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# THE DEVELOPMENT OF PHONOLOGICAL AWARENESS IN YOUNG CHILDREN: EXAMINING THE EFFECTIVENESS OF A PHONOLOGICAL AWARENESS PROGRAM

by

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A DISSERTATION

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THE DEVELOPMENT OF PHONOLOGICAL AWARENESS IN YOUNG CHILDREN: EXAMINING THE EFFECTIVENESS OF A PHONOLOGICAL AWARENESS PROGRAM

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University of Nebraska, 2011

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The purpose of the current study is to investigate the effectiveness of the *Road to the Code* phonological awareness program on the development of at-risk, kindergarten students' phonological awareness and early reading skills. Six kindergarten students were identified as experiencing difficulty in the area of phonological awareness and were divided into three groups. This study included three phases: a baseline phase, during which no instruction in the *Road to the Code* program was provided; an intervention phase, during which the *Road to the Code* program was implemented; and a maintenance phase. Student reading progress was monitored using standardized measures from the Dynamic Indicators of Basic Literacy Skills (DIBELS) and experimenter-developed measures. Program effectiveness was evaluated through a multiple baseline across participants design. Results indicated that participation in the *Road to the Code* program resulted in an increase in the students' phonological awareness skills and that these gains maintained following the completion of the program. Additionally, students demonstrated the ability to generalize learned skills to progress monitoring measures containing novel content. Limitations of the study, implications for practice, and future research directions will also be discussed.

# Table of Contents

Chapter 1: Introduction…….……...……..1

Chapter 2: Review of the Literature…….…….…..…….…..8

Chapter 3: Method……..…….…….....54

Participants and Setting…….…54

Materials…….....56

Screening Measures……...57

Dependent Variables……..60

Independent Variable..…….……..64

Experimental Design…….……66

Procedures…….……...…..68

Treatment Integrity and Interrater Reliability……....72

Chapter 4: Results…….……...……76

Chapter 5: Discussion…….……...……111

References……..……148

Appendices……..……....160

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## List of Tables


| | | |
|---|---|---|
| Table 1 | Participating Student Characteristics | 54 |
| Table 2 | Individual Student Screening Scores | 69 |
| Table 3 | Individual Student Means, Ranges, and Cut Points for Correct Sounds (CS) for the Baseline and Intervention Phases of the Phoneme Segmentation Fluency (PSF) Measure | 80 |
| Table 4 | Individual Student Mean Accuracy Percentages from Baseline and Intervention Phases for Phoneme Segmentation Fluency (PSF) | 80 |
| Table 5 | Individual Student Means and Ranges for the Road to the Code Intervention (RTCi) Measure | 87 |
| Table 6 | Individual Student Mean Accuracy Percentages from Baseline and Intervention Phases for Road to the Code (RTCi) Measure | 87 |
| Table 7 | Individual Student Means, Ranges, and Cut Points for Correct Letter Sequences (CLS) for the Baseline and Intervention Phases on the Nonsense Word Fluency (NWF) Measure | 93 |
| Table 8 | Individual Student Mean Accuracy Percentages from Baseline and Intervention Phases for the Nonsense Word Fluency (NWF) Measure | 93 |
| Table 9 | Individual Student Means and Ranges for the Road to the Code Generalization Measure | 101 |
| Table 10 | Individual Student Mean Accuracy Percentages from the Baseline to Intervention Phases for the Road to the Code Generalization (RTCg) Measure | 101 |
| Table 11 | Baseline Starting Points, Intervention Starting Points, and Intervention Ending Points for the RTCi and RTCg Probes for the Total Group, Low-performing and High-performing Students | 106 |
| Table 12 | Correct Letter Sequences (CLS) Mean Gains for Total Group, Low-performing Students, and High-performing Students on the RTCi and RTCg Measures during the Intervention Phase | 107 |

## List of Figures


| | | |
|---|---|---|
| Figure 1 | Multiple Baseline across Low-performing Students and High-performing Students for the Phoneme Segmentation Fluency (PSF) Measure | 79 |
| Figure 2 | Multiple Baseline across Low-performing Students and High-performing Students for the Road to the Code Instructional (RTCi) Measure | 86 |
| Figure 3 | Multiple Baseline across Low-performing Students and High-performing Students for the Nonsense Word Fluency (NWF) Measure | 92 |
| Figure 4 | Multiple Baseline across Low-performing Students and High-performing Students for the Road to the Code Generalization (RTCg) Measure | 100 |

# CHAPTER 1

## Introduction

Proficient reading is necessary to experience success both during and after the completion of formal schooling. Reading allows for the increase of skills, the expansion of knowledge, and the ability to construct meaning from written language (Adams, 1990; Snow, Burns, & Griffin, 1998). However, reading is a complex process and approximately 25% of children experience difficulty learning to read (Moats, 2007) even after receiving good classroom instruction (Schuele & Boudreau, 2008). The expectation of the educational system is that all students will be proficient readers upon completion of their schooling careers, which will allow them to generalize learned skills to settings outside of the classroom and transition successfully into the work environment (Nevills & Wolfe, 2009; Snow et al., 1998). However, research findings have repeatedly shown that reading difficulties often persist past formal education and interfere with one's ability to find and maintain employment (Moats, 2007; Snow et al., 1998). Such facts indicate the importance of providing children with those skills necessary for future reading success at an early age (Snow et al., 1998).

The ability to generalize learned skills or behavior is important as it allows for the utilization of such skills in a variety of settings and situations. The successful generalization of a skill or behavior is defined by the ability of an individual to independently produce an accurate response to a novel stimulus that is similar in some way to an initial stimulus (Daly, Martens, Barnett, Witt, & Olson, 2007; Miltenberger, 2004). For example, a student who is able to successfully generalize learned reading

skills would show the ability to read novel print encountered outside of the instructional setting.

Young children are demonstrating phonological awareness when they begin to develop an awareness of the various sound units of speech as separate from their meaning (Gillon, 2004; McBride-Chang, 2004; Snow et al., 1998). Phonological awareness is often described as encompassing a continuum of skills, ranging from such basic skills as rhyming and alliteration to more complex skills such as identifying and manipulating phonemes, which are the individual sound units of a word (Heroman & Jones, 2004; Snow et al., 1998). Phonological awareness has been found to have a significant and causal relationship with both early and future reading success (Gillon, 2004). Specifically, those children who experience difficulty understanding the phonology of their language often demonstrate later and persistent deficits in word recognition and spelling (Ball & Blachman, 1991).

Due to the important role of phonological awareness in the reading process, it appears necessary to provide assistance to those young children who either possess few phonological awareness skills or are experiencing difficulty acquiring and applying them to the reading process (Schuele & Boudreau, 2008; Snow et al., 1998). Researchers have, in fact, found that training in phonological awareness has a positive effect on a child's success with learning to read (Gillon, 2004; Perez, 2008), particularly for those children identified as at-risk for future reading difficulties (Gillon, 2004; Schuele & Boudreau, 2008; Snow et al., 1998). Providing instruction at the phoneme level to promote what is referred to as phonemic awareness is important for school-aged children as it is considered to be the strongest predictor of future reading success of all the skills on the

phonological awareness continuum (Adams, 1990; Gillon, 2004; Perez, 2008). Phonemic awareness is the ability to demonstrate that each word is comprised of a particular sequence of individual phonemes, or sounds (Ball & Blachman, 1991; Heroman & James, 2004; Schuele & Boudreau, 2004), and allows children to engage in such skills as blending, segmenting, substituting, and deleting phonemes (Adams, 1990; Heroman & James, 2004; Moats, 2007).

While results from a plethora of research have documented the importance of phonological awareness in the reading process, there does not appear to be complete agreement on how to teach it. Specifically, phonological awareness interventions and programs have been found to differ in their overall content, sequence, and duration (Bus & van IJzendoorn, 1999; Qi & O'Connor, 2000). There have been characteristics, components, and features that have been identified as contributing to the effectiveness of a phonological awareness program (Good, Simmons & Smith, 1998; Smith, Simmons, & Kameenui, 1998), yet there does not seem to be an overall consensus. For example, some researchers have indicated that phonological awareness programs should include tasks that increase in their level of difficulty, but research is mixed on the effectiveness of such basic skills as rhyming and alliteration in predicting and promoting future reading success (Bryant, MacLean, Bradley, & Crossland, 1990; Martin & Byrne, 2002; Smith, Scott, Roberts, & Locke, 2008; Yeh & Connell, 2008).

Some researchers suggest that phonological awareness programs should primarily target at least one of the more complex skills of phoneme blending and phoneme segmentation due to their link with future reading success (National Reading Panel [NRP], 2000; Schuele & Boudreau, 2008; Snider, 1995). However, other researchers

have indicated that phoneme blending training in isolation is less effective than when integrating instruction in both phoneme blending and phoneme segmentation (Torgesen, Morgan, & Davis, 1992). Furthermore, many researchers have not identified those individual students who are nonresponsive to training in these skills when reporting their results (Busink, 1997).

The integration of instruction in letter-sound correspondence has also been identified as contributing to the effectiveness of a phonological awareness program as it reinforces the connection between the sounds of oral language and their corresponding symbols, or letters, in written language (Bus & van IJzendoorn, 1999; NRP, 2000; Snow et al., 1998). While some researchers have demonstrated gains in phonological awareness and early reading skills without the inclusion of letters (Lundberg, Frost, & Petersen, 1988), results from a meta-analysis indicated a significant difference in the effectiveness of phonological awareness programs that did and did not incorporate instruction in letter-sound correspondence (NRP, 2000). This finding suggests the importance of including such instruction in a phonological awareness program.

A number of standardized programs have been created to develop and strengthen young children's phonological awareness and early reading skills based upon phonological awareness research (NRP, 2000; Santi, Menchetti, & Edwards, 2004). From the review of the literature on these programs, it appears that most phonological awareness programs target young children in preschool through the primary grades as researchers have shown that the development of such skills at an early age is critical in promoting early literacy (Gillon, 2004; National Reading Council [NRC], 1999; Snow et al., 1998). Further, the majority of the programs reviewed as part of this project attempt

to generalize phonological awareness to print through the integration of letters and instruction in letter-sound correspondence. However, the programs differ with regards to the variety of included phonological awareness tasks, the sequence of included components, the type of instructional format, and the duration of the program. While most phonological awareness programs are described as being based on research in the field, few studies evaluating the effectiveness of these programs were found in an comprehensive literature search. As many of these programs are used extensively in the school setting, it seems important to empirically validate the effectiveness of these programs to assist educators when making decisions about how best to promote student success when learning to read.

The phonological awareness program being evaluated for this project is *Road to the Code* (Blachman, Ball, Black, & Tangel, 2000). This program was developed to provide assistance to at-risk kindergarten and first-grade students through explicit instruction in phoneme blending and phoneme segmentation, letter-sound correspondence, and other phonological awareness skills such as rhyming and alliteration. While no studies evaluating the effectiveness of this program itself were found in a literature search, the authors of this program conducted earlier studies with kindergarten children that utilized similar tasks and procedures (Ball & Blachman, 1991; Blachman, Tangel, Ball, Black, & McGraw, 1999). Results from these studies indicated that trained children performed better on measures of phonological awareness and early reading than children who had not received such training. However, several factors suggested the importance of further examinations of this program. For example, the current program has been modified in content, sequence of lessons, and duration since the

previous studies were conducted. Further, neither previous study targeted individual students identified as at-risk for future reading difficulties or incorporated ongoing progress monitoring measures that would allow for a close inspection of individual progress and responsiveness to the program.

The purpose of this study is to investigate the effectiveness of the *Road to the Code* program on the development of at-risk, kindergarten students' phonological awareness and early reading skills. Based upon a review of past literature, there are four hypotheses with regards to the outcome of this study. First, it is hypothesized that trained children will increase their phonological awareness skills as evidenced by gains on a standardized measure of phonemic awareness and an experimenter-developed measure of phoneme segmentation and pseudoword decoding containing only those letters explicitly taught as part of the *Road to the Code* program. Second, it is hypothesized that trained children will generalize their learning to a standardized measure of phoneme segmentation and pseudoword decoding, as well as to an experimenter-developed measure of pseudoword decoding including letters not explicitly taught in the *Road to the Code* program. Third, it is hypothesized that gains will be larger on the experimenter-developed measure that contains letters explicitly taught as part of the *Road to the Code* program than on the experimenter-developed measures that contain letters that were not explicitly taught. Fourth, it is hypothesized that these gains will maintain until the end of the school year.

**Definition of terms**

As there are several similar terms discussed within this project, they are specifically defined as follows:

*Phonological awareness:* The awareness that oral language is comprised of sound units of various lengths, such as syllables, onsets and rimes, and phonemes that are separate from their meaning (Gillon, 2004; Heroman & Jones, 2004; Ranweiler, 2004). Skill in phonological awareness is demonstrated through rhyming, alliteration, matching sounds in words, and segmenting, or pulling apart, and blending units of sound.

*Phonemic awareness:* The awareness that words are comprised of individual sounds, or phonemes (Ball & Blachman, 1991; Heroman & Jones, 2004; Snow et al., 1998). Phonemic awareness is demonstrated through the blending, segmenting, deleting, and substituting of phonemes. An example of phoneme deletion would be deleting the phoneme /k/ from the word 'cat' to form the word 'at,' while an example of phoneme substitution would be the ability to substitute the phoneme /k/ from the word 'cat' for /p/ to form the word 'pat.' Phonemic awareness is considered the most difficult and complex skill on the phonological awareness continuum.

*Phoneme segmentation:* The ability to segment, analyze, or break down words into their individual phonemes. Those demonstrating phoneme segmentation would be able to divide the word 'cat' into its individual phonemes.

*Phoneme blending:* The ability to blend, synthesize, or connect phonemes within the context of spoken language. Children demonstrating phoneme blending would show the ability to blend the individual phonemes, /k/ /a/ /t/, to form the word 'cat.'

# CHAPTER 2

## Review of the Literature

The ability to read proficiently is one of the most important skills that a child will develop due to its necessity for the successful understanding, interpretation, and communication of ideas through written language. Proficient reading entails the ability to match letters with their corresponding sounds and to combine one's background knowledge and experiences with context cues encountered in print to successfully comprehend what is being read (Adams, 1990; Byrne, Fielding-Barnsley, Ashley, & Larsen, 1997). Previous researchers have identified reading as a necessary skill for success in school as it plays a significant role in the ability to gain information and increase one's overall knowledge (Lonigan, Burgess, & Anthony, 2000; NRP, 2000; Snow et al., 1998).

Reading is also essential for success outside of the classroom. It is expected that all students will be able to demonstrate proficient reading fluency and comprehension upon completion of their schooling careers and that the generalization of these skills to settings outside of the classroom will assist them in making a successful transition to the work environment (Nevills & Wolfe, 2009; Snow et al., 1998). The successful generalization of a skill or behavior is defined as the independent production of an accurate response to a novel stimulus that is similar in some way to the original, or initial, stimulus (Daly et al., 2007; Miltenberger, 2004). The ability to generalize a skill indicates proficiency, or that the skill is under control of antecedent stimuli, referred to as stimulus control (Daly, Martens, Skinner, & Noell, 2008). With regards to the reading process, a student who is able to successfully generalize learned skills would show the

ability to not only read print that was used explicitly for teaching purposes, but would also be able to read print encountered in other texts, tasks (e.g., instructions, job applications, etc.), and settings (e.g., home, community, work, etc.). Therefore, successful reading indicates that a student's reading behavior is under the control of such stimuli as punctuation, spaces, and the different combinations of presented letters.

Findings from a recent nationwide reading assessment indicate that students are indeed making progress in reading and are able to generalize such skills to novel tasks and content (National Assessment of Education Progress [NAEP], 2007). Specifically, results show the average reading score to have increased from the previous assessment in 2005, with a higher percentage of students performing at or above both the Basic and Proficient levels in fourth-grade and at or above the Basic level in eighth-grade.

However, there continue to be a number of students who experience significant difficulty learning to read (Moats, 1999). Many children often start school with fewer early literacy skills due to a lack of text exposure at home and typically increase their skills at a slower rate than their peers (Ball & Blachman, 1991; Good et al., 1998). Due to a lack of fluent reading skills, approximately 20% of students at the elementary level choose not to read independently (Moats, 1999). While these students do continue to make progress, it becomes almost impossible for them to close the reading gap with their typically developing peers without some type of intensive instruction (Good et al., 1998; Moats, 1999). Further, young children entering kindergarten lacking many early literacy skills are at a higher risk for being identified as eligible for special education services later in their academic career (Longian et al., 2000; Whitehurst & Lonigan, 2001). For example, the number of students in today's schools that are verified as having a specific

learning disability is on the rise, with the majority of these students being identified due to reading difficulties (NRC, 1999; Snow et al., 1998).

Unfortunately, reading difficulties tend to continue not only throughout the school years, but also following formal education. Students who are unable to demonstrate at least moderate reading skills upon completion of third-grade typically remain in the bottom quarter to third of readers and are unlikely to receive a high school diploma (Snow et al., 1998; Moats, 2007). Statistics have shown that the unemployment rate for those who do not hold a high school diploma is three times higher than for those who hold a college degree (Snow et al., 1998). Further, in today's workforce, approximately 25% of adults lack the basic reading and writing skills necessary to obtain employment and to meet job requirements (Moats, 1999). Such statistics are disheartening, as they suggest that early reading difficulties have significant, negative effects that often persist throughout an individual's life.

These presented facts regarding the necessity of reading in our society and the current state of our nation's readers demonstrate the importance of providing young children with those skills that aid in the development of proficient reading. The purpose of the following review is to provide evidence supporting the contribution and development of one of those important early reading skills, phonological awareness, in learning to read. This literature review will first present and briefly describe those skills identified as contributing to proficient reading before discussing the early development of the reading process in young children. Research supporting the importance of phonological awareness in learning to read will then be presented, followed by the importance of providing direct and explicit instruction in phonological awareness to

young children, especially those at-risk for future reading difficulties. Finally, the intervention literature on phonological awareness will be presented, which will provide a rationale for the implementation of this current project.

It seems important to first discuss those skills identified as critical to future reading success and how each contributes to proficient reading. Presenting the connection between a young child's phonological skill and other critical reading skills will better clarify the relationship between phonological awareness and future reading achievement.

**Necessary Skills for Proficient Reading**

Reading is a complex process that is comprised of a number of individual skills and abilities that work together to aid in the comprehension of the written word. A meta-analysis of the literature base on scientifically based reading instruction identified five skills that should be targeted as part of formal instruction due to their importance in learning to read (National Institute for Literacy [NIL], 2001; NRP, 2000). These skills include comprehension, vocabulary, fluency, phonics, and phonemic awareness.

