for the last half of the subtest. Subject B, again, made the greatest gains by increasing the raw score by 9 points. Subject A

made a two point gain while Subject C's scores remained the same. The blending subtest was the final subtest administered. Subject C made the greatest gains on this subtest increasing from nine points on the pre-test to 14 points on the post-test. Subjects A and B both made two point gains on this subtest.

Portions of the Graphemes and Decoding subtests were also given. Results are presented in Figure 9.

		Graphemes		Decoding		
		Consonants (20)	Long & short Vowels (10)	VC Words (10)	CVC Words (10)	Consonant Digraphs (10)
Subject A	Pre-test	11	4	0	0	0
	Post-test	9	7	2	0	0
Subject B	Pre-test	7	5	0	0	0
	Post-test	15	7	3	1	0
Subject C	Pre-test	14	3	0	0	0
	Post-test	11	5	0	0	0

Figure 9. Scores for all subjects from portions of the graphemes and decoding subtests of the PAT. Numbers in parenthesis indicate total possible number of points for each portion.

These portions of the two subtests from the PAT also revealed interesting findings. Subject B's raw score increased from 7 to 15 on naming consonants. The other two subjects, however, had scores which decreased. On naming long and short vowels, all subjects increased their raw scores. Increases ranged from two to three points. On decoding of VC words, Subject A and Subject B increased their scores by two and three points respectively, while Subject C remained at 0. Decoding of CVC

words showed an improvement only by Subject B. Subject A and C remained at 0 points correct for that portion of the subject. Finally, on the consonant digraphs, no subjects produced any of the words correctly on either the pre or post test.

CHAPTER V

Discussion

Summary of Results

Three students with phonologically based reading difficulties were chosen to participate in an individually based phonological awareness intervention program. The three subjects had already received individual pull-out therapy for speech or language delays in addition to classroom based phonological awareness training during kindergarten.

Results indicated that intense, individual training and use of acoustic and motoric properties of phonemes in the summer after kindergarten improved correct production of individual phonemes when given the grapheme. All three subjects' scores began at approximately 60% on 12 phoneme grapheme combinations and improved to over 90% in less than 4 weeks of treatment.

The results also indicated blending exercises, which emphasized the acoustic and motoric properties of phonemes, improved the accuracy of single word decoding. There was a significant increase in reading both real and pseudo words during the blending and segmenting treatment. Two of the three subjects had scores of 0% and one subject fluctuated between 0% and 7% accuracy throughout the baseline period. When treatment began, their pseudo word reading scores increased by at least 20%.

The results of the spelling portion were not as striking for all three subjects as were results of the reading portion. Two of the three subjects showed an overall gain in spelling scores after the blending and segmenting treatment began.

Interpretation/Explanation of Results

It is interesting to consider why all three of these subjects succeeded in individual phonological awareness training when they did not learn phonological awareness skills as well with classroom based instruction throughout the kindergarten school year. First, the amount of structured, repetitive practice was much greater with individual instruction. Second, children were given more specific feedback regarding the correctness or incorrectness of responses. Last, classroom based intervention focused primarily on acoustic/auditory properties of phonemes while individual instruction included both auditory and motoric properties of phonemes.

Phoneme/grapheme correspondence showed a steady increase in percent correct for all three subjects. The baseline scores attained for each subject remained consistent during each baseline period. Interestingly, all three subjects had similar baseline scores even though they had different kindergarten curriculums. Subject B was in a classroom in which the curriculum did not focus on the phoneme/grapheme association. Subject A and Subject C were both in classrooms where the curriculum focused on introduction of one letter a week.

After treatment began, scores did not increase immediately, most likely because phonemes that the subjects already knew were chosen to be first to promote a feeling of success. However, as treatment progressed, the percent accuracy for each child grew consistently until mastery was reached.

As treatment progressed, the subjects became more assertive in determining the articulatory postures they experienced. For approximately the first two weeks, they had difficulty expressing what was happening when they said a particular

phoneme. The clinician may have asked a question to prompt the child such as, "Is there air coming out of your mouth when you say the sound?" However, for the remaining two to three weeks of training they became more independent and accurate in their descriptions of the articulatory postures. Often, they would discuss the airflow, voicing, tongue posture, and nasality of the sounds.