Comprehension is described as the purpose for reading (NIL, 2001; NRP, 2000). If a person can decode or identify individual words but cannot construct meaning from the passage, then they are not truly reading (NIL, 2001). Therefore, one could state that the other skills recognized as important for proficient reading are identified as such due to their ability to foster successful comprehension of the written word. For example, a person uses their vocabulary to help them construct meaning from print. Fluency describes an individual's ability to automatically decode and recognize words to free up attention for text comprehension. Phonics assists an individual with understanding the

connection between written language (i.e., letters), and their corresponding sound(s) in oral language to promote fluency. Finally, phonemic awareness promotes word recognition and fluency through the awareness of sounds in spoken language.

Of the five skills identified as critical for proficient reading, phonemic awareness is the earliest to develop due to its connection to spoken language (Heroman & Jones, 2004; NRP, 2000; Ranweiler, 2004). Therefore, it can be considered an important bridge between oral language and print.

**The Connection between Oral Language and Print**

In order to promote early reading success, a large amount of research has been devoted to understanding how reading develops and what early literacy skills are important contributors to the reading process. A consistent finding from this research is that a young child's oral language skills provide a necessary foundation for later reading success (Griffith, Beach, Ruan, & Dunn, 2008; Nevills & Wolfe, 2009; Snow et al., 1998). Specifically, children are able to understand and express themselves through spoken language from an early age, which will later assist them as they begin to encounter written words through print (Adams, 1990). Researchers have shown that success with learning to read is dependent upon the development of a child's oral language structures (Nevills & Wolfe, 2009), which are thought to be specifically built into the brain to assist with the acquisition of a system that facilitates spoken communication (Gillon, 2004; Nevills & Wolfe, 2009). These structures allow young children to show sensitivity to the individual sounds of their native language even while they are not able to focus specific attention on them (McBride-Chang, 2004). Young children are unaware of or unable to understand that language is comprised of a string of

individual words or sounds as they are predisposed to listen to and extract meaning from full utterances containing words that they automatically and unconsciously combine (Adams, 1990).

How does oral language specifically contribute to reading? To read proficiently, children must gain an awareness of their oral language structure, both at the word and individual sound level (Liberman, 1973). This is a difficult task for young children as it now becomes necessary for them to pay attention to various speech sounds as separate from their meaning (Heroman & Jones, 2004). Further, they must develop an awareness of the various sound units of speech, which is often referred to as phonological awareness (Heroman & Jones, 2004; Liberman, 1973). This skill promotes an understanding of the explicit connection between oral and written language as children learn that print is actually comprised of the same units of sound that they use when speaking (Liberman, 1973).

**Phonological Awareness and its Connection to Reading**

Because of the connection between oral language and print, an awareness of the phonology of one's language appears to be an essential prerequisite to proficient reading. In fact, previous researchers have found this to be the case. A significant and casual relationship between a child's phonological skills and future reading success has been repeatedly demonstrated in the literature (Bryant et al., 1990; Gillon, 2004; Good et al., 1998). Further, it appears that the relationship between a young child's phonological skills and learning to read is bidirectional (Gillon, 2004; Snow, et al., 1998). Specifically, children must have an awareness of the phonology of their language to experience success with understanding and utilizing the alphabetic principle (Snow et al.,

1998). Difficulties in this area often lead to later and persistent deficits in word recognition and spelling, which result in an ever-widening gap between struggling readers and their typically developing peers (Ball & Blachman, 1991). Conversely, young children who experience difficulty learning to read frequently demonstrate a phonological deficit, in which they are unable to use the sounds of spoken language to learn and successfully use written language (Good et al., 1998). Children with such phonological deficits often have difficulty recalling information, demonstrate inaccuracy in identifying similar sounding words, and drop word endings when spelling (Moats, 2007).

Many children gain a gradual awareness of the phonological structure of their language throughout the preschool years as they engage in such activities as rhyming, substituting sounds, segmenting words into syllables, and discovering the concept of alliteration (NRC, 1999; Snow et al., 1998). Therefore, many young children enter kindergarten with at least a rudimentary level of phonological awareness. However, others do not. The difference in acquired literacy skills of incoming kindergarteners is an important fact for educators to consider as recent researchers have found that those children with a higher level of phonological awareness upon entering kindergarten typically experience the most success when learning to read (NRC, 1999), while those possessing few or no phonological awareness skills often experience difficulties with the reading process (Schuele & Boudreau, 2008).

Phonological awareness is typically referred to as the ability to pay attention to and differentiate between the various sound units and patterns of a language as separate from their meaning (Gillon, 2004; McBride-Chang, 2004; Snow et al., 1998).

Specifically, young children learn to identify, separate, and manipulate the stream of speech into individual sentences, words, syllables, and sounds (Ball, 1993; Heroman & Jones, 2004; Ranweiler, 2004). They then demonstrate their understanding of phonological awareness through such skills as rhyming, identifying and matching initial and ending sounds in words, and counting, blending and segmenting various sound units (Gillon, 2004; NIL, 2001; NRP, 2000).

Because phonological awareness is such a broad construct, there has been some disagreement as to which skills and tasks best define it (Gillon, 2004; Runge & Watkins, 2006; Stahl & Murray, 1994; Stanovich, Cunningham, & Cramer, 1984). While some researchers have indicated that all phonological awareness tasks are interrelated and therefore measure the same construct (Anthony & Lonigan, 2004; Stahl & Murray, 1994), other researchers have suggested that rhyming should be categorized as a separate dimension of phonological awareness as it taps more basic skills such as listening to and hearing sounds (Runge & Watkins, 2006; Stanovich, et al., 1984). However, the varying level of difficulty between phonological awareness tasks may result in conflicting evidence regarding a child's phonological awareness skills (Adams, 1990; Good et al., 1998; Stahl & Murray, 1994). Specifically, a child may exhibit higher skills on one type of phonological awareness task and lower skills on another. This discrepancy in performance has prompted some researchers to focus on the linguistic complexity of a phonological awareness task, which can be described by word features, such as word length and number of consonant clusters, and task requirements, such as the position of phonemes in words and the size of phonological units being manipulated (Good et al., 1998; Runge & Watkins, 2006). Some researchers have suggested that the linguistic

complexity of a phonological awareness task not only has an influence on a child's current performance, but may also be a better predictor of future reading success than the type of task itself (Adams, 1990; Stahl & Murray, 1994).

**The Phonological Awareness Continuum.** Phonological awareness encompasses a wide range of skills, and previous researchers have focused on the sequence and importance of each skill on the phonological awareness continuum with regards to its impact on future reading success (Heroman & Jones, 2004). At the simple end of the continuum, children begin to develop and demonstrate early phonological awareness skills through listening and attending to sounds in their environment, which assists them in later focusing on specific sounds in words. Around 2 to 3 years of age, children then begin to use rhyme and alliteration to explore the sound similarities between words (Goldsworthy, 1998; Heroman & Jones, 2004; Israel, 2008). Rhyme refers to the knowledge that words share common rimes, which are comprised of the ending syllable of a word (Heroman & Jones, 2004; Martin & Byrne, 2002) and alliteration is described as the ability to identify commonalities in beginning sounds (Qi & O'Connor, 2000). A young child's ability to recognize and produce rhyme typically appears at an early age without formal instruction (Lundberg et al., 1988; Martin & Byrne, 2002). While some researchers have suggested that rhyme and alliteration contribute to later reading success (Bryant et al., 1990; Goswami & Bryant, 1990; Nation & Hulme, 1997), other studies have produced different results (Martin & Byrne, 2002; Muter, Hulme, Snowling, & Taylor, 1998; Yeh & Connell, 2008). Results of research studying the effects of rhyme on future reading success will be elaborated on later within this literature review.

As they become more aware of their language structure, young children between 3 to 5 years of age recognize that spoken language is made up of individual words that can be further broken down into syllables, which are described as a combination of individual sounds that contain a vowel (Heroman & Jones, 2004; Israel, 2008; Ranweiler, 2004). Awareness of syllables appears to connect a child's ability to recognize sound similarities through rhyme to their ease with detecting smaller sounds units (Adams, 1990; Snider, 1995). Children also become able to recognize and identify onsets, which are the initial sounds preceding the first vowel in a syllable, and rimes (Ball, 1997; Heroman & Jones, 2004; Ranweiler, 2004). Some researchers have shown that children who are able to identify, categorize, and produce words based upon their commonalities in onsets and rimes tend to experience more reading success than those who cannot perform such tasks (Ball, 1997; Stahl & Murray, 1994). However, other researchers have indicated that awareness of and skill in onset and rime segmentation is not a strong predictor of future reading ability (Nation & Hulme, 1997).

Children at the most complex end of the continuum are able to demonstrate phonemic awareness, in which they recognize that each word is comprised of a sequence of individual sounds, or phonemes (Ball & Blachman, 1991; Ball, 1997; Heroman & James, 2004; Schuele & Boudreau, 2008; Snow et al., 1998). Phonemic awareness encompasses the ability to manipulate the individual phonemes in a word (Cunningham, 1990; NIL; NRP, 2000). Students are demonstrating an understanding of phonemic awareness when they engage in such activities as blending, segmenting, substituting, and deleting phonemes (Adams, 1990; Heroman & Jones, 2004; Moats, 2007; NIL, 2001; Perez, 2008; Vaughn & Linan-Thompson, 2004). Researchers have found children to

begin developing this more advanced level of awareness in kindergarten and to gain more understanding and sophistication with these skills throughout the elementary school years (Bryant et al., 1990; Ranweiler, 2004; Stahl & Murray, 1994).

**Phonemic Awareness and its Specific Importance to the Reading Process.** As stated previously, a child's skill in phonological awareness has been found to be causally related to reading success (Gillon, 2004; Good et al., 1998). However, of all of the phonological awareness skills, the most advanced skill of phonemic awareness is considered to be the strongest predictor of future reading achievement (Adams, 1990; Gillon, 2004; Perez, 2008; Snider, 1997). Recent researchers have indicated that phonemic awareness, along with letter knowledge, are the two best predictors of a child's success in reading during the first two years of schooling (Adams, 1990; NRP, 2000; Vaughn & Linan-Thompson, 2004). Further, a child's phonemic awareness skills have been found to be better predictors of reading success than such variables as vocabulary knowledge, intelligence quotients, and socioeconomic status (SES) (Gillon, 2004).

Some researchers have suggested that phonemic awareness, similar to other phonological awareness skills, has a bidirectional relationship with reading (Ball, 1993; Snider, 1995). Specifically, phonemic awareness skills typically increase a child's success in learning to read (Ball, 1993). Conversely, reading often leads to a better understanding of and performance on phonemic awareness activities. Children who experience difficulty with the reading process in kindergarten and first-grade often have trouble successfully engaging in phonemic awareness activities (Adams, 1990; Vaughn & Linan-Thomspon, 2004). Further, those children at the end of kindergarten who continue to demonstrate poor phonemic awareness skills are often identified as the poorest readers

later in their academic career (Adams, 1990; Ball, 1993; Vaughn & Linan-Thompson, 2004).

Phonemic awareness has been found to contribute to early reading development in several ways. First, phonemic awareness assists young children in understanding and applying the alphabetic principle (Ranweiler, 2004; Torgesen, 1999). Phonemic awareness helps a child to understand how letters correspond to specific phonemes, which are described as the smallest unit of sound in a spoken language that affect the meaning of a word (NIL, 2001; NRP, 2000; Ranweiler, 2004). Phonemes are typically represented by graphemes, or the letters of the alphabet, which is an essential understanding that children must acquire to experience success when learning to read (Ball, 1993; Goswami & Bryant, 1990; Nevills & Wolfe, 2009; Vaughn & Linan-Thompson, 2004). Not only does phonemic awareness reinforce specific letter-sound patterns and combinations, but it allows the child to create a mental picture of both the spoken and written form of a word (Torgesen, 1999). This connection between phonemic awareness and letter knowledge illustrates how the two skills work together to promote and predict future reading success.

The smallest functional response in the reading process is the ability to produce the correct sound for a phoneme when it is accompanied by a letter or a combination of letters, which can be referred to as phonemic responding (Daly, Martens et al., 2008). In order for a student to demonstrate mastery of this process and to successfully generalize reading behavior, the correct response must be made each time the student encounters the specific letter or combination of letters in print. While this becomes an automatic process for students who have mastered and are able to generalize learned reading skills,

recognizing letters and letter combinations is often a difficult process for those that have not. Phonemic responding is an example of a minimal response repertoire (MRR; Alessi, 1987; Daly, Martens et al., 2008). A MRR in itself is not useful to a student, but becomes functional when the student is able to produce the response and combine it with other relevant responses when presented with novel stimuli.

While phonemic responding is an example of a minimal response repertoire, phonemes are examples of minimal textual repertoires (MTR), the smallest level of textual repertoires (Daly, Chafouleas, Persampieri, Bonfiglio, & LaFleur, 2004). The reading process involves the ability to bring a phoneme under the control of its associated letter or letter combination. If a student displays stimulus control at this level as indicated by the ability to consistently produce rapid and correct responses, she will be able to demonstrate the ability to combine MTR (producing a correct sound) to correctly produce larger textual responses (e.g., reading a word within a large number of different letter-sound combinations).

Phonemic awareness also assists a beginning reader in locating and producing possibilities for partially decoded words (Torgesen, 1999). For example, if a child comes to an unfamiliar word and can recognize only the initial sound that is associated with the first letter(s), a beginning understanding of phonemic awareness allows the child to search his vocabulary for word possibilities beginning with that particular sound. Further, skill in phonemic awareness has been linked to proficient decoding during the elementary school years (Bus & van IJzendoorn, 1999; Nevills & Wolfe, 2009). A firm understanding of how each sound in a word corresponds to a particular letter or letter combination facilitates a child’s ability to decode pseudowords, read unfamiliar words,

and engage in both invented and conventional spelling (Honig, 1998; Moats, 1999; Schuele & Boudreau, 2008; Snow et al., 1998).

As important as skill in phonemic awareness is to future reading success, it is a difficult skill for children to acquire, master, and apply for several reasons (Adams, 1990; Snow et al., 1998). First, the individual sounds in spoken language are typically not pronounced separately in the speech stream, but are instead blended together into larger sound units (Chall, 1983; Gillon, 2004; Ranweiler, 2004; Stahl & Murray, 1994). This automatic process has been modeled for children since infancy and makes the necessity of segmenting, or pulling apart, a word into individual phonemes for reading purposes extremely difficult. Further complicating the reading process is the fact that the spaces between words in print do not exist within oral language (Ranweiler, 2004). Therefore, the child must learn to perceive breaks that they do not actually hear within spoken language.

Second, the fact that English is an alphabetic language, in which letters are designated to represent sounds, also makes the acquisition of phonemic awareness more difficult. Letters within an alphabetic system are, by themselves, meaningless (Nevills & Wolfe, 2009; Snow et al., 1998). Therefore, a child must learn to identify individual sounds in a word to assist them in remembering the connection between each sound and its corresponding letter or letter combination (Adams, 1990). However, because spoken language contains more individual sounds than letters, there is not a true one-to-one correspondence between phonemes and graphemes, which makes a child's task for forming and remembering such connections even more problematic (Adams, 1990; Ranweiler, 2004; Perez, 2008).

**Summary of phonological research.** Previous researchers have identified a significant, causal, and reciprocal relationship between phonological awareness, especially at the phoneme level, and future reading success (Adams, 1990; Bryant et al., 1990; Gillon, 2004; Good et al., 1998; Perez, 2008). Young children who are able to recognize that words are comprised of syllables, onsets and rimes, and phonemes, and can manipulate these smaller sound units tend to experience a higher level of reading achievement throughout their schooling career than those children who are unable to demonstrate such awareness and skills. However, while the connection between spoken and written language helps to facilitate phonological awareness, the fact that individual sounds in spoken language are typically blended together in the speech stream makes the acquisition of phonological awareness, especially at the phoneme level, more difficult for beginning readers (Chall, 1983; Gillon, 2004; Ranweiler, 2004; Stahl & Murray, 1994).

Such information reinforces the importance of developing and strengthening young children's phonological skills at an early age. Providing instruction through some type of early intervention for those students who either possess few phonological awareness skills or demonstrate difficulty with learning and generalizing them to the reading process is critical for young children as it provides a firm foundation for the successful acquisition of other skills necessary for the development of proficient reading (Good et al., 1998; Schuele & Boudreau, 2008; Snow et al., 1998).

This fact has prompted researchers to develop specific interventions or programs that foster the development of phonological awareness skills. However, there continues to be some disagreement on what skills to target and how to successfully teach them. Further, the effectiveness of many of these programs in developing and strengthening

young children's phonological awareness and early reading skills have not been specifically evaluated, while others have been only minimally examined. Both of these issues will be discussed in the next section of this literature review, which now focuses on the importance of providing young children with explicit instruction in phonological awareness.

**Phonological Awareness Training**

Phonological awareness training has been found to have a positive effect on the ease with which a child learns to read (Gillon, 2004; Goswami & Bryant, 1990; Perez, 2008). Specifically, researchers have shown that those young children who have received instruction in the area of phonological awareness have learned to read more quickly than those who have not received such instruction (Bus & van IJzendoorn, 1999; Snow et al., 1998) and often maintain their early reading success over the next several years (Lundberg et al., 1988; Schneider, Ennemoser, Roth, & Kuspert, 1999). However, some children need support above and beyond the instruction received within the classroom. Specifically, almost a quarter of young children who receive good classroom instruction continue to demonstrate a lack of phonological awareness (Schuele & Boudreau, 2008).

Providing those children who demonstrate poor phonological awareness skills with early intervention during the kindergarten year can significantly improve their ability in this area and narrow or even eliminate the gap between them and their peers with typically developing phonological skills (Gillon, 2004; Schuele & Boudreau, 2008; Snow et al., 1998). One study compared the effects of a phonological awareness program on at-risk, typically developing, and advanced early readers (Schneider et al., 1999). While results showed that at-risk readers did not catch up to those in the other two

training groups, they demonstrated similar gains to both groups and also scored higher than those in the control group on measures of phonological awareness and reading.

Researchers have also promoted the idea that phonological awareness instruction should be provided at the phoneme level once children enter school (Gillon, 2004; Smith et al., 1998). Instruction at the phoneme level is necessary as it bears a critical relation to beginning reading, does not develop easily without instruction, and is problematic for those students with phonological deficits or delays. It has been found that the majority of young children require explicit teaching to acquire phonemic awareness as it is not typically achieved through exposure alone (Adams, 1990; McBride-Chang, 2004; Nevills & Wolfe, 2009). However, because the development of phonemic awareness is typically slow for most children, and particularly difficult for some, combining phonemic awareness and formal reading instruction can significantly increase a child's rate of success (Adams, 1990).

Previous researchers have shown that phonemic awareness can be successfully taught to children as young as kindergarten, especially when specific instruction in phonemic skills and practice with related activities are provided (NIL, 2001; Snider, 1995). In fact, children in kindergarten appear to benefit more from this type of training than older children (Cunningham, 1990; NRP, 2000). Results from a study providing direct instruction to kindergarten children in the area of phonemic awareness showed these children to not only improve their phonemic awareness skills beyond those of other kindergarten children, but also to perform better than first-graders who did not receive such training (Cunningham, 1990). Kindergarten children in the training group were also found to demonstrate significant improvements in their overall reading performance.

Phonemic awareness instruction benefits not only those children who demonstrate some degree of phonological skill, but also those who are considered to be at-risk for future reading difficulties (NIL, 2001; NRP, 2000; Vaughn & Linan-Thompson, 2004). Specifically, increasing an at-risk reader's understanding of and skill in phonemic awareness may decrease the chance that he will experience early or future reading difficulties or be identified as eligible for special education services (Ball & Blachman, 1991; Moats, 1999; O'Connor, Jenkins, & Slocum, 1995; Snider, 1995).

Effective instruction at the phoneme level assists young children in learning how to identify and manipulate individual sounds in oral language, which assists them with learning to read and spell (NIL, 2001). For example, results from a meta-analysis investigating the effects of phonemic awareness instruction showed that children who had received some type of training made greater gains in both phonemic awareness and reading than those who had not received such training (NIL, 2001; NRP, 2000). Further, such gains were found to be larger when the connection between phonemic awareness and reading was made explicit. Specifically, those children trained in phonemic awareness made gains in their word reading, which has been found to have a positive effect on reading comprehension as the ability to accurately and quickly read words allows readers to focus their attention on the meaning of the passage. Results of this meta-analysis not only showed there to be short-term positive effects of phonemic awareness training, but also found that such effects typically persisted through several occasions of follow-up testing (NRP, 2000). Further, results from this meta-analysis also indicated that student gains were higher when training was conducted in small groups than when conducted in either large groups or individually. As the purpose of this project

is to evaluate the effectiveness of a current phonological awareness program, the literature base on effective components of such programs was also examined.

**Effective Components of a Phonological Awareness Program.** While many researchers have documented the importance of phonological awareness to reading and has documented the effectiveness of providing early intervention to those that encounter specific difficulty in this area, there does not seem to be an overall consensus of how to best teach these skills. Specifically, phonological awareness programs have been found to differ with regards to overall content, the sequence of included components, and the duration of the program (Bus & van IJzendoorn, 1999; Qi & O'Connor, 2001). However, researchers have identified some consistent findings with regards to the characteristics, components, and features that contribute to the effectiveness of a phonological awareness program, which will be described in detail (Good et al., 1998; Smith et al., 1998).

***Phonological awareness tasks increase in their level of linguistic complexity.*** Phonological awareness tasks should be scaffolded according to their linguistic complexity (Good et al., 1998; Smith et al., 1998). A study investigated the importance of both the type of phonological awareness task as well as the linguistic complexity of each task, including the analyzing of onsets and rimes, of vowels and codas within rimes, and of phonemes comprising both cluster onsets and cluster codas, when measuring phonological awareness (Stahl & Murray, 1994). Results from this study indicated that the linguistic complexity of the task showed a stronger correlation to a kindergarten child's performance on measures of phonological awareness and early reading than the actual type of phonological awareness task.

***Phonological awareness tasks increase in their level of difficulty.*** Researchers have indicated that phonological tasks and activities should progress from the basic skills of rhyming and alliteration to the more advanced skills of phoneme identification and segmentation as skills with simpler phonological awareness tasks facilitate the development of more complex skills (Good et al., 1998; Snider, 1995; Schuele & Boudreau, 2008). Results from two studies that implemented phonological awareness training with young children including tasks that progressed from the more basic skills of rhyming and alliteration to the more complex skill of phonemic awareness found that both typically developing and at-risk students made significant gains on outcome measures of phonological awareness and early reading skills that maintained over several occasions of follow-up testing (Lundberg et al., 1988; Schneider et al., 1999).

Many phonological awareness programs developed for school-aged children target such higher level skills as phoneme blending and phoneme segmentation due to the consistent link between skill on these tasks and future reading success (NRP, 2000; Snider, 1995). However, some researchers have found that the more basic phonological awareness skills of rhyming and alliteration have both a direct and indirect connection to reading (Bryant et al., 1990; Goswami & Bryant, 1990; Nation & Hulme, 1997) as well as a positive impact on a child's later reading success even after controlling for differences in social background and intelligence level (Anthony & Lonigan, 2004). A correlational study investigating the relationship between rhyming, phonemic awareness, and success in reading when measured two years later, found that the measures of rhyme and alliteration were related to both phonemic awareness and future reading success (Bryant et al, 1990). The authors concluded that these results suggest both rhyming and

alliteration have not only an indirect connection to and impact on reading through phonemic awareness, but also a direct connection to reading as indicated through their distinct and direct relationship to and significant prediction of a young child's future reading achievement. Results from other longitudinal research has shown that those children who receive specific instruction in rhyme and alliteration tend to experience greater success when engaged in the reading process than those who do not receive such training (Smith et al., 2008). These authors concluded that such findings suggest that rhyming has both a separate and distinct contribution to the reading process.

However, other researchers have suggested that rhyming and alliteration are not useful predictors of success with learning to read (Martin & Byrne, 2002; Muter et al., 1998; Yeh & Connell, 2008). One longitudinal study suggested that attention to rhyme does not necessarily translate to awareness of individual phonemes in words as supported by results that young children trained in recognizing rhyme made growth on measures of rhyme but not on measures of phonemic awareness (Martin & Byrne, 2002). However, the authors do state that a lack of long-term follow-up and the use of only type of assessment could have limited their results. A second longitudinal study also found rhyming to be a less useful predictor of early reading success when compared with phoneme segmentation (Muter, et al., 1998). A study comparing the effects of training in rhyme, vocabulary and phoneme segmentation found that those young children trained in rhyme produced smaller gains on measures of phoneme segmentation, phoneme blending, and letter-sound correspondence than those trained in phoneme segmentation (Yeh & Connell, 2008). Children were trained by their classroom teachers using a whole group presentation format, which could have introduced confounds such as teacher

preference and instructional style into the study. Taking into account the mixed results in this area, it appears that more research into the effectiveness of rhyming instruction is warranted.

***Integration of instruction in letter-sound correspondence.*** Another component that is often considered to be important for inclusion in a phonological awareness program is direct teaching in letter-sound correspondence (Good et al., 1998; Smith et al., 1998). Including letters in a phonological awareness program is thought to be important because of the assistance it provides to young children when learning how to identify and match letters with their corresponding sound(s) (NRP, 2000). In fact, results from recent research have repeatedly shown that integrating instruction in letter-sound correspondence into a phonological awareness program increases its overall effectiveness (Ball & Blachman, 1991; Bus & van IJzendoorn, 1999; Good et al., 1998; NRP, 2000; Snow et al., 1998). It has been found that young children who receive training in phonological awareness together with letter-sound correspondence typically perform better on such measures of early reading as letter naming, vocabulary, and pseudoword decoding than those that are taught these skills in isolation (Perez, 2008; Tunmer, 1991). For example, a study found that when 4- and 5-year old children were trained in both a sound categorization (phonological awareness) and visual orthographic (letter recognition) strategy and were taught how to connect the two strategies, they were better able to understand the alphabetic principle and to make more early growth in reading than those children trained only in the visual orthographic strategy or trained in both strategies in isolation without emphasis on the connection between letters and their corresponding sounds (Bradley, 1988). The authors did note that participating schools used different

reading curricula, which could have played a role in the level of a child's phonological awareness skills even after attempting to control for this difference through a matching procedure. Further, this training took place over a short period of time and the follow-up conducted two years later showed no difference between any of the three groups with regards to their knowledge of letter-sound correspondence.

Providing children with explicit instruction in letter-sound correspondence has also been found to improve performance on such phonemic awareness activities as phoneme segmentation and phoneme blending. For example, results of a study investigating the effects of a program including both phoneme segmentation and letter-sound correspondence showed children who received such training to not only demonstrate knowledge an understanding of both skills in isolation, but also to be better able to match letters with their corresponding phonemic segments than children in either of the control groups (Ball & Blachman, 1991).

While results from the majority of research studies have promoted the integration of letters into a phonological awareness program, some researchers have demonstrated success without the inclusion of such instruction (Lundberg et al., 1988; Schneider et al., 1999). One study demonstrated that young children are able to make gains not only with their phonological awareness skills, but also on measures of reading achievement without the integration of instruction in letter-sound correspondence (Lundberg et al, 1988). As a result of this study, the authors suggested that young children's growth in phonological awareness appeared to be due more to explicit instruction on phonological awareness tasks than to exposure to letters. While classrooms were matched, experimental and control groups were in different schools and training was conducted by the classroom

teacher. Both factors could have been confounds as they could introduce distinct school and teacher variables and characteristics into the study.

However, results from a meta-analysis of scientifically based reading research indicated the effect size of phonological awareness interventions that included instruction in letter-sound correspondence to be almost twice as large as those programs that did not (NRP, 2000). Combined with the findings of the majority of research in this area, these results suggest that integrating letter-sound correspondence into phonological awareness programs gives young children a significant advantage when learning to read.

***Inclusion of phoneme segmentation tasks.*** Phoneme segmentation tasks have also been found to be an effective component of phonological awareness program (Good et al., 1998; Smith et al., 1998; Snider, 1995). Phoneme segmentation requires children to break down words into their individual phonemes (Adams, 1990; Nevills & Wolfe, 2009) and has been found to not only increase segmentation skills but also to facilitate the reading process (Adams, 1990; Lundberg et al., 1988; NRP, 2000; Snider, 1995; Yeh & Connell, 2008). Specifically, researchers have indicated that phoneme segmentation skills have promoted success in word recognition (Ball & Blachman, 1991; Blachman et al., 1997) and reading comprehension (Snider, 1997; Yeh & Connell, 2008).

Phoneme segmentation is thought to contribute to improvement in a child's reading performance as it reinforces the connection between phonemes and their corresponding graphemes (Ball 1993; Ball & Blachman, 1991; NRP, 2000). Results from two longitudinal studies indicated skill in phoneme segmentation to be a strong predictor of future reading success (Nation & Hulme, 1997; Snider, 1997). In one study, skill in phoneme segmentation was found to be a significant predictor of performance on

measures of phonological awareness and word recognition at the end of second-grade and to be a stronger predictor than skill in rhyme, alliteration, and onset-rime segmentation (Nation & Hulme, 1997). However, this study did not compare the performance of at-risk students with their typically developing peers so it is unknown whether there was a difference in learning and generalization of skills. Further, the included tasks varied in linguistic complexity, which could have also influenced results. A second study showed phoneme segmentation to be highly predictive of success on measures of word analysis and reading comprehension at the end of second grade (Snider, 1997). However, this study did not compare phoneme blending with phoneme segmentation and did not include many of those students in post-testing who had received the lowest scores when pretested in kindergarten.

Other researchers have indicated that a lack of skill in phoneme segmentation is an indicator of early reading difficulty that can persist throughout a child's school years (Ball & Blachman, 1991; Liberman, 1973). This finding suggests that those children who are unable to segment words into their individual phonemes should receive early training in this area (Tunmer & Rohl, 1991). As important as phoneme segmentation is to the reading process, it does not appear to develop naturally as evidenced by researchers who have indicated that young children experience difficulty with these types of tasks (Liberman, 1973; Lundberg et al., 1988). One study found that young children were unable to segment words into their individual phonemes until the age of 5 and less than one quarter of these children were able to successfully do so without assistance (Liberman, 1973). While 6-year-old children demonstrated more success with phoneme segmentation, there were still approximately 30% of children who could not

independently complete such tasks. However, researchers have demonstrated that children as young as kindergarten can be successfully taught to segment words into their individual phonemes and that such training can assist them with generalizing their segmentation skill to words that are not included within the intervention itself (Ball & Blachman, 1991).

It has been noted that many studies investigating the effect of phoneme segmentation on reading achievement do not report individual scores or identify those children who do not respond to or benefit from this type of training (Busink, 1997; Snider, 1997). This suggests that while phoneme segmentation skill is beneficial for many students as demonstrated through its strong correlation with reading, it may not be a sufficient skill for improving the reading skill of all children.

***Inclusion of phoneme blending tasks.*** Phoneme blending has also been shown by some researchers to contribute to the effectiveness of a phonological awareness program (NRP, 2000). Phoneme blending is described as the ability to connect phonemes in the context of spoken language (Perez, 2008). While blending is thought to be one of the easier phonemic awareness tasks and to develop before other more complex phonemic awareness like phoneme segmentation, deletion, and substitution (Ball, 1993; Smith et al., 2008), it is also described as requiring a relatively high level of abstraction (Ball, 1993). Specifically, for a child to experience success on a blending task, they must move beyond merely identifying and pronouncing individual sounds and demonstrate the ability to connect each sound to form a recognizable word. Phoneme blending has been found to demonstrate a strong correlation with future reading success primarily because of its importance to the skill of decoding (Adams, 1990; NRP, 2000; Perez, 2008). When

a child encounters an unfamiliar word in print, his ability to identify and blend the phonemes that correspond with each letter or letter combination assists him with successfully reading the word and increases the probability that he will recognize the word the next time it is encountered (NRP, 2000).

While both phoneme-blending and phoneme-segmentation tasks require the child to recognize, identify, and pronounce the individual phonemes within a word, these tasks differ in several ways (Adams, 1990). First, they differ with regards to the level of phonemic awareness that a child must possess in order to be successful on each type of task. Specifically, in a phoneme-segmentation task, a child must not only demonstrate awareness that larger sound units can be segmented into phonemes, but also have some knowledge as to the property and size of phonemes. In phoneme-blending tasks, however, phonemes are explicitly presented to a child, therefore requiring only the knowledge that the sounds must be combined to form a recognizable word. Second, the two tasks differ in the demands they make on a child's ability to hold phonemes in memory. In a phoneme-blending task, a child is typically presented with more individual phonemes. However, the fact that the child is probably more familiar with producing phonemes in isolation reduces the demands of a phoneme-blending task in comparison to a phoneme-segmentation task, in which the child must first recognize the phonemes within a whole word and be able to hold them in memory before being able to individually pronounce them (Adams, 1990).

Some researchers have argued against training young children in phoneme blending without corresponding training in phoneme segmentation (Torgesen et al., 1992). Results from one study compared the effects of training in phoneme blending

with training in phoneme blending together with phoneme segmentation and indicated that children receiving training in both phoneme blending and phoneme segmentation made significant gains on measures of letter-sound correspondence and word recognition when compared with a control group. However, those young children receiving training only in phoneme blending did not demonstrate significant gains on either measure when compared with the control group. This suggests that including both phoneme-blending and phoneme-segmentation tasks within a phonological awareness program may be more effective than training phoneme blending in isolation.

***Inclusion of both phoneme segmentation and phoneme blending tasks.*** While phoneme-blending and phoneme-segmentation tasks differ in their level of difficulty, the fact that researchers have found both of them to have a strong correlation with future reading success suggests that a phonological awareness program should include both types of tasks. In fact, results from previous research support this assertion (O'Connor et al., 1995; Snider, 1995; Torgesen et al., 1992). Some researchers consider phoneme blending and phoneme segmentation to be the two most important phonological awareness skills due to their contributions to and correlations with future reading success (NRP, 2000; Schuele & Boudreau, 2008; Vaughn & Linan-Thompson, 2004). Further, results from such research suggests that other phonological awareness tasks should be included in training packages only if they facilitate and further the development of phoneme blending and phoneme segmentation (Lewkowicz, 1980; Schuele & Boudreau, 2008).

Researchers have shown that both phoneme blending and phoneme segmentation can be successfully taught to children as young as kindergarten (Cunningham, 1990;

O'Connor et al., 1995). One study found that kindergarten children trained in both phoneme blending and phoneme segmentation not only showed significant improvement on these types of tasks, but were better able to generalize their phonological knowledge to other phonemic awareness tasks when compared with those in a control group (O'Connor et al., 1995). Another study showed that kindergarteners trained in both phoneme blending and phoneme segmentation performed higher on measured phonemic awareness tasks than both kindergarten and first-grade children who had not received such training (Cunningham, 1990).

Both phoneme blending and phoneme segmentation skills appear to increase with age, especially as children progress through the first few years of elementary school (Chall, 1983). Results from a recent study indicated that training in phoneme segmentation and phoneme blending not only assisted first-grade children in reading previously encountered words, but also in generalizing their responding to new and unfamiliar words (Daly et al., 2004).

Due to the amount of research documenting the importance of phonological awareness in learning to read, there has been a number of standardized phonological awareness programs developed for use with young children over the past several decades (NRP, 2000; Santi et al., 2004). While many of these programs include several, if not most, of the aforementioned components and features supported by results from previous research, a review of the current literature base indicates that few have been specifically evaluated with regards to their effectiveness in developing and increasing a young child's phonological awareness and early reading skills. Discussion will now turn towards several phonological awareness programs that are described as being scientifically based,

indicating that there has been research conducted on the program itself to evaluate its effectiveness.

**Standardized phonological awareness programs.** In reviewing the literature on phonological awareness programs, it appears that most programs target young children in preschool through first- or second-grade. This is consistent with phonological awareness research stating that the development of these skills at an early age is critical due to their connection with learning to read and future reading success (Gillon, 2004; NRC, 1999; Snow et al., 1998). This review also indicated that most phonological awareness programs attempted to generalize to print through the inclusion of letters and targeted at least one phonemic awareness skill. However, these programs varied in their range of activities, sequence of included components, duration, and type of presentation format. Further, while most programs were described as including research-based activities, few empirical studies were found as part of this literature review that evaluated their effectiveness in developing and strengthening a young child's phonological awareness and early reading skills. The programs included as part this review of the literature have been examined by at least one research study and are specifically described and reviewed below.

***Stepping Stones to Literacy (2004).*** *Stepping Stones to Literacy* is a phonological awareness program that was developed for preschool and kindergarten children (Nelson, Cooper, & Gonzales, 2004). As part of this program, children receive individualized instruction in a variety of phonological awareness skills through 25 lessons that progress from such basic skills as rhyming to the more complex skill of blending and segmenting

individual phonemes. This program also incorporates listening activities and instruction in letter naming and can be administered by classroom teachers or other school personnel.

An experimental study investigated the effectiveness of the *Stepping Stones to Literacy* program with kindergarten children identified as being at risk for both an emotional disturbance and future reading difficulties (Nelson, Benner, & Gonzales, 2005). Children were selected for participation in this study using both standardized measures and teacher nomination. Results indicated that those children receiving individualized instruction through this program showed significant gains on measures of word reading, rapid naming skill, and phonological awareness than those at-risk children in the control group. While tutors were trained in this program prior to the study, the same tutor was not used for each child, which could have resulted in implementation differences. Further, the authors stated that it was unclear how much of the children's progress could be attributed to the program rather than the core kindergarten curriculum and that long-term effects were not measured.