When the treatment for Behavior II began, all three subjects had become frustrated with their failed attempts at blending and segmenting. Because of the large number of times the skill had been baselined, they had experienced a great deal of discouragement. Therefore, they were very interested when the clinician began to teach them how to decode the words. This may have contributed to the significant gains made by all three subjects after only one day of treatment. Prior to treatment, all three subjects would sound out each phoneme individually. There was no cohesion between phonemes to form a word. Occasionally, the subjects would guess a word that contained a phoneme which the target word contained. For example, the word "bat" would be written on the card. The subject would sound out /b. . . æ. . .t/ , then pause and say the word "tree" or "ball."

Auditory blending was the first blending exercise completed for the treatment of Behavior II and was beneficial for all three subjects. After this treatment, while being presented with words for data collection they slowly sounded out each sound in the word, but the process was repeated more quickly. They blended the sounds together until it "sounded" like a word. Finally, they would say it one last time as their answer. This process was used for all three subjects for both real and pseudo words. The subjects' scores continued to increase as they became more proficient

with this strategy. Subject C seemed to be tired or acted apathetic to treatment at times. This may account for the greater fluctuation in percent accuracy in the scores.

Treatment for the segmenting portion of Behavior II was not explicitly taught. Slight increases in spelling were seen in two of the subjects, however. Subject A had baseline spelling scores between 22% and 68% accuracy. He was most frequently able to determine the initial sound in words. After approximately two weeks of treatment for phoneme awareness and baselining of spelling, he was often able to determine the final sound in words.

Subject B was also able to determine the initial sounds of the word more accurately than the medial or final sounds. However, as blending treatment progressed, sounds in the medial and final positions were more accurately written. Interestingly, Subject B was the only subject to include extra letters in words when spelling them during baselining. For example, when the clinician said the word "pat" the subject wrote "pftteere." In baselining Subject B also included star shapes rather than letters in some words. At the end of treatment, even when spelling was not 100% accurate, the appropriate number of phonemes were used in segmenting.

Similar to the other two subjects, Subject C also was most consistently able to accurately determine the initial sounds of words when spelling. Subject C was rarely able to determine the medial or final sounds of a word. As stated before, an apathetic attitude, in addition to no explicit segmenting treatment, may have contributed to a lack of progress in segmenting.

Relation to Past Studies/Research

ASHA (2000) suggested that speech-language pathologists should play a role in the prevention and remediation of language-based reading difficulties. Some believe that classroom-based intervention by the regular education classroom teacher is an effective type of intervention for students (Blachman, 1991; Bradley R Bryant, 1983, 1985; Lundberg, Frost, & Petersen, 1988). Others, however, believe that SLPs possess knowledge important for training phonological awareness and should be involved in this training (Catts, et al., 1998; Swank & Catts, 1994). In addition, Swank (1994) promotes individual treatment for children who do poorly in the classroom-based phonological awareness programs. The results of the present study support the idea that SLPs should be involved in phonological awareness training and that individual therapy can be effective in remediation of phonological awareness skills. Speech-language pathologists were involved in the classroom treatment that these students received and most children learned a considerable amount during the phonological awareness training in kindergarten, however, these subjects did not perform well in the classroom-based program. The combination of individual therapy and classroom therapy by an SLP seemed to be successful for these three students with phonologically based reading difficulties.

All three of the subjects who participated in the present study had speech and/or language delays. These characteristics support the findings of Clark-Klein (1991), Bird et al. (1995), Apel et al. (1992), and Dominick, et al. (1993) which state that children with speech and/or language disorders perform more poorly on phonological awareness tasks. Because SLPs are likely to be involved with this group

of children due to speech and/or language goals, it is important they consider that these students may be at-risk and incorporate phonological awareness as part of children's individualized treatment when deficits exist.