***Ladders to Literacy (1998).*** *Ladders to Literacy* is a program designed to develop and increase the phonological awareness, oral language, and print awareness skills of preschool and kindergarten children (O'Connor, Notari-Syverson, & Vadasy, 1998). As part of this program, teachers are trained to provide direct instruction at the classroom level using specially developed games and activities, such as utilizing songs to isolate phonemes, representing phonemes with finger cues, and guessing games, that promote the development of each skill. *Ladders to Literacy* was reviewed with regards to its inclusion of research-based principles (Santi et al., 2004). Results from this study showed the *Ladders to Literacy* program to include modeling, to sequence tasks from

easy to difficult, to generalize to print, to provide sufficient practice and review, and to give recommendations for adapting instruction.

One study compared the effects of the implementation of 25 different activities that would later make up the *Ladders to Literacy* program by classroom teachers in a general education kindergarten classroom, transition classroom, and self-contained kindergarten classroom over a six-month period (O'Connor, Notari-Syverson, & Vadasy, 1996). Results indicated children in all three classrooms performed better on phonemic awareness and reading tasks than those children that had not received this exposure. However, children identified as having some type of disability were not found to perform at the same level as that of their typically developing peers. A second study indicated that providing professional development to teachers throughout their implementation of the *Ladders to Literacy* program in the kindergarten classroom resulted in larger performance gains for their students on measures of phoneme blending, phoneme segmentation, rapid letter naming, reading, and spelling than for those children whose teachers did not participate in professional development (O'Connor, 2000). While both studies demonstrated positive gains, the authors indicated that teacher-effects could be present (O'Connor, 2000; O'Connor et al., 1996). Further, the authors suggested that phonological awareness training may need to be more intensive and used with smaller groups of students to result in stronger and longer-lasting gains.

***Lindamood Phoneme Sequencing Program [LiPS], 1984).*** The *Lindamood Phoneme Sequencing Program* (Lindamood & Lindamood, [LiPS], 1984) was developed to provide direct instruction in phonemic awareness to elementary school children identified as having poor phonemic awareness skills (Listening Ears, 2008). This

program helps students become aware of the movement of their mouth while producing various phonemes. This training is done first through the use of pictures, with corresponding letters being gradually incorporated as children become more proficient with their oral movements.

One study compared the effectiveness of the LiPS program with both individual tutoring in the regular kindergarten curriculum and an embedded phonics program, which included word-level drill, instruction in letter-sound correspondence using letters of included sight words, and reading and writing those words (Torgesen et al., 1999). This program was implemented in an individual presentation format with kindergarteners identified as at-risk through a screening procedure using measures of letter-naming, phonological awareness, rapid letter naming and vocabulary. Results from this study indicated that those receiving instruction from this program performed significantly better on measures of phonological awareness and word reading. However, there was no difference found between the two groups on measures of reading comprehension. An identified limitation of this study was in the difference of background and training of the tutors implementing the three programs. Further, the authors noted that some of the strategies used in the two experimental programs were inconsistent with what was being taught in the regular classroom.

A second study compared the effectiveness of the LiPS program with an Embedded Phonics program with primary school children identified as Learning Disabled (LD) over an 8 to 9 week period (Torgesen et al., 2001). Results indicated both groups of children made significant gains on measures of phonological awareness, rapid letter naming, word recognition, pseudoword decoding, and comprehension, both immediately

following completion of this program and two years later. There were no significant differences found between the performances of the children in the two experimental groups.

In summary, results from these reviewed programs indicate that those young children receiving phonological awareness training made gains on measures of phonological awareness and early reading skills. However, the types of program differed, as did follow-up procedures, implementation procedures, presentation format, and the demographics and at-risk status of the participating students.

***Project Emphasis: Road to the Code (2000).*** The program being evaluated as part of this project is *Road to the Code*. *Road to the Code* is a structured, phonological awareness program that was designed to provide assistance to kindergarten and first-grade children having difficulty learning and mastering important early literacy skills (Blachman et al., 2000). As part of this program, young children are provided direct instruction in such skills as phoneme segmentation and phoneme blending, letter-sound correspondence, and other phonological awareness skills such as rhyming and alliteration either individually or in a small group format. When reviewed for the inclusion of research-based principles, the *Road to the Code* program was found to incorporate modeling, the sequencing of tasks from easy to difficult, generalization to print, inclusion of a pronunciation guide, provision of sufficient practice and review, and recommendations for instruction adaptation (Santi et al, 2004).

The *Road to the Code* program was chosen for evaluation as part of this project for several reasons. First, this program is described as being based upon a large body of scientifically based research, in which results suggest that phonological awareness can be

successfully taught to young children and can assist in strengthening those early literacy skills found to be most predictive of future reading success (e.g., Nation & Hulme, 1997; NRP, 2000; Snow et al., 1998; Torgesen et al., 1992). Further, the research supporting the development of this program is described as having used empirical methods, included rigorous data analysis procedures, used reliable and valid measurements, and met the criteria for inclusion in the National Reading Panel's (2000) meta-analysis of reading research (Blachman, et al., 2000).

Second, a preliminary review of the *Road to the Code* program indicated that it includes many of the characteristics and components that researchers have identified as important contributors to young children's future reading success. Specifically, this program not only integrates explicit instruction in letter-sound correspondence through the inclusion of eight letters, but also includes tasks that focus on developing and improving young children's skills in rhyming, alliteration, phoneme segmentation, and phoneme blending. Further, the included phonological awareness tasks progress in level of task difficulty as well as in linguistic complexity.

Third, the *Road to the Code* program promotes generalization. As mentioned previously, the ability to generalize learned skills and behaviors is not only an indication of proficiency in a particular area, but also essential for success outside of the teaching setting (Daly et al., 2007). While generalization has traditionally been seen as a passive phenomenon, researchers have promoted the premise that instruction should actively program generalization (Stokes & Baer, 1977). One of the techniques that have been used by researchers to program generalization is the training of sufficient exemplars. As part of this technique, a specific number and type of exemplars are chosen as the focus

for training with the purpose of promoting generalization to those that are untrained. The *Road to the Code* program appears to utilize this technique in the area of letter-sound correspondence. Specifically, only eight letters are explicitly taught as part of this program, with the goal that students will be able to generalize their learning from this program to the novel letter-sound combinations. Some previous researchers have asserted that the concept of phoneme identity is stable once it is achieved and therefore all phonemes do no need to be taught (Byrne & Fielding-Barnsley, 1990; 1995). Specifically, results from such studies have found that teaching a specified number of phonemes to young children have resulted in significant gains on both trained and untrained phonemes.

While an extensive literature search failed to identify any studies evaluating the effectiveness of the *Road to the Code* program itself, the authors of this program have conducted previous research incorporating similar procedures and tasks. One experimental study investigated the effect of training in phoneme segmentation, phoneme blending, and letter-sound correspondence with a small group of general education kindergarten children over a 7-week period in a small group presentation format (Ball & Blachman, 1991). Results indicated that those children in the training group performed significantly better than the group participating in a variety of language activities or those in the control group on a measure of phoneme segmentation that included both trained and generalization items and on a measure of word recognition. However, there were no differences between the three groups on a measure of letter-sound correspondence, which the authors concluded indicates that instruction in letter-sound correspondence without

associated instruction in phonological awareness is not sufficient to improve higher level phonological or reading skills.

The authors conducted a second study that targeted at-risk students and extended phonological awareness and early reading instruction into first- and second-grades (Blachman et al., 1999). The kindergarten children were selected from low-income, inner city schools and each school was assigned to either the experimental or control condition. Children in the experimental groups received training in phoneme segmentation, phoneme blending, and letter-sound correspondence through 41 lessons over an eleven week period. Initial results from this study indicated that the kindergarten children in the experimental groups performed significantly higher on measures of phonological awareness, letter-sound correspondence, and standardized measures of word recognition and pseudoword decoding when compared with those in the control groups.

Children in the experimental groups also received instruction throughout their first-grade year in letter-sound correspondence, phoneme segmentation and phoneme blending, word recognition, reading connected text, and dictated writing (Blachman et al., 1999). Results at the end of the first-grade year indicated that children in the experimental groups significantly outperformed those children in the control groups on measures of phoneme segmentation, letter-sound correspondence, and standardized measures of word recognition, pseudoword decoding, and spelling. Those children who were found to be reading at or below grade level at the end of first-grade continued in this program throughout their second -grade year. Results at the end of the second grade indicated that all children from the experimental groups continued to significantly outperform those students in the control groups on standardized measures of word

recognition and pseudoword decoding. While the authors concluded that the results indicated that those children who participated in the phonological awareness program for 2, or possibly 3, years consistently and significantly outperformed those in the control group for the majority of outcome measures, the fact that experimental and control children were learning separate skills could have introduced a confound into the study.

While the results of these two studies indicate the effectiveness of the phonological awareness tasks in this program, several factors suggest that further evaluation of this program is important. First, the current program has been modified and lengthened since the above studies were conducted. Second, neither study specifically targeted kindergarten students who were identified as at-risk for future reading difficulties based upon their actual performance in the kindergarten classroom or on measures of phonological awareness or early reading skill. For example, the first study included did not designate at-risk status (Ball & Blachman, 1991), and the second study generalized the term at-risk to SES status and overall school achievement scores (Blachman et al., 1999). Third and finally, while several outcome measures were used to assess the children's progress at the end of the training period, neither study used any type of progress monitoring measure, which would provide an ongoing evaluation of student progress throughout the course of the program. Further, both studies grouped the scores of children in the experimental groups and children in the control groups when conducting statistical analyses and the reported results making it virtually impossible to identify the number of children who did not respond to the program.

**A summary of phonological awareness training**. From this review of the literature, it appears that providing explicit instruction in the area of phonological

awareness not only improves a child's phonological awareness skills, but also significantly contributes to his future reading achievement (Bus & Van IJzendoorn, 1999; Gillon, 2004; Goswami & Bryant, 1990; Perez, 2008; Snow et al., 1998). While many children are able to demonstrate gains in their phonological awareness skills as a result of good classroom instruction, approximately one quarter of young children do not show such gains (Gillon, 2004; Schuele & Boudreau, 2008; Snow et al., 1999). Results from previous research has demonstrated the importance of providing explicit instruction at the phoneme level to school-aged children, especially to those considered to be at-risk for future reading difficulties, due to its significant role in the reading process (Gillon, 2004; Good et al., 1998).

While there does not appear to be an overall consensus of how best to teach phonological awareness to young children, there are several components that previous researchers have identified as contributing to a program's effectiveness in developing and improving a young child's phonological awareness and early reading skills. Such components are included in Appendix A and are accompanied by examples of sources that have documented the effectiveness of these components.

Many studies have demonstrated that those children who have received explicit instruction in letter-sound correspondence typically demonstrate greater gains not only on measures of phoneme segmentation and phoneme blending (Ball & Blachman, 1991), but also on important early reading skills such as vocabulary, pseudoword decoding, and letter naming (Perez, 2008; Tunmer, 1991). While some researchers have demonstrated gains in young children's phonological awareness and early reading skills without the inclusion of letters (Lundberg et al., 1988), the significant difference between the

effectiveness of phonological awareness programs integrating letter-sound correspondence and those not including such instruction in a meta-analysis provides strong support for the inclusion of this component in such programs (NRP, 2000).

Researchers have also shown that phonological awareness programs should begin with simpler tasks of phonological awareness and then progress to more complex tasks (Good et al., 1998; Snider, 1995; Schuele & Boudreau, 2008; Smith et al., 1998). While the results from some research has suggested that instruction in the more basic phonological awareness skills of rhyming and alliteration have both an indirect and direct connection to early reading success (Bryant et al., 1990; Smith et al., 2008), other researchers have indicated skill in rhyming is not a useful predictor of reading (Martin & Byrne, 2002; Yeh & Connell, 2008). Many programs targeting school-aged children focus primarily on the more complex skill of phonemic awareness as researchers have indicated that activities at the phoneme level have a strong correlation with future reading achievement (Adams, 1990; Gillon, 2004; Perez, 2008).

Phoneme segmentation and phoneme blending have been found to be significant predictors of a child's future reading success. Specifically, while some researchers have shown that activities targeting phoneme segmentation have a more significant impact on both phonemic awareness and early reading skills than activities targeting only phoneme blending (e.g., Torgesen et al., 1992), other researchers have documented the importance of including phoneme blending in phonological awareness programs due to its important role in a young child's ability to decode new and unfamiliar words (Adams, 1990; NRP, 2000; Perez, 2008). Further, other studies have documented the effectiveness of incorporating both phoneme blending and phoneme segmentation into a phonological

awareness program due to their specific, individual contributions to the reading process (Cunningham, 1990; O'Connor et al., 1995; Torgesen et al., 1992).

A review of the literature on current, standardized phonological awareness programs indicated that the majority of such programs target children in preschool through early elementary school and are described as including research-based instructional activities. However, a review of the literature base revealed few empirical studies evaluating the effectiveness of these programs. The *Stepping Stones to Literacy*, *Ladders to Literacy* and the *Lindamood Phoneme Sequencing Program* programs have documented positive effects for kindergarten children in the training groups, but such issues as teacher preferences and instructional style, difficulty partialling out the effects of the kindergarten curriculum, and presentation format were recognized as possible limitations to those studies.

As *Road to the Code* is the program that will be evaluated as part of this project, it was described and reviewed in depth. This program is reported to be based upon scientifically based research, to include many of the characteristics and components that researchers have identified as being important contributors to a young child's future reading success, and to actively program generalization through the training of sufficient exemplars. While there have been no conducted studies that evaluate the effectiveness of the program itself, the authors conducted several earlier studies that included similar activities and procedures (Ball & Blachman, 1991; Blachman et al., 1999). While positive and significant effects were found in both studies, there were several issues and factors previously described in this review that indicate the importance of evaluating the

current program with regards to effectiveness in developing and improving young children's phonological awareness and early reading skill.

**Purpose of This Study**

Information gathered for this review of the literature suggests that young children who demonstrate phonological awareness skills are typically able to make greater gains in their ability to master more difficult phonological awareness tasks and to show more improvement in early reading skills than those who do not possess such skills. Further, researchers have shown that increases on measures of early reading often persist through several occasions of follow-up testing (NRP, 2000). Additionally, phonological awareness programs that sequence their activities with regards to level of difficulty and linguistic complexity, integrate explicit instruction in letter-sound correspondence, and include both phoneme segmentation and phoneme-blending activities have typically been found to demonstrate the largest effects on measures of phonological awareness and early reading (e.g., Ball & Blachman, 1991).

Due to the documented importance of phonological awareness in learning to read, especially at the phoneme level, there are a number of specific interventions and standardized programs that have been created to promote the development and increase of such skills, particularly in children who are considered to be at-risk for future reading difficulties. These programs have been found to vary widely with regards to the included components and overall content, sequence of activities, and duration (Bus & Van IJzendoorn, 1999). While many of the current phonological awareness programs are described as including research-based instruction and activities, few empirical studies evaluating the effectiveness of these programs could be found in an extensive literature

search. The programs that were identified and reviewed in this study varied with regards to content, length, and duration, and provide limited research evaluating the effectiveness of these programs (Lindamood & Lindamood, 2004; Nelson et al., 2004; O'Connor, et al., 1998). It therefore appears important to provide empirical evidence regarding the effectiveness of commercially available phonological awareness programs designed for use with young children. The purpose of this project is to evaluate the effectiveness of the phonological awareness program, *Road to the Code* (Blachman et al., 2000), in developing, increasing, and maintaining at-risk, kindergarten student's phonological awareness and early reading skills and in generalizing effects when used in small groups.

While the *Road to the Code* program is described as having been developed from scientifically based research in the area of phonological awareness, no studies of the effectiveness of the program itself were found in an extensive search of the literature. Therefore, this project is significant on several counts. First, providing evidence with regards to the effectiveness of an established phonological awareness program can assist educators as they make decisions about how to best serve at-risk children with developing and increasing both their phonological awareness and early reading skills. This literature review showed that there are a variety of phonological awareness programs that are available to educators, with many being described as including research based instructional activities. However, with few studies documenting the effectiveness of these programs, educators are forced to make decisions with little or no empirical evidence to support their choice.

Second, this project will utilize progress-monitoring measures that provide ongoing information regarding each child's progress throughout the program. Past

research has typically identified student gains through the use of pre- and post-measures (NRP, 2000). Ongoing progress monitoring will allow for immediate feedback regarding student progress with the skills taught in the *Road to the Code* program, and will assist with decision-making when approaching lessons that allow for modification and adaptation. The children's skill and progress will be assessed using a standardized measure of phoneme segmentation, a standardized measure of phoneme segmentation and pseudoword decoding, and two experimenter-developed measures of phoneme segmentation and pseudoword decoding. One measure is comprised of pseudowords that contain the eight letters explicitly taught in the *Road to the Code* program, and the second measure is comprised of pseudowords that contain the remaining letters of the alphabet.

The standardized measure and the experimenter-developed measure of pseudoword decoding that does not contain letters explicitly taught as part of the *Road to the Code* program provide an opportunity for the children to demonstrate generalization of their learning. While several studies have demonstrated that children receiving direct instruction in phonological awareness have generalized learned skills to measures of phonological awareness (O'Connor et al., 1995; Torgesen et al, 1992; Yeh & Connell, 2008) and word recognition (Ball & Blachman, 1991; Blachman et al., 1999), results from other studies have not resulted in such transfer of skills (Qi & O'Connor, 2001)

Third, this project will utilize a multiple-baseline-across-participants design to evaluate the effectiveness of the *Road to the Code*. A multiple-baseline design was chosen for this study due to its utility in academic settings (Neuman & McCormick, 1995). Specifically, multiple-baseline designs are often used in educational settings due to their flexibility with the timing of the implementation of the intervention (Kennedy,

2005). A multiple-baseline-across-participants design is frequently used for studies investigating an intervention's effectiveness in modifying or changing a particular difficulty (Riley-Tillman, & Burns, 2009). Most research investigating the effectiveness of phonological awareness training has utilized group designs (NRP, 2000). As such designs do not investigate individual differences that may be meaningful, researchers utilizing this type of design are not concerned about those students whose data do not "fit" with the rest of the group's (Daly, Martens et al., 2008). One benefit of a multiple-baseline design is the ability to evaluate individual responses to the intervention program.

Based upon this review of the literature, one research question and four corresponding hypotheses regarding the outcomes of this project were generated.

**Research Question: Is phonological awareness training using the *Road to the Code* program effective in increasing and maintaining at-risk kindergarten students' phonological awareness skills and in generalizing the effects when delivered in small groups?**

(a) Children receiving instruction through the *Road to the Code* program are expected to increase their phonological awareness skills.

(b) Trained children are expected to generalize their learning to a standardized measure of phoneme segmentation and pseudoword decoding and to an experimenter-developed measure of phoneme segmentation and pseudoword decoding that incorporates all letters not explicitly taught as part of the *Road to the Code* program.

(c) Student gains are expected to be larger on the experimenter-developed progress-monitoring measure including those letters explicitly taught as part

of the *Road to the Code* program than on the experimenter-developed measure containing letters not included in the *Road to the Code program.*

(d) Students are expected to maintain their gains on all progress-monitoring measures until the end of the school year.

CHAPTER 3

# Method

## Participants and Setting

Seven kindergarten students were initially identified through teacher nomination as having difficulty with phonological awareness skills, and further screening (described in *Procedures*) was conducted to verify early reading difficulty. Following screening, a total of six students, four males and two females, were found to meet criteria for participation in this study. Four of the participating students were European American, one student was African American, and one student was Hispanic. English was the primary language for five of the six participating students, with one student being identified as an English as a Second Language (ESL) student who would be receiving services during his first-grade year. Table 1 includes an overview of all participant characteristics.

Table 1

*Participating Student Characteristics*

| Student | Gender | Ethnicity | Age | Primary Language in the Home |
|---|---|---|---|---|
| Evan | Male | European American | 5-6 | English |
| Gillian | Female | European American | 6-2 | English |
| Marcus | Male | African American | 6-1 | English |
| Elisa | Female | European American | 7-1 | English |
| Jeff | Male | Hispanic | 6-1 | Spanish |
| Chad | Male | European American | 6-4 | English |

**All names are pseudonyms

All participating students were selected from three kindergarten classrooms located in a Midwestern, elementary school of approximately 500 students. Each kindergarten classroom consisted of approximately 20 to 25 5- and 6-year-old students, one lead teacher, and several part-time paraprofessionals. Less than 5% of the students in any of the three classrooms had been identified as eligible for special education services, with the majority of students being Caucasian, and approximately 10% being of a different ethnicity. These kindergarten classrooms implement the Literacy by Design program (i.e., Hoyt et al., 2007), which uses leveled readers to foster student fluency, vocabulary, phonemic awareness, phonics, and comprehension skills. Further, this classroom began implementing the Phonics Lessons and Word Study Lessons program (i.e., Fountas & Pinnell, 2006) during the 2009-2010 school year. This particular program contains 100 mini-lessons that teach and reinforce the areas of phonemic awareness, letters and sounds, reading words, and early reading concepts.

This study was conducted within the targeted elementary school. Specifically, each session was conducted in a small conference room, which was free from distraction.

Evan continued to receive Title I services prior to and throughout the duration of this study, and Elisa continued to receive a small group reading intervention from one of the kindergarten teachers three times a week for 30 minutes. They were included in this study as school staff indicated they continued to experience difficulty acquiring early literacy skills even after receiving additional literacy assistance throughout the school year. While the remaining four students were not currently receiving any outside intervention, they all had received Title I services at some time during the previous six

months of their kindergarten year. No new services occurred for any of the six participating students during the course of this study.

**Materials**

Materials for screening, progress monitoring, and the targeted intervention were necessary to complete this study. Assessments used for screening required materials from the Test of Phonological Awareness (TOPA; Torgesen & Bryant, 1994) and the Word Attack and Sound Awareness subtests from the Woodcock-Johnson Tests of Achievement Third Edition (WJ-III – 3; Woodcock, McGrew, & Mather, 2001). Progress-monitoring measures included the Phoneme Segmentation Fluency and Nonsense Word Fluency subtests from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski & Good, 1996). In addition, two experimenter-developed measures were used, which are described later in this chapter in further detail. A stopwatch was used for the two DIBELS subtests. While protocols for the TOPA and the two subtests from the WJ-III are not included for test security purposes, all other assessment protocols and materials can be found in Appendices B, C, D, and E.

The *Road to the Code* phonological awareness program (Blachman et al., 2000) was used during the intervention phase of this project. Materials needed to complete this phase of the project are included the intervention manual, which contains 44 lesson plans containing necessary materials, scripted instructions, and teacher notes for the three sections that comprise each lesson. Materials that were needed to administer the *Road to the Code* program that were included within the manual are say-it-and-move-it sheets, alphabet picture cards, sound categorization by rhyme cards, alphabet books, sound bingo cards, sound categorization by initial sound cards, Elkonin cards, a list of jingles, pictures

of objects beginning with the target letters of a, m, t, i, b, s, r, and f, and sound boards. Necessary materials that were provided by the researcher included small manipulatives to move when saying letter sounds, a puppet, crayons, bingo chips, 1 die with a target letter on each side, a small fishing pole, letter disks, brown lunch bags, a tote bag, and dry erase boards and markers. A sample lesson plan with the scripted instructions for Lesson 1 of the *Road to the Code* program can be found in Appendix F.

A behavior management program was used throughout all phases of this project. Necessary materials for this program included the two group rules in written form, marbles, a marble jar, and a variety of small reinforcers.

**Screening Measures**

**Test of Phonological Awareness (TOPA).** The kindergarten version of the TOPA (Torgesen & Bryant, 1994) was individually administered to all teacher nominated students prior to the intervention phase. The TOPA is comprised of 20 total items, with 10 items focusing on sounds that are the same at the beginning of words and the remaining 10 items targeting sounds that are different at the beginning of words. As part of this test, students were provided with a student response booklet on which they were instructed to mark the picture containing the object that contains either a similar or different beginning sound than the orally presented target word. The TOPA was scored by tallying the number of correctly marked items, and a total raw score was converted to a standard score and a percentile rank, through which each student was compared to a standardized sample of students with the same chronological age. One of the identified uses of the TOPA is to identify students early in the second half of their kindergarten year who may need extra support and/or instruction in the area of phonological awareness.

According to the authors of the TOPA, a student scoring below the 25th percentile is considered to be at-risk for future reading difficulties due to delayed phonological awareness skills. The eligibility criterion used for this study was set at the 50th percentile for the total score on the TOPA to take into account student performance with the included content. However, performance on each of the two individual scales was also considered as each measured a different aspect of phonological awareness.

The kindergarten version of the TOPA was standardized on 857 randomly sampled students in 10 different states. The coefficient alphas for the TOPA were .90 for 5-year-olds and .91 for 6-year-olds, with test-retest reliability being .94 after adjusting for internal consistency error. The TOPA was also found to demonstrate concurrent validity through a correlation of .66 with the Word Analysis subtest of the Woodcock-Johnson Tests of Achievement—Revised (WJ-R), and .60 with the Word Identification subtest of the WJ-R. One-year predictive validity of .62 was found between performance on the TOPA when administered in kindergarten and on the Word Analysis subtest of the Woodcock-Reading Mastery Test when administered at the end of first-grade (Torgesen & Bryant, 1994).

**Woodcock-Johnson Tests of Achievement Third Edition (WJ-III).** Two subtests from the WJ-III (Woodcock et al., 2001) were also administered to teacher-nominated students prior to their participation in the study. The WJ-III consists of 22 achievement tests targeting the areas of reading, oral language, mathematics, written language, and general knowledge. Subtests from the WJ-III were scored by tallying the number of correctly marked items, and a total raw score was converted to a standard score and percentile rank, through which each student was compared to a standardized

sample of students with the same chronological age. The school age sample of the WJ-III was standardized with over 4,000 students in kindergarten through twelfth grade from over 100 communities nationwide.

According to the authors of the WJ-III, students scoring below the 25th percentile on a subtest were considered to be demonstrating below average skills in that particular area when compared to others their age. The eligibility criterion used for this study was set at the 50th percentile for both the Word Attack and Sound Awareness subtests due to the types of items included for 5- and 6-year-old students, the influence these items have on student scores, and their relatedness to included progress monitoring measures.

***Word Attack subtest.*** The Word Attack subtest measures a student's ability to apply structural and phonic analysis skills to decoding non-words. As part of this task, students were initially presented with individual letters and asked to produce the sounds of each letter. As the test progressed, students were visually presented with a non-word that followed a phonetically consistent pattern and were required to segment the non-word into its individual phonemes in order to blend the individual sounds together to form the non-word. The median reliability for both five- and six-year-olds on the Word Attack subtest is .94 (Woodcock et al., 2001).

***Sound Awareness subtest.*** The Sound Awareness subtest of the WJ-III measures a school-aged student's phonological awareness skills through the four tasks of rhyming, deletion, substitution, and reversal. For the rhyming items, each student was asked to initially point to and later produce a rhyming word for an orally presented stimulus; the deletion task required students to remove either a syllable or an individual sound from one word to create a new word; the substitution task asked the student to substitute either

a word, its ending, or an individual sound to form a new word; and as part of the reversal task, the student reversed syllables or individual sounds to form new words. The median reliability of the Sound Awareness subtest is .85 for five-year-olds, and .93 for six-year-olds year-old students (Woodcock et al., 2001).

**Dependent Variables**

Progress-monitoring assessments are used to measure a student's growth in a specific area (Coyne & Harn, 2006). A student who is participating in a supplemental intervention is typically monitored on a regular basis to give the teacher consistent feedback and promote instructional decision-making. Four assessments were administered on a bi-weekly basis to measure the students' progress in the *Road to the Code* program. Two subtests from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Kaminski & Good, 1996) and two experimenter-developed measures were used to monitor progress throughout this study.

**Dynamic Indicators of Basic Early Literacy Skills (DIBELS).** The DIBELS consists of a set of fluency-based subtests that were designed to measure a student's early literacy and reading skills from preschool through third grade (Kaminski & Good, 1996). Each subtest requires only a brief amount of time to individually administer to students. The two DIBELS subtests that were used as part of this study are the Phoneme Segmentation Fluency (PSF) and the Nonsense Word Fluency (NWF) subtests. The PSF and the NWF subtests were chosen for use in this study as they measure phoneme segmentation and phoneme blending, two skills taught as part of the *Road to the Code* program.

The DIBELS provides cut points for all its subtests for the beginning, middle, and end of each school year. As this study was conducted during the final three months of the students' kindergarten year, the cut points for the end of the kindergarten year were used when examining each student's scores on both the PSF and NWF probes.

***Phoneme Segmentation Fluency (PSF)***. The PSF task measures young student's phonological skills through their ability to verbally segment words containing three to four phonemes that are orally presented by the examiner (University of Oregon, 2009). The PSF subtest has been found to have sufficient reliability and validity (e.g., Elliott, Huai, & Roach, 2006; Good, Gruba, & Kaminski, 2002). Specifically, the alternate form reliability when using one probe was .88 and when using three probes was .96, with a slope reliability of .71. One-year predictive validity ranging from .73 to .91 (Kaminski & Good, 1996; Good et al., 2002). The PSF subtest has also been found to have a strong and positive association with standardized measures of reading achievement and to demonstrate both discriminant and convergent validity (Rouse & Fantuzzo, 2006).

As the number of needed PSF probes across the three phases of this project exceed the number of available PSF probes through the DIBELS, a random sampling with replacement procedure was used to account for practice effects. With regards to cut points at the end of the kindergarten year, a score under 7 indicates a deficit in phonological awareness, a score between 10 and 35 indicates emerging skills in this area, and a score above 35 indicates established phonological awareness skills. Specific instructions for the PSF subtest can be found in Appendix G, and an example of a PSF probe is located in Appendix B.

***Nonsense Word Fluency (NWF).*** The NWF subtest is a brief measure of a student's understanding of the alphabetic principle (University of Oregon, 2009). A student is shown a nonsense word containing letters that represent the most common sounds in either vowel-consonant (VC) or consonant-vowel-consonant (CVC) patterns and is required to blend the individual phonemes to orally produce the word. The NWF measure has also been found to have sufficient reliability and validity (e.g., Elliott, et al., 2006; Good, et al., 2002). Specifically, the alternate form reliability when using one probe was .92 and when using three probes was .96, with a slope reliability of .71 (Kaminski & Good, 1996; Good et al., 2002). Concurrent validity with the PSF subtest was .59, and predictive validity ranged from .66 to .82 (Good et al., 2002). Further, the NWF task has also been found to demonstrate discriminant and convergent validity through a strong and positive association with standardized measures of reading achievement (Rouse & Fantuzzo, 2006).

As the number of needed NWF probes across the three phases of this project exceeded the number of available NWF probes through the DIBELS, a random sampling with replacement procedure was used to account for practice effects. With regards to NWF cut points at the end of the kindergarten year, a score under 15 indicates the student to be at-risk with phoneme segmentation and pseudoword decoding skills and for future reading difficulties, a score between 15 and 25 indicates the student to be at some risk for future reading difficulties, and a score above 25 indicates the student to be at low risk for future reading difficulties. Specific instructions for the NWF subtest can be found in Appendix H, and an example of a NWF probe is located in Appendix C.

***RTC instructional (RTCi) probe.*** While the DIBELS measures have been found to have adequate psychometric properties (e.g., Elliott, et al., 2006; Good, et al., 2002), progress on standardized measures may not appear for some time if they do not match the specific content and sequence of skills that are being taught (Daly, Johnson, & LeClair, 2008). Research has shown that young students show significantly greater gains on experimenter-developed measures of phonemic awareness as they are more sensitive to individual progress, especially when they are specifically created to identify taught phonemes and graphemes (NRP, 2000). For example, one study found that first-graders who had received training in phoneme blending and segmentation were more successful when reading nonsense words containing the same letters as those in the real words used during training sessions than those who had been taught using a sight-word approach (Daly et al., 2004). While this study was not designed to compare the two instructional approaches, it did show that training at the phoneme level resulted in more success when a student encountered novel words when reading. Therefore, a progress-monitoring measure designed from the content of the *Road to the Code* program, identified as the RTC instructional probe (RTCi), was also used. A total of 42 nonsense words were developed using the eight letters specifically taught in the program.

Nonsense words were used to ensure that the student's performance was not due to practice effects from exposure to a particular word in the program (e.g., Daly, Johnson et al., 2008). To attempt to control for practice effects with this measure, the nonsense words on each probe were presented in a random order. This measure was administered and scored similarly to the NWF subtest from the DIBELS. Specifically, each student was shown a nonsense word and asked to blend the phonemes together to orally produce

the word. The student received one point for each correctly produced phoneme, and a total score was calculated by summing the number of received points. Words included in the RTCi Probe can be found in Appendix D, and specific instructions for this probe are located in Appendix I.

***RTC generalization (RTCg) probe.*** A second progress-monitoring measure, identified as the RTC generalization probe (RTCg), was developed to assess whether each student was able to further generalize his new learning from instruction in *Road to the* Code to novel words that do not include content from this program. Specifically, a pool of nonsense words including letters that were not explicitly taught as part of the *Road to the Code* program was developed. As with the RTCi probe, a total of 42 nonsense words were included on each probe, and the nonsense words on each probe were presented in random order attempt to control for practice effects. This measure was also administered and scored similarly to the NWF subtest from the DIBELS. Specifically, each student was shown a nonsense word and asked to blend the phonemes together to orally produce the word. The student received one point for each correctly produced phoneme, and a total score was calculated by summing the number of received points. Words included in the RTCg probe can be found in Appendix E and specific instructions for this probe are located in Appendix J.

## Independent Variable

**Road to the Code Program.** The six students participating in this study received instruction through the *Road to the Code* program. This program is a structured, phonological awareness program that was designed to provide assistance to kindergarten and first-grade students having difficulty learning and mastering important early literacy

skills (Blachman et al., 2000). *Road to the Code* is comprised of 44 lessons that can be taught to either individual students or to small groups for approximately 11 weeks. For this study, each lesson lasted approximately 15-20 minutes and was administered for a total of seven weeks for Group 1, for six weeks for Group 2, and for five weeks for Group 3. The *Road to the Code* program is divided into three sections. The first section in each lesson of the *Road to the Code* program consists of Say-it-and-Move-it activities, which were designed to instruct students in how to segment words into phonemes. Specifically, students were first asked to repeat the target sound and to then move a concrete object as they say the sound aloud. As the program progressed, students were asked to repeat a target word, to move a concrete object for each sound they heard in the target word, and to then blend the phonemes to orally produce the target word. Letter tiles were introduced into this activity approximately midway through the program to reinforce the association between letters and their corresponding sounds.

The second section of each lesson in the *Road to the Code* program consists of letter name and sound instruction (Blachman et al., 2000). Letter-sound correspondence is reinforced through various activities including alphabet picture cards containing both the letter and an object that begins with that particular sound, sound jingles, tracing the letters on paper or in the air while saying the letter name and sound aloud, and playing games such as sound bingo, fishing for letters, and concentration. The eight letters of the alphabet that are introduced in this section through the course of the program are short a, m, t, short i, s, r, b, and f. The authors of the *Road to the Code* program stated that these eight letters were chosen as they represent only the closed syllable pattern, which they

suggest assists young students with the transition to reading and spelling other words that follow this pattern as well as other syllable patterns (Blachman et al., 2000).

The third and final section of each lesson in the *Road to the Code* program consists of a phonological awareness activity, such as categorizing sounds by rhyming or by initial sound, counting phonemes in a target word, blending phonemes into a word, and using Elkonin boxes to segment words into their individual phonemes. An example of a lesson from the *Road to the Code* program is located in Appendix F.

**Experimental Design**

A multiple-baseline-across-participants design was used to determine the effectiveness of the *Road to the Code* program in increasing a kindergarten student's phonological and phonemic awareness skills as measured through bi-weekly progress monitoring assessments of phoneme segmentation, phoneme blending, and pseudoword decoding. A multiple-baseline design was chosen for this study due to its utility in academic settings (Neuman & McCormick, 1995). Specifically, multiple-baseline designs are often used in educational or other applied settings due to their flexibility with the timing of the implementation of the intervention (Kennedy, 2005). Further, multiple-baseline designs are often more practical to use in those settings in which learning takes place as the target behavior is unlikely to return to baseline following exposure to an intervention as it cannot be unlearned (Neuman & McCormick, 1995).

A multiple-baseline-across-participants design is frequently used for studies investigating an intervention's effectiveness in modifying or changing a particular skill or behavior with small groups of participants (Riley-Tillman, & Burns, 2009). Within this type of multiple-baseline design, experimental control is obtained by replicating the

effect of the intervention across multiple participants and with an individual participant. Staggering the onset of the independent variable is important as it allows for validation that the change in a participant's behavior was due to the introduction of the independent variable rather than to other external factors such as history or maturation, and indicates internal validity (Barlow, Nock, & Hensen, 2009; Kazdin, 2010; Kucera & Axelrod, 1995). In other words, if an effect is found for each participant only after implementation of the intervention following a stable baseline period, then experimental control is achieved (Neuman & McCormick, 1995). Additionally, each replication of the effect with a new participant adds to the level of experimental control.