Recently there has been considerable debate concerning the best method of teaching children who are at risk for reading difficulties because of poor phonological awareness skills. The results of this study support the findings of Alexander et al. (1991), Brown and Fetton (1990), and Lovett et al. (1994) who reported significant success in building functional alphabetic reading skills in children with phonologically based reading difficulties. Lovett et al. (1994) was most successful when using direct instruction, practice "sounding out" words, and focus on blending and segmenting skills. The method involved in the phonological awareness training of the present study included all of these factors, direct instruction, practice sounding out words, and blending and segmenting tasks, and found similar successful results. The training conducted by Lovett et al. (1994), with a group of nine year old children was effective after approximately 35 hours of treatment. Six year old subjects with poor phonological awareness skills in the present study had similar successful results after only 14 hours of training.

An important component of the phoneme awareness portion of the study (Behavior I) was the use of some of the concepts of the Lindamood and Lindamood LiPS (1998) program, formerly Auditory Discrimination in Depth (1975). Results indicated that the acoustic and motoric cues used in this program may have been a helpful part of the training. Skjelfjord (1976) and Alexander, et al. (1991) found the program to be essential in their phonological awareness training program. Kennedy

and Backman (1993), however, found that children who received both the ADD program (Lindamood & Lindamood, 1975) and a comprehensive remedial program did not develop better reading, spelling, and phonological awareness skills than children who received only the comprehensive remedial program. More research comparing the ADD program (Lindamood & Lindamood, 1975) and other phonological awareness programs needs to be conducted.

Practical Implications

There are several practical implications that can be drawn from this study. First, the results of this data conclude that some children with phonological difficulties benefit from a one-on-one environment with an SLP. The intensive individual therapy with the SLP seemed to better meet the needs of these children with phonological awareness difficulties.

The age of intervention is another factor to consider in the effectiveness of phonological awareness intervention. Training for the six year old subjects in the current study lasted only 14 hours per subject. The training conducted by Lovett et al. (1994) with nine year old children lasted more than twice as long. Therefore, intervention at an early age may be as effective in a shorter amount of time than intervention that occurs when a child is older.

Results of the present study indicate that explicit teaching of segmenting and blending skills were needed as stepping stones for learning to read and decode single words. These important skills may help a child to better understand components of words and the process of decoding those components to form words.

Lastly, a phonological awareness program which emphasizes the acoustic and motoric aspects of sounds is beneficial in teaching phoneme/grapheme associations. When children are experiencing difficulty with this foundation for reading, it is important to implement a combination of approaches which will assist the child in learning these associations.

Limitations of the Study

The first limitation of the study is the short period of time that remained for the blending and segmenting portion (Behavior II) in the study. Mastery of the 12 phonemes presented during the phoneme awareness (Behavior I) portion of the study required more sessions than anticipated. As a result, a fewer number of sessions could be spent focusing on explicit teaching of the blending and segmenting skills. Additional weeks of treatment may have shown more definite trends, especially in the percent accuracy of spelling using segmenting skills, for all subjects.

Another limitation is that time constraints did not allow for a long-term follow-up of the skills for these three subjects. Follow-up testing might determine if the subjects were able to build on the skills they learned during individual therapy with information attained during classroom based instruction during their 1st grade year. In addition, follow-up testing of the three subjects and their peers could help determine if their skills continued to improve or if the subjects' scores remained significantly below their class means.

Future Research

There is a great deal of information to be researched in the area of phonological awareness training. Future research should include a follow-up study of

these subjects or a longitudinal study of students with phonological awareness difficulties who receive similar treatment. This type of long-term study would determine if students were able to remain "caught-up" with their phonological awareness skills and benefit from classroom-based instruction, or if their skills would again become delayed.

As stated before, another area of research might be to compare the ADD program (Lindamood & Lindamood, 1975) type of phoneme awareness with another program that does not emphasize the motoric cues and articulatory postures of each phoneme. This comparison would help determine if the motoric cues are the effective component of the phonological awareness program.