As stated previously, six kindergarten students participated in the intervention as part of this project. These six students were divided into three groups of two. Prior to implementation of the intervention, an attempt to establish a stable baseline for participants in each group was made as it is important to obtain a stable baseline that does not show an increasing trend prior to implementing the intervention (Riley-Tillman, & Burns, 2009). The more time between phase changes during which no changes in behavior occurred for a participant, the more confident one can be that any observed behavioral changes are due to the effect of the intervention rather than to extraneous factors.

Within a multiple-baseline design, the effectiveness of a chosen treatment is determined through a visual inspection of the data. Visual inspection refers to the ability to make a determination about the effects of an intervention after a visual examination of the graphed data (Kazdin, 2010). When conducting a visual inspection of data, one needs to examine the trend, level, and variability of the data (Kennedy, 2005) to determine

whether there was a change in level and/or trend between the baseline and intervention phase, and whether there was any overlap of data points between each phase (Riley-Tillman, & Burns, 2009).

**Procedures**

**Informed Consent.** Prior to the onset of this proposed study, approval was obtained from both the University of Nebraska-Lincoln's Institutional Review Board (IRB) as well as from administrators from the school district and elementary school. Parents or guardians of each participating student provided written informed consent on a previously approved consent form, and each participating student provided written informed assent.

**Screening.** Each student that was nominated by their kindergarten teacher as having delays in the area of phonological awareness was screened to ensure that they were demonstrating phonological awareness deficits. Students were selected for participation in this study based on the results of the TOPA, and the Word Attack and Sound Awareness subtests from the WJ-III.

As Gillian's eligibility for the study continued to be questionable following the administration of the screening instruments, sample PSF and NWF probes from the DIBELS were administered to examine her current performance on the actual measures being used to monitor progress throughout this study. Gillian was considered to be demonstrating emerging skills, or to be at some risk with phonological awareness according to the DIBELS assessment, and she was included in this study. Table 2 includes the individual screening scores for the six students who participated in this study.

Table 2

*Individual Student Screening Scores*

| Student | Initial Sound Same TOPA (# correct) | Initial Sound Different TOPA (# correct) | TOPA Total Percentile ($50^{th}$) | Word Attack Score WJ-III ($50^{th}$) | Sound Awareness Total Score WJ-III ($50^{th}$) |
|---|---|---|---|---|---|
| Evan | 3/10 | 2/10 | $13^{th}$ | $61^{st}$ | $23^{rd}$ |
| Marcus | 10/10 | 0/10 | $27^{th}$ | $62^{nd}$ | $39^{th}$ |
| Jeff | 3/10 | 4/10 | $19^{th}$ | $23^{rd}$ | $11^{th}$ |
| Gillian | 9/10 | 7/10 | $55^{th}$ | $81^{st}$ | $51^{st}$ |
| Elisa | 10/10 | 4/10 | $30^{th}$ | $11^{th}$ | $3^{rd}$ |
| Chad | 7/10 | 2/10 | $23^{rd}$ | $46^{th}$ | $1^{st}$ |

Each of the six students was then designated as a high-performing student or a low-performing student based upon their screening measures. Specifically, both the Total Percentile on the TOPA and the raw scores on each individual section were examined along with total percentiles and performance on tasks within the two subtests of the WJ-III to designate which three students would be the high-performing students and which three students would be the low-performing students. Gillian, Elisa, and Chad were designated as high-performing students, and Evan, Marcus, and Jeff were designated as low-performing students for the purposes of this study.

Each of the three intervention groups was comprised of one high-performing and one low-performing student as the belief was that both the high- and low-performing student would benefit from the modeling that the high-performing student could provide within the small group. During data analysis, performance comparisons were made

among and across the low-performing students and the high-performing students through visual inspection of the data. The performance of each individual student was also examined.

With regards to the high-performing students, Gillian demonstrated high skills on all screening measures when compared to the other participating students; Elisa demonstrated the ability to identify words that begin with the same sound and demonstrated more success with phoneme blending at the word level; and Chad's ability to correctly identify and pronounce individual phonemes aided in his success with those tasks requiring phoneme segmenting and blending using letters. With regards to the low-performing students, Marcus was unable to correctly identify words that were administered orally and contained different initial sounds and experienced difficulty with tasks at the individual phoneme level; Jeff experienced difficulty on all of the screening measures; and Evan demonstrated difficulty on all screening measures with the exception of the Word Attack measure.

**Intervention.** This study included three phases. One interventionist, a doctoral student in a school psychology program with experience using all screening and dependent measures as well as with administering standardized programs to young children, conducted all phases of this study. Further, a review of the components and procedures within the *Road to the Code* lessons was conducted prior to the onset of this study.

A reward program was used across all phases to manage student behavior throughout the *Road to the Code* lesson. As part of this reward program, students in each group earned a marble intermittently throughout each lesson if they remained in their seat

and followed directions. No marbles were removed from the jar. Once the students reached a predetermined number of marbles, they selected a reward from the prize bucket, the marbles were emptied from the jar, and the cycle started over.

***Baseline phase.*** While each group was in the baseline phase, no instruction in the *Road to the Code* program was provided. Each student participating in the *Road to the Code* program completed three PSF probes, three NWF probes, one RTCi probe, and one RTCg probe per administration session. Three PSF and NWF probes were administered during each session due to the higher reliability obtained when using three probes rather than only one probe (Kaminski & Good, 1996; Good et al., 2002), and the median score for both the three PSF and NWF probes were recorded for each session. Only one probe was administered for both the RTCi and the RTCg measures during each session due to the limited amount of available content. A mean accuracy percentage was also obtained for each student on each of the four progress monitoring measures. The mean accuracy percentage was calculated by dividing the number of Correct Sounds (CS) or Correct Letter Sequences (CLS) by the total number of CS or CLS attempted. Once a stable baseline was obtained for both students in the first group, the instructional phase began for those students while the remaining two groups of students continued in the baseline phase. The instructional phase began for the second group of students after an attempt to achieve stable baselines for both students was made. These procedures were repeated for the third group.

***Instructional phase.*** Following completion of the baseline phase for each group, the students met with the researcher multiple times a week. The intervention phase of this project involved the implementation of the *Road to the Code* program for the three

groups of participating students, during which each group completed one lesson with the researcher during each session that lasted approximately 15-30 minutes. While this program has a standard scope and sequence, some flexibility with regards to pace is allowed for the say-it-and-move-it section of lessons 20 to 44. Specifically, this section may be adapted for a student demonstrating particular difficulty with the ability to associate a letter with its particular sound. The introduction of letter tiles was therefore delayed for Group 1 until both students demonstrated understanding of this association.

Twice a week throughout the intervention phase, all six students participating in the *Road to the Code* program completed three PSF probes and three NWF probes, one RTCi probe, and one RTCg probe. Each student's performance on all four measures was scored and graphed to monitor progress and to make determinations regarding the implementation of the intervention.

***Maintenance phase.*** The final phase of this study involved the collection of data to ensure maintenance of learned skills. Following completion of the intervention phase for each student participating in the *Road to the Code* program, bi-weekly assessments using three PSF probes and three NWF probes, one RTCi probe, and one RTCg probe were administered. These assessments were administered until the end of the school year.

## Treatment Integrity and Interrater Reliability

**Treatment Integrity.** The integrity of the implementation of the *Road to the Code* program was examined to ensure that all steps were correctly implemented. As part of this process, all intervention sessions were audiotaped. An intervention session was randomly selected approximately every two weeks to monitor treatment integrity,

resulting in 35% (46 out of a total of 132 lessons) being scored for treatment integrity. A graduate student in a local university's school psychology program used a treatment integrity checklist to verify that all steps of the *Road to the Code* program were being followed in the correct sequence while listening to the corresponding audiotaped session. A review of all checklists corresponding to the randomly selected lessons indicated the level of treatment integrity was 99.7% throughout the intervention phase of this study (standard deviation = 0.1043; range = 88% to 100%). A treatment integrity checklist for the *Road to the Code* program can be located in Appendix K.

**Interrater Reliability.** Interrater reliability was examined during all phases of this study. The reliability of included measures was ensured through the consistency of ratings between two independent raters. As part of the screening phase, a graduate student reviewed the scoring procedures for the TOPA, the Word Attack and the Sound Awareness subtests of the WJ-III, and asked questions as needed. The graduate student had been trained by faculty in previous classes, had mastered the WJ-III, and was proficient with learning and administering various assessment instruments. The graduate student was blind to the procedures of this project and was trained on these tasks by independently reading and reviewing the instructions for scoring that are included in each manual.

The graduate student was also trained to score both DIBELS probes and the RTC probes used as part of this study. The graduate student read directions for scoring the PSF and NWF probes, and then scored examples of such probes. As the RTCi and RTCg probes are similar in composition and scoring to the NWF subtest from the DIBELS, no additional training or practice was given for these particular probes. The graduate student

and researcher reached over 80% interrater agreement before the graduate student independently scored student probes.

PSF, NWF, RTCi, and RTCg probes administered during the intervention and maintenance phases were randomly selected for interrater reliability checks initially every two weeks. A total of 58% (49 out of a possible 84) progress-monitoring sessions were randomly selected to examine for interrater reliability. Due to each group being in the intervention and maintenance phases for different lengths of time, there were a total of 34 progress-monitoring sessions during the intervention and maintenance phases for Group 1, a total of 28 progress-monitoring sessions for Group 2, and a total of 22 progress-monitoring sessions for Group 3. Out of these sessions, a total of 41% (n=14) sessions for Group 1 were randomly selected for an examination of interrater reliability, a total of 64% (n= 18) sessions for Group 2, and a total of 77% (n= 17) sessions for Group 3. More sessions were randomly selected for Groups 2 and 3 for examination of interrater reliability towards the end of the study as students were receiving more intervention sessions in shorter periods of time.

The calculation of interrater reliability for each measure was completed by dividing the smaller number by the larger number and then multiplying by 100 to obtain a final percentage. Interrater agreement for the PSF probe was 99.3%, with a standard deviation of 15.455 and a range of 88% to 100%; interrater agreement for the NWF probe was 99.3%, with a standard deviation of 13.501 and a range of 67% to 100%; interrater agreement for the RTCi probe was 99.5%, with a standard deviation of 12.975 and a range of 75% to 100%; and interrater agreement for the RTCg probe was 99.6%, with a standard deviation of 13.333 and a range of 75% to 100%. Interestingly, the range of

data for both the PSF and the NWF probes would be smaller if Evan's data were removed from the calculation due to his smaller number of attempted and correct responses on both of these probes. Specifically, the range for the PSF probe if Evan's scores were removed would be 92% to 100%, and the range for the NWF probe if Evan's scores were removed would be 91% to 100%.

# CHAPTER 4

## Results

As part of this study, data were collected on four progress monitoring measures. Phoneme segmentation skill was measured through scores on the Phoneme Segmentation Fluency (PSF) subtest of the DIBELS. Skill with phoneme segmentation, blending and pseudoword decoding was measured through scores on the Road to the Code Instructional (RTCi) probe, which consisted of words that included letters explicitly taught as part of the implemented intervention. Phoneme segmentation, blending, and pseudoword decoding was also measured through scores on the two generalization measures: the Nonsense Word Fluency (NWF) subtest of the DIBELS; and the Road to the Code Generalization (RTCg) probe that consisted of words including all remaining letters of the alphabet. Results from these assessments will be discussed in detail.

### Progress Monitoring across the Three Phases

The baseline phase of this study began at the same time for all three groups, with all probes being administered on a bi-weekly basis. As outlined in the previous chapter, at least three stable points were obtained before the implementation of the intervention began for the first group, with at least three additional points gathered before implementing the intervention phase of the study for each following group (Riley-Tillman & Burns, 2009).

Based upon the performance of both students in Group 1 on all baseline measures, the intervention was implemented for this group after four baseline data points were collected. A visual inspection of the data then determined which of the remaining two groups would first begin the intervention phase, with the implementation of the

intervention beginning after seven baseline data points were collected for Group 2. The issue of time also played a factor with regards to intervention implementation for Group 3. Specifically, due to the number of lessons included as part of the *Road to the Code* intervention when compared to the number of weeks remaining in the current school year, intervention implementation for Group 3 began after 11 baseline data points were collected even though a stable baseline was not obtained across every measure for the low-performing student, Jeff, in this group. This lack of stability in baseline affected the achievement of experimental control, which will be discussed in further detail throughout this and the following chapter.

**Research Hypotheses**

The primary research question set forth in this study was whether or not phonological awareness training using the *Road to the Code* program was effective in increasing and maintaining at-risk kindergarten students' phonological awareness skills and generalizing the effects when delivered in small groups. Four hypotheses were generated from this research question, and each will be discussed with the corresponding data. A summary of all six students' performance on each of the four progress monitoring measures accompanied by a comparison of the low-performing students' and high-performing students' performance will be followed by a more detailed description of each individual student's performance for each hypothesis.

**Hypothesis 1: Children receiving instruction through the *Road to the Code* program will increase their phonological awareness skills.**

Information for this hypothesis was collected through both the PSF and RTCi probes. The PSF probe is a DIBELS subtest that was designed to measure a young

child's phonological awareness skills. Figure 1 illustrates the multiple baseline across both the low-performing students and high-performing students for the baseline and intervention phases on the PSF measure. Table 3 shows the means and ranges for both the baseline and intervention phases on the PSF measure and the cut points for the PSF measure at the end of kindergarten. Table 4 shows the mean accuracy percentage for each student on the PSF measure during both the baseline and intervention phases.

A visual inspection of the students' data indicated that all six students made continuous improvement in their performance on the PSF measure throughout the intervention phase. When examining student performance against the PSF cut points, five students were considered to be in the established range by the end of the study. The remaining student, Evan, demonstrated a stable performance, with little progress on the PSF probe throughout all phases of this study. Based upon these results, this hypothesis was confirmed for the PSF probe.

A visual inspection of the data, along with an examination of student scores, indicated that those designated as low-performing students had a lower starting point in the baseline phase (i.e., 6.3 Correct Sounds; CS) than those designated as high-performing students (i.e., 17 CS), a difference of 10.7 CS. This difference was maintained throughout the intervention phase, with the low-performing students demonstrating an average ending score of 35.33 CS, and the high-performing students having an average ending score of 54.67 CS, a difference of 19.34 CS. However, the low-performing students had a larger increase during the course of the study, with an increase of 24.64 CS from the beginning of baseline to the end of the intervention phase, while the high-performing students demonstrated an increase of 19.34 CS.

Figure 1. Multiple Baseline across Low-performing Students and High-performing Students for the Phoneme Segmentation Fluency (PSF) Measure

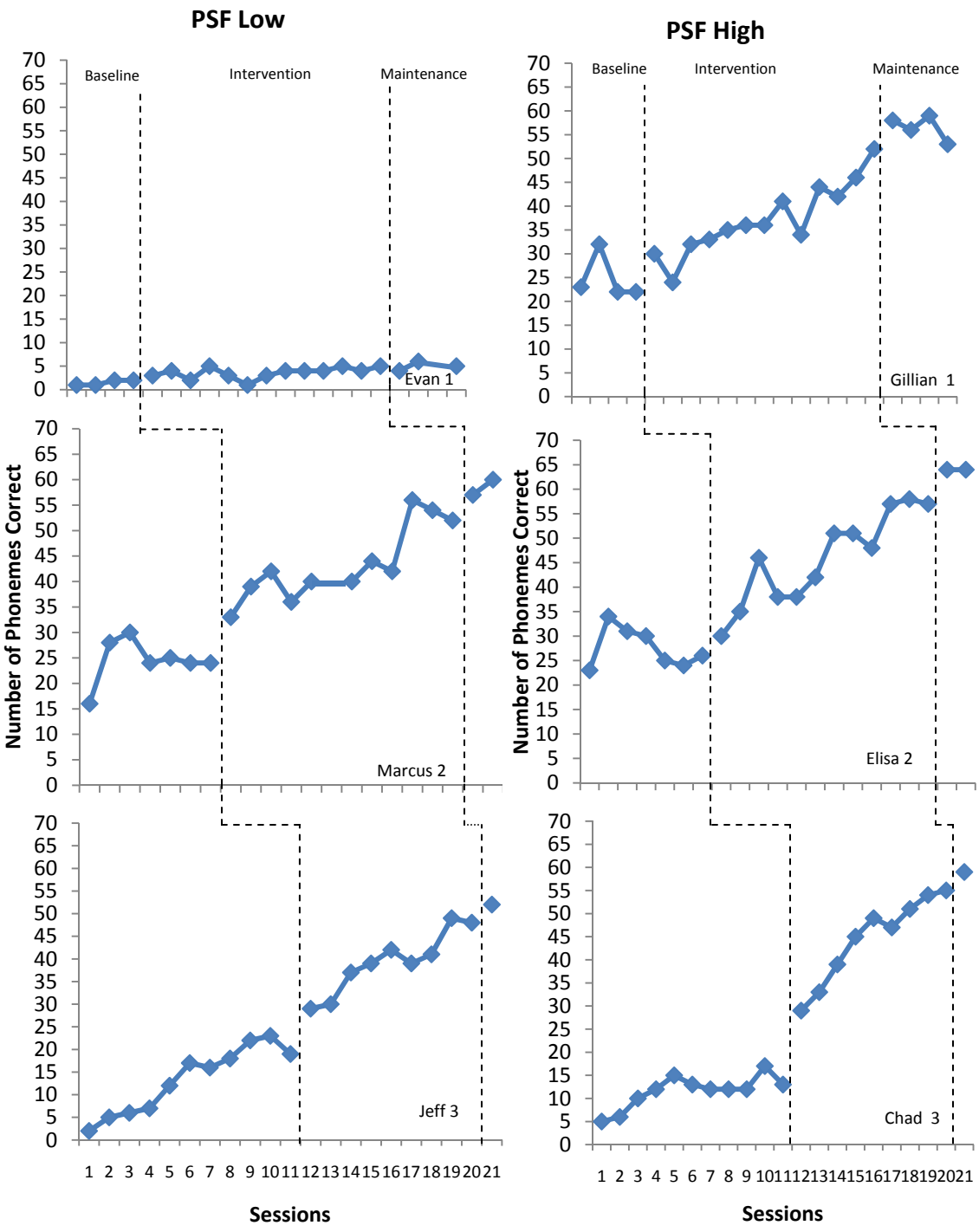

Table 3

*Individual Student Means, Ranges, and Cut Points for Correct Sounds (CS) for the Baseline and Intervention Phases of the Phoneme Segmentation Fluency (PSF) Measure*

| Student | PSF Baseline Mean (CS) | PSF cut point descriptor for end of kindergarten (baseline) | PSF Baseline Range (CS) | PSF Intervention Mean (CS) | PSF cut point descriptor for end of kindergarten (intervention) | PSF Intervention Range (CS) |
|---|---|---|---|---|---|---|
| Evan | 1.5 | Deficit | 1-2 | 3.77 | Deficit | 1-5 |
| Marcus | 24.42 | Emerging | 17-30 | 43.55 | Established | 33-56 |
| Jeff | 13.36 | Emerging | 2-23 | 39.33 | Established | 29-49 |
| Gillian | 25.25 | Emerging | 22-32 | 37.31 | Established | 24-53 |
| Elisa | 27.57 | Emerging | 23-35 | 45.92 | Established | 30-58 |
| Chad | 11.5 | Emerging | 5-17 | 44.67 | Established | 29-55 |

Table 4

*Individual Student Mean Accuracy Percentages from Baseline and Intervention Phases for Phoneme Segmentation Fluency (PSF) Measure*

| Student | PSF Mean Accuracy Percentage (Baseline) | PSF Mean Accuracy Percentage (Intervention) | PSF Mean Percentage Change |
|---|---|---|---|
| Evan | 5% | 7% | +4% |
| Marcus | 66% | 79% | +13% |
| Jeff | 54% | 80% | +26% |
| Gillian | 72% | 80% | +8% |
| Elisa | 70% | 83% | +13% |
| Chad | 36% | 76% | +40% |

A visual inspection of the multiple baseline data for those designated as low-performing students within each group suggests variability in performance across the three students as well as for each individual student on the PSF probe. Specifically, Evan's and Marcus's data demonstrated a relatively stable baseline prior to the implementation of the intervention, while Jeff's data demonstrated a consistently increasing trend throughout the baseline phase. This variability across all three students continued into the intervention phase. Marcus and Jeff demonstrated continuous improvement throughout this phase, with Jeff showing a consistently increasing trend and Marcus showing more variability between data points as part of his increasing trend. Evan continued throughout the phase with a relatively flat trend. Taken together, Jeff's steadily increasing trend during baseline coupled with Evan's lack of change, or progress, during the intervention phase limited experimental control for the low-performing students on the PSF probe.

A visual inspection of the data for those designated as the high-performing students in each of the three groups on the PSF probe indicates that all three students, Gillian, Elisa, and Chad, demonstrated a stable baseline prior to the implementation of the intervention. The data also showed all students to demonstrate continuing improvement in the total number of Correct Sounds (CS) per minute on this specific measure throughout the intervention phase. Taken together, the stable baselines coupled with the change made during the intervention phase for all three students indicates the demonstration of experimental control for the high-performing students on the PSF probe. With regards to mean accuracy on the PSF probe, all students improved from the

baseline phase to the intervention phase.

*Evan.* Evan was designated as the low-performing student in Group 1. He did not make progress on this variable during the study and continued to be in the Deficit range during the intervention phase according to the PSF cut point. His mean score on the PSF probe was 1.5 CS, with a range of 1 to 2 CS for the baseline phase. Evan's mean score during the intervention phase was 3.77 CS with a range of 1 to 5 CS. Evan's mean accuracy increased from 5% during the baseline phase to 9% during the intervention phase, a mean gain of 4%.

*Marcus.* Marcus was designated as a low-performing student in Group 2. While his data demonstrated initial variability on the PSF probe during baseline, performance stabilized prior to the onset of the intervention phase. An immediate increase in Marcus' performance was observed on the PSF probe following the implementation of the intervention. While a visual inspection of the data indicates some variability in his performance during the intervention phase, it also suggests a continuously increasing trend. This improvement can also be seen through his transition from Emerging to Established according to the PSF cut points. Marcus' mean score of 24.42 CS during the baseline phase increased to 43.55 CS during the intervention phase. Marcus' mean accuracy increased throughout the study. Specifically, he demonstrated 66% mean accuracy during the baseline phase, which increased to 79% mean accuracy during the intervention phase.

*Jeff.* Jeff was designated as the low-performing student from Group 3. A visual inspection of Jeff's baseline data indicated an increasing trend throughout this phase of the study, indicating experimental control was not achieved. There was an immediate,

but small, increase in level immediately following the introduction of the intervention. An increasing trend continued throughout the intervention phase of this study. Jeff's performance on the PSF measure also improved from Emerging to Established according to the PSF cut points. Jeff's mean score during the baseline phase was 13.36 CS, which increased to 39.33 CS during the intervention phase. While there was a relatively large range during both the baseline (i.e., 2 to 23 CS) and intervention (i.e., 29 to 49 CS) phases of this study, a visual inspection suggests that this is due more to the increase in scores from the beginning to end of each phase rather than to a large amount of variability in scores within each phase. There was also an increase in Jeff's mean accuracy from 54% during the baseline phase to 80% during the intervention phase, a mean gain of 26%.

*Gillian.* Gillian was the high-performing students in Group 1. While her data showed variability on the PSF probe during the baseline phase, a stable trend was observed. The mean score on the PSF probe was 25.25 CS, with a range of 22 to 32 CS. While minor variability did occur at two different times during this phase, a visual inspection of the data indicated slow but steady improvement on the PSF measure during the intervention phase as evidenced by her mean score of 37.31 CS and range of 24 to 53 CS. Gillian transitioned from Emerging to Established according to the PSF cut points.

While Gillian demonstrated good accuracy on this measure throughout both the baseline and intervention phases of the study, a mean gain was observed from baseline to intervention. Specifically, Gillian demonstrated 72% mean accuracy during baseline, which increased to 80% mean accuracy during the intervention phase.

*Elisa.* Elisa was the designated high-performing student for Group 2. Her data demonstrated a decreasing trend during baseline, which stabilized prior to the onset of the intervention phase. The mean score during the baseline phase was 27.57 CS, with a range of 23 to 35 CS. While a visual inspection of Elisa's performance during the intervention phase showed variability, the increasing trend indicated that Elisa made constant progress. This finding was supported by Elisa's transition from Emerging to Established according to the PSF cut points. Specifically, the mean score during the intervention phase increased to 45.92 CS, with a range of 30 to 58 CS. Elisa's mean accuracy was 70% during the baseline phase and increased to 83% during the intervention phase.

*Chad.* Chad, who was designated the high student for Group 3, demonstrated a relatively stable performance on the PSF probe throughout the baseline phase The mean score during the baseline phase was 11.5 CS, with a range of 5 to 17 CS. Following the implementation of the intervention, Chad's data demonstrated an immediate increase in level once intervention began. He continued to consistently improve in identifying individual phonemes, which can also be seen by his transition from Emerging to Established according to the PSF cut points. The mean score during the intervention phase was 44.67 CS, with a range of 29 to 55 CS.

Chad's data demonstrated low mean accuracy during the baseline phase. Specifically, he accurately identified only 36% of the individual phonemes during the baseline phase. Chad's mean accuracy increased to 76% during the intervention phase.

**Road to the Code instructional probe (RTCi).** The second measure chosen to assess student progress in the development of phonological awareness was the RTCi

probe, which was an experimenter-developed probe designed to measure phoneme segmentation and pseudoword decoding. The RTCi probe included nonsense words comprised only of the eight letters taught explicitly as part of the *Road to the Code* program. Figure 2 illustrates the data in a multiple baseline design across both the low-performing students and high-performing students for the baseline and intervention phases on the RTCi measure. Table 5 shows the means and ranges for both the baseline and intervention phases on the RTCi measure. Table 6 shows the mean accuracy percentages for each student on the RTCi measure during both the baseline and intervention phases.

A visual inspection of all six students' graphs representing their scores from the RTCi probe indicated a large amount of variability in the students' performance during both the baseline and intervention phases. All students except Marcus demonstrated a stable baseline trend. However, the data also showed Elisa and Chad to make little, if any, progress from the baseline to intervention phase with correctly identifying and pronouncing those letter sounds explicitly taught as part of the *Road to the Code* program. Further, Marcus' data was highly variable throughout the intervention phase, both Marcus' and Gillian's data showed a high overlap of data points between the baseline and intervention phases, Evan's data stabilized at the end of the intervention phase, and the increase in Gillian's performance during the intervention phase was not seen until the 10$^{th}$ data point. Based upon these results, the hypothesis that participation in the *Road to the Code* program increased students' phonological awareness was not confirmed for the RTCi probe.

Figure 2. Multiple Baseline across Low-performing Students and High-performing Students for the Road to the Code Instructional (RTCi) Measure

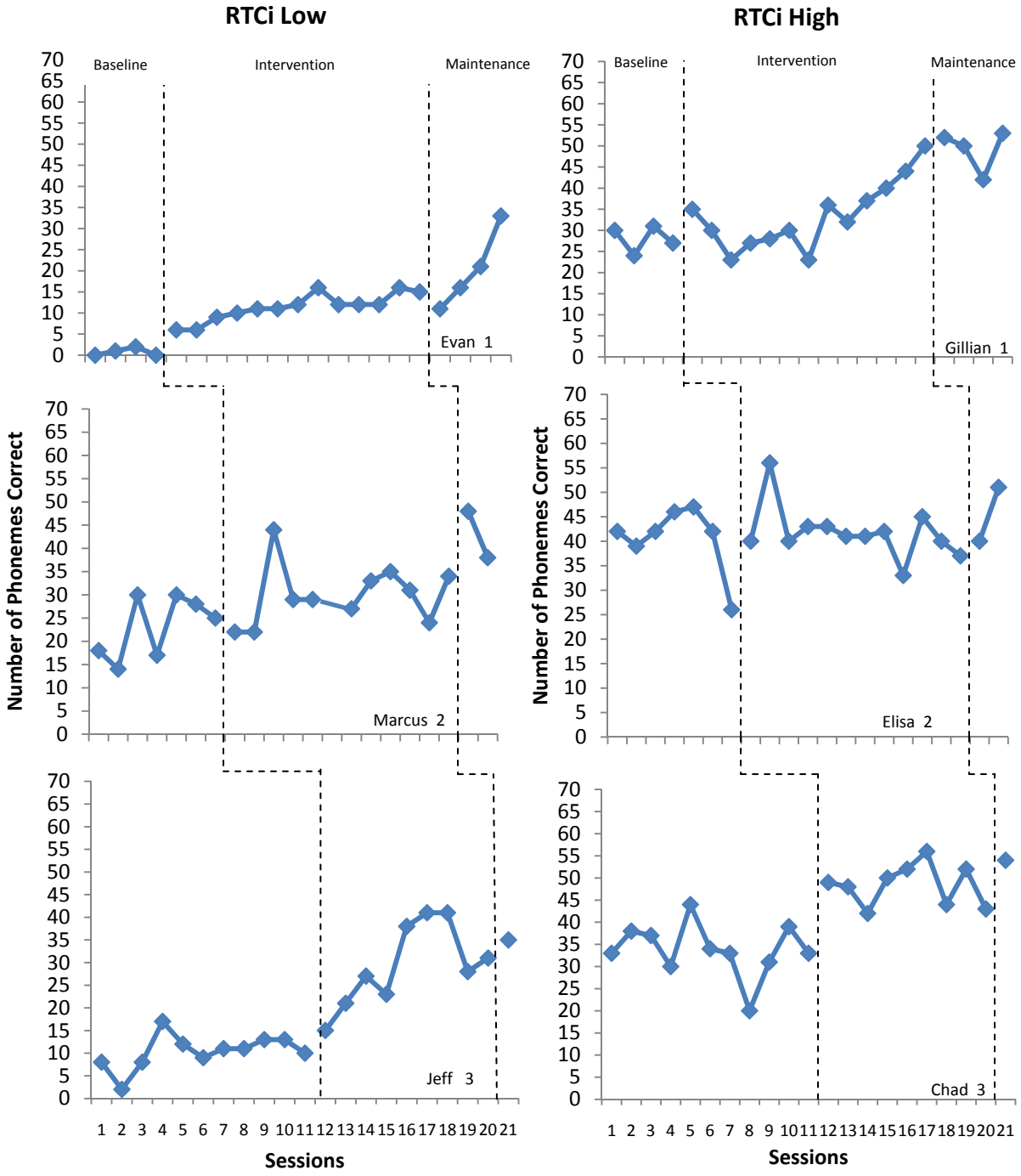

Table 5

*Individual Student Means and Ranges for the Road to the Code Intervention (RTCi) Measure*

| Student | RTCi Baseline Mean (CLS) | RTCi Baseline Range (CLS) | RTCi Intervention Mean (CLS) | RTCi Intervention Range (CLS) |
|---|---|---|---|---|
| Evan | 0.75 | 0-2 | 11.38 | 6-16 |
| Marcus | 23.14 | 14-31 | 30 | 22-44 |
| Jeff | 10.36 | 2-17 | 29.44 | 15-41 |
| Gillian | 27.75 | 24-31 | 33.46 | 23-50 |
| Elisa | 40.57 | 26-47 | 41.83 | 33-56 |
| Chad | 33.81 | 20-45 | 48.44 | 42-56 |

Table 6

*Individual Student Mean Accuracy Percentages from Baseline and Intervention Phases for the Road to the Code Intervention (RTCi) Measure*

| Student | RTCi Mean Accuracy Percentage (Baseline) | RTCi Mean Accuracy Percentage (Intervention) | Mean Percentage Of Change |
|---|---|---|---|
| Evan | 3% | 40% | +37% |
| Marcus | 83% | 90% | +7% |
| Jeff | 47% | 83% | +36% |
| Gillian | 94% | 96% | +2% |
| Elisa | 96% | 92% | -4% |
| Chad | 96% | 99% | +3% |

A difference was seen in the initial starting points between the low-performing and high-performing students, with regards to their ability to segment and decode the presented words. Specifically, low-performing students had an average starting point of 8.7 Correct Letter Sequences (CLS) with the average for high-performing students being 35 CLS, a difference of 26.3 CLS. This difference indicated the high-performing students to demonstrate more familiarity with the letters explicitly taught as part of the *Road to the Code* program than the low-performing students. However, it does appear that the difference between the low-performing and high-performing students in each group narrowed by the end of the intervention phase. Specifically, the average gain score at the end of the intervention phase was 26.7 CLS for the low-performing students and 43.3 CLS for high-performing students, a difference of 16.6 CLS. In other words, the low-performing students had an increase of 18 CLS from the beginning of baseline to the end of the intervention phase, while the high-performing students demonstrated an increase of 8.3 CLS.

A visual inspection of the data for those designated as low-performing students within each group on the RTCi probe indicated both Evan's and Jeff's data to demonstrate a stable baseline, and Marcus' data to demonstrate a variable but increasing trend. Marcus' data indicated little progress during the intervention phase and there was a large amount of overlap between obtained scores in the baseline and intervention phases. Jeff's data displayed variability during the intervention phase that accompanied an increasing trend, and Evan demonstrated small improvements during the intervention phase.

A visual inspection of the data for those designated as the high-performing students in each of the three groups also indicated variability between the three students. Specifically, all three students showed some variability during baseline but with a stable trend. Elisa and Chad demonstrated a stable trend during the intervention phase. Gillian initially demonstrated a variable, but stable trend, which was followed by an increasing trend at the end of the intervention phase. With regards to mean accuracy, five students increased their mean accuracy from baseline to intervention. Elisa's data, however, showed a slight decrease in accuracy from the baseline to the intervention phase.

*Evan.* Evan's data demonstrated stability on the RTCi probe throughout the baseline phase. His mean score on the RTCi probe during baseline was 0.75 CLS, with a range of 0 to 2 CLS. Evan demonstrated a small increase in his performance during the intervention phase, but his data stabilized towards the end of this phase. Evan's mean score during the intervention phase was 11.38 CLS, with a range of 6 to16. Evan's mean accuracy on the RTCi probe showed an improvement from baseline to intervention. Specifically, Evan initially demonstrated 3% accuracy during the baseline phase, which increased to 40% during the intervention phase, a mean gain of 37%.

*Marcus.* Marcus' data demonstrated a relatively variable trend throughout both the baseline and intervention phases. Marcus' mean baseline score on the RTCi probe was 23.14 CLS, with a range of 14 to 31 CLS. Marcus demonstrated an increasing trend throughout the baseline phase and a small increasing trend during the intervention phase. However, Marcus' progress was somewhat masked during a visual inspection of the data due to the large amount of variability throughout the phase. Marcus' mean score on the RTCi probe during the intervention phase was 30 CLS, with a range of 22 to 44 CLS.

Marcus demonstrated 83% mean accuracy during the baseline phase, which increased to 90% during the intervention phase, a mean gain of 7%.

*Jeff.* While there was some initial variability in Jeff's baseline performance on the RTCi probe, his data indicated a stable performance at the end of this phase. Jeff had a mean baseline score of 10.36 CLS, with a range of 2 to 17 CLS. More variability accompanied an increasing trend throughout the intervention phase. Jeff's mean score during the intervention phase was 29.44 CLS, with a range of 15 to 41 CLS. Jeff's mean accuracy increased from 47% during the baseline phase to 83% during the intervention phase, a mean gain of 36%.

*Gillian.* Gillian's data demonstrated stability during the baseline phase, with a mean baseline score of 27.75 CLS and a range of 24 to 31 CLS. While her data initially demonstrated stability during the intervention phase, an increasing trend was observed at the end of this phase. Gillian had a mean score of 33.46 CLS, with a range of 23 to 50 CLS during the intervention phase. Gillian's demonstrated a high level of accuracy at the beginning of the study. Gillian's accuracy level was 94% during the baseline phase and increased to 96% during the intervention phase, a mean gain of 2%.

*Elisa.* Elisa's data demonstrated a stable baseline trend that ended with an outlier immediately prior to the onset of the intervention phase. Elisa had a mean baseline score of 40.57 CLS and a range of 26 to 47 CLS. While Elisa's performance demonstrated variability during the intervention phase, there was a stable trend indicating little or no progress. Elisa's mean score during the intervention phase was 41.83 CLS, with a range of 33 to 56 CLS. Elisa's accuracy decreased from 96% during the baseline phase to 92% during the intervention phase, a mean change of -4%.

*Chad.* While Chad showed variability on the RTCi probe throughout both the baseline and intervention phases, stable trends were observed throughout both the baseline and intervention phases. Chad had a mean baseline score of 33.81 CLS, with a range of 20 to 45 CLS. There was an immediate increase in his level of performance from the end of the baseline phase to the beginning of the intervention phase, but his data showed a stable trend throughout the duration of this phase indicating little or no progress during the intervention phase. His mean intervention score was 48.44 CLS with a range of 42 to 56 CLS. Chad's mean accuracy on the RTCi probe began at a high level and remained at this level. His mean accuracy during the baseline phase was 96% and increased to 99% during the intervention phase.

**Hypothesis 2: Trained children will generalize their learning to a standardized measure of phoneme segmentation and pseudoword decoding and to an experimenter-developed measure of phoneme segmentation and pseudoword decoding that incorporates all letters not taught as part of the *Road to the Code* program.**

Information for this hypothesis was collected through the NWF task from the DIBELS and the RTCg probe. Figure 3 illustrates the multiple baseline across both the low-performing students and high-performing students for the baseline and intervention phases on the NWF measure. Table 7 shows the means, ranges, and cut points for the end of the kindergarten year for both the baseline and intervention phases on the NWF measure, and Table 8 shows the mean accuracy percentages for each student on the NWF measure during the baseline and intervention phases.