Another area of research should focus on the age of the child when intervention begins. As stated before, the subjects in the present study were able to improve their phonological awareness skills through approximately 14 hours of training. The nine year old children in the study by Lovett et al. (1993) required a longer period of treatment. Future research may include using the same phonological awareness intervention program with subjects from two different age groups.

The present study determined that for the three subjects included with phonologically based reading difficulties, classroom based intervention was not as effective as individual training. The individual training provided the opportunity for a great deal of specific feedback for each child. Future research should explore the effectiveness of phonological awareness training for small groups of children.

A final idea for future research may be to compare subjects with different characteristics. Alexander et al. (1991) researched the effects of the ADD program

on children with severe dyslexia ages 7:9 to 12:9. Future research may include subjects with other difficulties such as children with hearing impairment. Additionally, it will be important to determine the age which is most conducive to phonological awareness remediation. The ages of children in the literature range from preschool age (Korkman & Peltomaa; 1993) to 17 years (Kennedy & Backman, 1993). However, it has not been determined whether more training is needed for older children or if remediation is more successful with younger children.

A large body of research supports the relationship between phonological awareness and reading skills. Current research has begun to explore the relationship between children who have speech/language difficulties and poor reading skills. Continuing to search for information in these areas will assist professional in developing effective strategies for remediation.

References

Adams, M. J. (1990). Beginning to read: Thinking and learning about print. Cambridge, MA: MIT Press.

Alexander, A. W., Anderson, H. G., Heilman, P. C., Voeller, K. K. S, & Torgesen, J. K. (1991). Phonological awareness training and remediation of analytic decoding deficits in a group of severe dyslexics. Annals of Dyslexia, 41,193-206.

American Speech-Language Hearing Association Ad Hoc Committee on Reading and Writing. (2000). Roles and responsibilities of speech-language pathologists with respect to reading and writing in children and adolescents. Unpublished manuscript.

Apel, K., Shields, M., & Perrin, N. (1992, November). Emergent literacy skills in normal and phonologically impaired children. Paper presented at the annual meeting of the American Speech-Language-Hearing Association. San Antonio, TX.

Aram, D. M., Ekelman, B. L., & Nation, J. E. (1984). Preschoolers with language disorders: 10 years later. Journal of Speech and Hearing Research, 27, 232-244.

Ball, E. W. & Blachman, B. A. (1988). Phoneme segmentation training: Effect on reading readiness. Annals of Dyslexia, 30, 208-225.

Ball, E. W. & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and development of spelling? Reading Research Quarterly, 26, 49-66.

Barnes, C., Smitley, J., & Throneburg, R. (1998). Phonological awareness training: Effects on phonological awareness and reading skills. Presentation at the National Convention for the American Speech-Language-Hearing Association.

Bentin, S., & Leshem, H. (1993). On the interaction between phonological awareness and reading acquisition: It's a two-way street. Annals of Dyslexia, 43, 125-148.

Bird, J., Bishop, D. V. M. & Freeman, N. H. (1995). Phonological awareness and literacy development in children with expressive phonological impairments. Journal of Speech and Hearing Research, 38, 446-462.

Bishop, D. V. M. & Adams, C. (1990). A prospective study of the relationship between specific language impairment, phonological disorders and reading retardation. Journal of Speech and Hearing Research, 38, 446-462.

Blachman, B. A. (1989). Phonological awareness and word recognition: Assessment and intervention. In A. Kamhi & H. Catts (Eds.), Reading disabilities: A developmental language perspective, (pp. 133-158). Boston, MA: Allyn & Bacon.

Blachman, B. A. (1991). Early intervention for children's reading problems: Clinical applications of the research in phonological awareness. Topics in Language Disorders, 12, 51-65.

Blachman, B. A., Ball, E. W., Black, R. S., & Tangel, D. M., (1994). Kindergarten teachers develop phoneme awareness in low-income, inner-city classrooms: Does it make a difference? Reading and Writing: An Interdisciplinary Journal, 6, 1-18.

Boudreau, D. M., & Hedberg, N. L. (1999). A comparison of early literacy skills in children with specific language impairment and their typically developing peers. American Journal of Speech-Language Pathology, 8, 249-60.

Bradley, L., & Bryant, P. (1983). Categorizing sounds and learning to read: A causal connection. Nature, 30, 419-421.

Bradley, L., & Bryant, P. (1985). Rhyme and reason in reading and spelling. Ann Arbor: University of Michigan Press.

Brown, I.S., & Felton, R.H. (1990). Effects of instruction on beginning reading skills in children at risk for reading disability. Reading and Writing: An Interdisciplinary Journal, 2, 223-241.

Catts, H. (1993). The relationship between speech-language impairments and reading disabilities. Journal of Speech and Hearing Research, 36, 948-957.

Catts, H., & Kamhi, A. (Eds.). (1999). Language and reading disabilities. Boston, MA: Allyn, & Bacon.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (1998). Subtypes of reading disabilities: An alternative to IQ-achievement discrepancy. Paper presented at the annual meeting of the Society for the Scientific Study of Reading, San Diego, CA.

Chall, J (1983). Stages of reading development. New York: McGraw Hill.

Clarke-Klein, S.M. (1991). Expressive phonological deficiencies: Impact on spelling development. Topics in Language Disorders, 14, 40-55.

Dominick, M., Hodson, B., Coffman, G., & Wynne, M. (1993). Metaphonological awareness performance and training: Highly unintelligible prereaders. Paper

presented at the annual convention of the American Speech-Language-Hearing Association, Anaheim, CA.

Damon, W. (Ed.) (1998). Handbook of child psychology. New York: John Wiley & Sons, Inc.

Dunn, L. M.& Dunn, L. M. (1997) Peabody Picture Vocabulary Test Third Edition. American Guidance Service; Circle Pines, MN.

Ehri, L. (1979). Linguistic insight: Threshold of reading acquisition. In T. G. Waller & G. E. MacKinnon (Eds.), Reading research. Advances in theory and practice, Vol. 1. New York: Academic Press.

Fox, B., & Routh, D. (1980). Phonemic analysis and severe reading disability in children. Journal of Psycholinguistic Research, 9,115-119.

Gillam, R. B. & Carlile, R. M. (1997). Oral reading and story retelling of students with specific language impairment. Language, Speech, and Hearing Services in Schools, 28, 12-29.

Gillon, G. T. (2000). The efficacy of phonological awareness intervention for children with spoken language impairments. Language, Speech, and Hearing Services in Schools, 31, 126-141.

Goldsworthy, C. (1996). Developmental reading disabilities: A language-based reading approach. San Diego, CA: Singular Publishing Group, Inc.

Gough, P. & Tunmer, W. (1986). Decoding, reading, and reading disability. Remedial and special Education, 7, 6-10.

Hall, P. K. & Tomblin, J. B. (1978). A follow-up study of children with articulation and language disorders. Journal of Speech and Hearing Disorders, 43, 227-241.

Harbers, H. M., Paden, E. P. & Halle, J. W. (1999). Phonological awareness and production: Changes during intervention. Language, Speech, and Hearing Services in Schools, 30, 50-60.

Helfgott, J. (1976). Phonemic segmentation and blending skills of kindergarten children: Implication for beginning reading acquisition. Contemporary Educational Psychology, 1, 157-169.

Hoover, W., & Gough, P. (1990). The simple view of reading. Reading and Writing: An Interdisciplinary Journal, 2, 127-160.

Howard, M. (1988). Phonology first-A natural approach to beginning reading. Idaho Reading Report, 31, 123-134.

Invernizzi, M. & Meier, J. (1997). Phonological Awareness Literacy Screening. Charlottesville, VA.; University of Virginia Press.

Kennedy, K. M. and Backman, J. (1993). Effectiveness of the Lindamood auditory discrimination in depth program with students with learning disabilities. Learning Disabilities Research and Practice, 8, 253-259.

Korkman, M. and Peltomaa, A. K. (1993). Preventative treatment of dyslexia by a preschool training program for children with language impairments. Journal of Clinical Child Psychology, 22, 277-287.

Kozminsky, L., & Kozminsky, E. (1995). The effects of early phonological awareness training on reading success. Learning and Instruction, 5,187-201.

Levi, G., Capozzi, F., Fabrizi, A., & Sechi, E. (1982). Language disorders and prognosis for reading disabilities in developmental age. Perceptual and Motor Skills, 54, 1119-1122.

Lewis, B. A. & Freebairn, L. (1992). Residual effects of preschool phonology disorders in grade school, adolescence, and adulthood. Journal of Speech and Hearing Research, 35, 819-831.

Lewkowicz, N. K. (1980). Phonemic awareness training: What to teach and how to teach it. Journal of Educational Psychology, 72, 686-700.

Liberman, I. (1983). A language-oriented view of reading abilities and its disabilities. In Myklebust (Ed.). Progress in Learning Disabilities, 5, 81-101. New York: Grune & Stratton

Lie, A. (1991). Effects of a training program for stimulating skills in word analysis in first-grade children. Reading Research Quarterly, 26, 234-250.

Lindamood C. H. & Lindamood P. C. (1975). The A.D.D. Program, Auditory Discrimination in Depth. Hingham, MA: Teaching Resources Corporation.

Lindamood C. H. & Lindamood P. C. (1979). The LAC Test, Lindamood Auditory Conceptualization Test. Hingham, MA: Teaching Resources Corporation.

Lindamood C. H. & Lindamood P. C. (1998). The Lindamood Phoneme Sequencing Program for Reading, Spelling, and Speech (3rd ed.). Austin, TX: Pro-Ed.

Lovett, M. W., Borden, S. L., DeLuca, T., Lacerenza, L., Benson, N. J., & Brackstone, D. (1994). Treating the core deficits of developmental dyslexia: Evidence transfer of learning after phonologically-and strategy-based reading training programs. Developmental Psychology, 30, 805-822.

Lovett, M. W., Warren-Chaplin, P. M., Ransby, M. J., & Borden, S. L. (1990). Training the word recognition skills of reading disabled children: Treatment and transfer effects. Journal of Educational Psychology, 82, 769-780.

Lundberg, I., Frost, J. & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. Reading Research Quarterly, 23, 263-283.

Lundberg, I., Olofsson, A., & Wall, S. (1980). Reading and spelling skills in the first school years predicted from phonemic awareness skills in kindergarten. Scandinavian Journal of Psychology, 21, 159-173.

Lyon, G. R. (1985). Research in learning disabilities: Contributions from scientists supported by the National Institute of Child Health and Human Development. Journal of Child Neurology, 10, 120-126.

McGuiness, D., McGuiness, C., & Donohue, J. (1995). Phonological training and the alphabet principle: Evidence for reciprocal causality. Reading Research Quarterly, 30, 830-852.

Menyuk, P., & Chesnick, M. (1997). Metalinguistic skills, oral language knowledge, and reading. Topics in Language Disorders, 17, 75-87.

Moncure, Jane Belk (1979). My S Sound Box. Elgin, IL: Children's Press.

Newcomer, P. L. & Hammill, D. D. (1997). Test of Language Development. Austin, TX: Pro-Ed.

O'Conner, Jenkins, Leicester, and Slocum (1993). Teaching phonological awareness to young children with disabilities. Exceptional Children, 59, 532-46.

Perfetti, C.A. (1991). Representations and awareness in the acquisition of reading competence. In L. Rieben & C.A. Perfetti (Eds.), Learning to read: Basic research and its implications (pp. 33-44). Hillsdale, NJ: Erlbaum.

Richards, R. G. (1999). The source for dyslexia and dysgraphia. East Moline, IL: LinguiSystems.

Robertson, C. & Salter, W. (1997). The Phonological Awareness Test. East Moline, IL: LinguiSystems, Inc.

Share, D. (1995). Phonological recoding and self-teaching: sine qua non of reading acquisition. Cognition, 55, 155-218.

Share, D. & Stanovich, K. (1995). Cognitive processes in early reading development: Accommodating individual differences into a model of acquisition. Issues in Education, 1, 1-57.

Skjelfjord, V. J. (1976). Teaching children to segment spoken words as an aid in learning to read. Journal of Learning Disabilities, 9, 297-305. (Handbook of Child Psy., W. Damon, 1998).

Snowling, M., & Hulme, C. (1989). A longitudinal case study of developmental phonological dyslexia. Cognitive Neuropsychology,6, 379-401.

Stackhouse, J. (1997). Phonological awareness: Connecting speech and literacy problems. Ch. 7 in Hodson, B. and Edwards, M. (Eds.). Perspectives in Applied Phonology. 154-190.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. Reading Research Quarterly, 27, 360-406.

Stark, R. E., Bernstein, L. E., Condion, R., Bender, M., Tallal, P., & Catts, H. (1984). Four year follow-up study of language impaired children. Annals of Dyslexia, 34, 49-68.

Swank, L. K. & Catts, H. W. (1994). Phonological awareness and written decoding. Language, Speech, and Hearing Services in Schools, 25, 9-14.

Torgesen, J. K., & Davis, C. (1996). Individual difference variables that predict response to training in phonological awareness. Journal of Experimental Child Psychology, 63, 1-21.

Torgesen, J.K., Morgan, S., & Davis, C. (1992). The effects of two types of phonological awareness training on word learning in kindergarten children. Journal of Educational Psychology, 84, 364-370.

Troia, G. A. (1999). Phonological awareness intervention research: A critical review of the experimental methodology. Reading Research Quarterly, 34, 28-52.

van Kleeck, A., Gillam, R. B., & McFadden, T. U. (1998). A study of classroom based phonological awareness training for preschoolers with speech and/or language disorders. American Journal of Speech-Language Pathology, 7, 65-76.

Wagner, R. K., Torgesesn, J. K., & Rashotte, C. A. (1994). The development of reading-related phonological processing abilities: New evidence of bi-directional causality from a latent variable longitudinal study. Developmental Psychology, 30, 73-87.

Warrick, N., Rubin, H. & Rowe-Walsh, S. (1993). Phoneme awareness in language-delayed children: comparative studies and intervention. Annals of Dyslexia, 43, 153-173.

Wingert, P. (1999). Dyslexia and the new science of reading. Newsweek, 72-78.

APPENDIX A

Scores of Standardized Tests for All Subjects

Test of Language Development-Primary

TOLD (Standard Scores)										
	PV	RV	OV	GU	SI	GC	WD	PA	WA	Total
Subject A	13	10	10	8	4	10	11	9	1	55
Subject B	10	6	5	11	5	6	8	9	12	43
Subject C	11	9	11	11	6	7	7	9	8	55

PV = Picture Vocabulary
RV = Relational Vocabulary
OV = Oral Vocabulary
GU = Grammatic Understanding
SI = Sentence Imitation
GC = Grammatic Completion
WD = Word Discrimination
PA = Phonemic Analysis
WA = Word Articulation
Total = Sum of all Standard Scores

Peabody Picture Vocabulary Test-3rd ed.

PPVT (Standard Scores)	
Subject A	119
Subject B	96
Subject C	94

Goldman-Fristoe Test of Articulation

GTFA (percentiles)	
Subject A	14 *
Subject B	99
Subject C	59 *

* None of the phonemes in error were included in the sound/letter portion of the study.

Phonological Awareness Test

Subject	R (20)	S (30)	I (30)	D (10)	S (20)	B (10)	GC (20)	GV (10)	D VC (10)	D CVC (10)	D CD (10)
Subject A	17	20	16	14	3	15	11	4	0	0	0
Subject B	14	23	13	11	5	17	7	5	0	0	0
Subject C	20	15	7	10	3	9	14	3	0	0	0

* Number in ( ) equals the total points possible for each subtest

R = Rhyming
I = Isolation
S = Substitution
GC = Graphemes – Consonants
D VC = Decoding – VC Words
D CVC = Decoding – CVC Words
D CD = Decoding – Consonant Digraphs

S = Segmentation
D = Deletion
B= Blending
GV = Graphemes – Vowels