*Figure 3.* Multiple Baseline across Low-performing Students and High-performing Students for the Nonsense Word Fluency (NWF) Measure

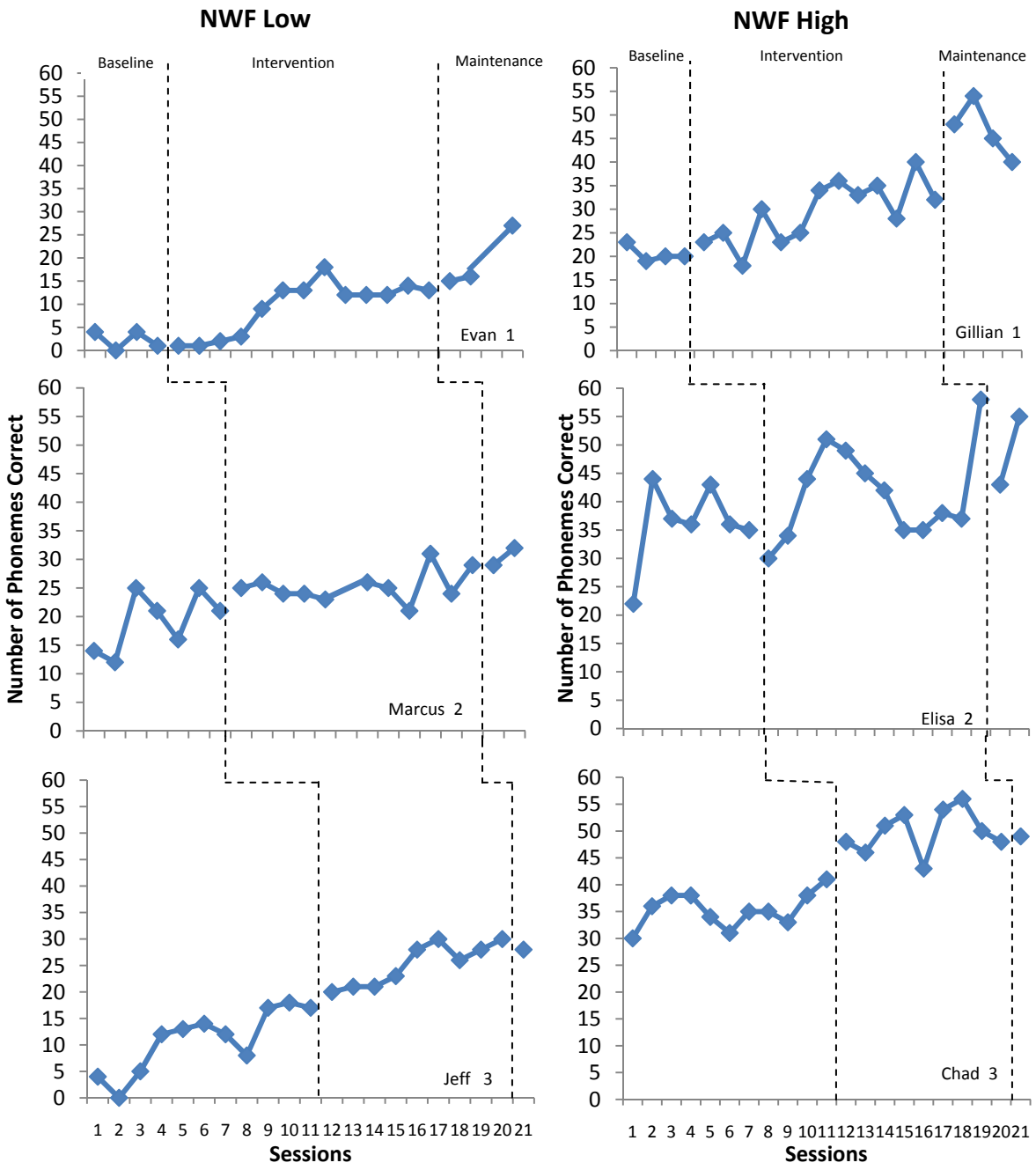

Table 7

*Individual Student Means, Ranges, and Cut Points for Correct Letter Sequences (CLS) for the Baseline and Intervention Phases on the Nonsense Word Fluency (NWF) Measure*

| Student | NWF Baseline Mean (CLS) | NWF cut point descriptor for end of kindergarten (baseline) | NWF Baseline Range (CLS) | NWF Intervention Mean (CLS) | NWF cut point descriptor for end of kindergarten (intervention) | NWF Intervention Range (CLS) |
|---|---|---|---|---|---|---|
| Evan | 2.25 | At-risk | 0-4 | 9.46 | At-risk | 1-18 |
| Marcus | 19.14 | Some risk | 12-25 | 25.27 | Low risk | 21-31 |
| Jeff | 10.91 | At-risk | 0-18 | 25.22 | Low risk | 20-30 |
| Gillian | 20.5 | Some risk | 19-23 | 29.38 | Low risk | 18-40 |
| Elisa | 36.14 | Low risk | 22-44 | 41.5 | Low risk | 30-58 |
| Chad | 35.36 | Low risk | 30-41 | 49.89 | Low risk | 43-56 |

Table 8

*Individual Student Mean Accuracy Percentages from the Baseline and Intervention Phases for the Nonsense Word Fluency (NWF) Measure*

| Student | NWF Accuracy Percentage (Baseline) | NWF Accuracy Percentage (Intervention) | Mean Percentage of Change |
|---|---|---|---|
| Evan | 7% | 30% | +23% |
| Marcus | 62% | 82% | +20% |
| Jeff | 51% | 75% | +24% |
| Gillian | 75% | 86% | +11% |
| Elisa | 93% | 88% | -5% |
| Chad | 96% | 98% | +2% |

A visual inspection of all six students' data from the NWF probe indicated there was a wide range of variability between and among the students. Chad and Jeff demonstrated increasing baselines on this measure, which compromised the demonstration of experimental control. All students demonstrated variability in their performance throughout the intervention phase, which sometimes resulted in difficulty when determining the amount of progress made. When examining student performance against the NWF cut points (see Table 7), five students were considered to be at low risk for future reading difficulties by the end of the study. While the remaining student, Evan, made progress on the NWF probe, he continued to be at-risk according to the cut points. Based upon these results, this hypothesis was confirmed for the NWF probe.

A visual inspection of graphed data from the NWF probe as well as an examination of student performance revealed that there was a difference in the initial starting point between the high-performing and low-performing students, with regards to their ability to segment and decode the presented words. Specifically, low-performing students had a mean starting point of 7.33 CLS, with the mean for high-performing students being 25 CLS, a difference of 17.67 CLS. Further, it appears that the difference between the high and low-performing students in each group widened by the end of the intervention phase, with the mean score at the end of the intervention phase being 24 CLS for the low-performing students and 46 CLS for high-performing students, a difference of 22 CLS.

When examining the baselines across the low-performing students and high-performing students for the NWF measure, a visual inspection of the data for those designated as low-performing students within each group suggests variability in Jeff's

performance and stability in Evan's performance. While Marcus' data indicated variability over the last five data points during baseline, there was no trend in the final five data points. Jeff demonstrated an increasing baseline, while Evan's and Marcus' data remained relatively stable throughout the baseline phase. While this variability in performance across students continued into the intervention phase, it did not appear to be quite as large as during baseline. Jeff's data demonstrated continuous improvement throughout this phase, and Evan's data demonstrated an initial increase before stabilizing. Marcus' data indicated no progress on this measure.

A visual inspection of the data for those designated as the high-performing students in each of the three groups also indicates variability across the three students. Specifically, Gillian and Elisa demonstrated stable baselines before the implementation of the intervention, while Chad initially demonstrated a stable trend that began increasing prior to the implementation of the intervention phase. While all students made progress from the beginning to the end of the intervention phase, variability can also be seen throughout this phase. Gillian and Elisa demonstrated an overlap of scores between the baseline and intervention phases. With regards to mean accuracy, five students' data displayed an increase in mean accuracy from the baseline to intervention phases. Elisa's data showed a decrease in mean accuracy between the two phases.

*Evan.* Evan's baseline performance showed stability. His mean baseline score on the NWF probe was 2.25 CLS, with a range of 0 to 4 CLS. His data demonstrated an initial increase followed by a stabilizing trend during the intervention phase. During the intervention phase, Evan had a mean score of 9.46 CLS, with a range of 1 to18 CLS. While Evan did make progress during the intervention phase, he remained at-risk for

future reading difficulties according to the NWF cut points. Evan's mean accuracy on the NWF probe increased from 7% during the baseline phase to 30% during the intervention phase, a mean gain of 23%.

*Marcus.* A visual inspection of baseline performance suggests Marcus' data to demonstrate variability on the NWF probe. While his data did show a decreasing trend of at least one point prior to the implementation of the intervention, there was stability during this phase. Marcus' mean score on the NWF probe during baseline was 19.14 CLS, with a range of 12 to 25 CLS. During the intervention phase, Marcus' mean score was 25.27 CLS, with a range of 33 to 56 CLS, indicating little progress on this measure. While a visual inspection of his data suggested his performance remained relatively stable throughout the intervention phase, he did transition from at-risk to low risk for future reading difficulties according to the NWF cut points. Marcus' mean accuracy on the NWF probe increased from 62% during the baseline phase to 82% during the intervention phase, a mean gain of 20%.

*Jeff.* Jeff's mean score during the baseline phase was 10.91 CLS, with a range of 0 to18 CLS. As was seen with his baseline scores on the PSF probe, there was an increasing trend on the NWF measure during the baseline phase that stabilized over the final three points before the implementation of the intervention. During the intervention phase, Jeff had a mean score of 25.22 CLS, with a range of 20 to 30 CLS. His performance consistently increased during the intervention phase and he was considered to be at low risk for future reading difficulties according to the NWF cut points. With regards to accuracy, Jeff initially demonstrated 51% mean accuracy with the nonsense

words during the baseline phase. His mean accuracy increased to 75% during the intervention phase, a mean gain of 24%.

*Gillian.* Gillian's data demonstrated stability during the baseline phase on the NWF probe. Gillian's mean baseline score on the NWF probe was 20.5 CLS, with a range of 19 to 23 CLS. While a visual inspection showed a slightly increasing trend throughout the intervention phase, there was a large amount of variability and many of her scores overlapped with those obtained during the baseline phase. Gillian's mean score during the intervention phase was 29.38 CLS, with a range of 18 to 40 CLS. According to the NWF cut points, she transitioned from some risk for future reading difficulties during the baseline phase to low risk during the intervention phase. Gillian's mean accuracy on the NWF probe increased from 75% during the baseline phase to 86% during the intervention phase, a mean gain of 11%.

*Elisa.* A visual inspection shows Elisa's data to demonstrate variability on her NWF probe scores during both the baseline and intervention phases. Elisa had a mean baseline score of 36.14 CLS, with a range of 22 to 44 CLS. She initially demonstrated stability during baseline that decreased slightly prior to the implementation of the intervention. While Elisa showed variability during the intervention phase with a sharp increasing trend immediately prior to the onset of the maintenance phase, a visual inspection indicated little progress was made during the phase. Elisa was considered to be at low risk for future reading problems according to the NWF cut points during the baseline phase, and she continued to be performing at this level during the intervention phase. Elisa's mean score was 41.5 CLS, with a range of 30 to 58 CLS. Elisa's mean

accuracy with the presented words on the NWF probe decreased from 96% during the baseline phase to 88% during the intervention phase, a mean change of -5%.

*Chad.* Chad's data initially showed increasing and decreasing trends before demonstrating an increasing trend prior to the onset of the intervention phase. Chad's mean score during the baseline phase was 35.36 CLS, with a range of 30 to 41 CLS. His mean score increased to 49.89 CLS during the intervention phase, with a range of 43 to 56 CLS. While Chad demonstrated an initial increasing trend during the intervention phase, it stabilized throughout the remainder of the phase indicating little progress throughout this phase. Chad was considered to be at low risk for future reading difficulties according to the NWF cut points at the beginning of this study, and continued to perform at this level at the end of the intervention phase.

Chad's mean accuracy on the presented words included on the NWF probe was high throughout the baseline and intervention phases. Specifically, Chad's initial mean accuracy was 96% during the baseline phase and increased to 98% during the intervention phase.

**Road to the Code Generalization Probe (RTCg).** The second measure of generalization was an experimenter-developed probe designed to measure phoneme segmentation and pseudoword decoding and included nonsense words comprised of the remaining letters not explicitly taught as part of the *Road to the Code* program. Figure 4 illustrates the multiple baseline across both the low-performing students and high-performing students for the baseline and intervention phases on the RTCg measure. Table 9 shows the means and ranges for both the baseline and intervention phases on the

RTCg measure and Table 10 shows the accuracy percentages for each student on the RTCg measure at both the beginning and end of the baseline and intervention phases.

A visual inspection of the graphed data of all six students indicated most students to have variability in their performance across the baseline and intervention phases on the RTCg probe, with several students demonstrating little progress throughout the intervention phase. A look at the baseline data reveals that Marcus and Jeff had increasing baselines, with the remaining four students demonstrating stable baselines. Based upon these results, the hypothesis that students would generalize learning from the intervention program to novel content was confirmed for the RTCg probe.

Consistent with both the NWF and the RTCi probes, those designated as low-performing students had a lower starting point (i.e., 3 CLS) than those designated as high-performing students (i.e., 17.33 CLS ), a difference of 14.33 CLS. This difference was maintained throughout the intervention phase, with the low-performing students demonstrating an average ending score of 25.33 CLS, and the high-performing students having an average ending score of 42.33 CLS, a difference of 17 CLS. However, the low-performing students had a larger increase on the RTCg probe during the course of the study, with an increase of 22.33 CLS from the beginning of baseline to the end of the intervention phase, while the high-performing students demonstrated an increase of 17 CLS. A visual inspection of the data collected during the intervention phase indicates Evan’s, Gillian’s, and Chad’s data to demonstrate an increasing trend, or positive progress throughout this phase.

Figure 4. Multiple Baseline across Low-performing Students and High-performing Students for the Road to the Code Generalization (RTCg) Measure

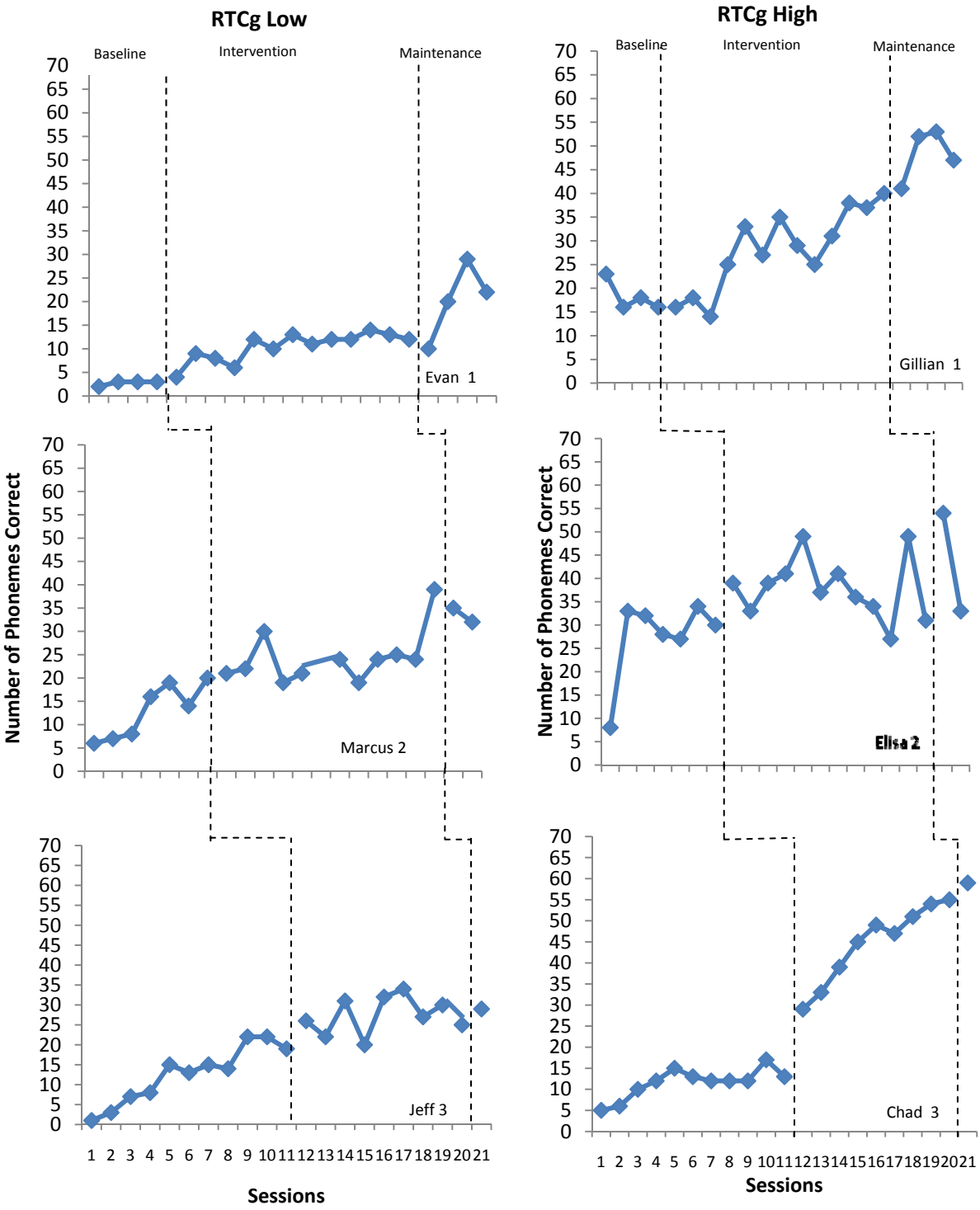

Table 9

*Individual Student Means and Ranges for the Road to the Code Generalization (RTCg) Measure*

| Student | RTCg Baseline Mean (CLS) | RTCg Baseline Range (CLS) | RTCg Intervention Mean (CLS) | RTCg Intervention Range (CLS) |
|---|---|---|---|---|
| Evan | 2.75 | 2-3 | 10.46 | 4-14 |
| Marcus | 12.86 | 6-20 | 24.18 | 19-39 |
| Jeff | 12.64 | 1-19 | 27.44 | 20-34 |
| Gillian | 18.25 | 16-23 | 28.31 | 14-40 |
| Elisa | 27.43 | 8-34 | 38 | 27-41 |
| Chad | 31.45 | 21-40 | 50.33 | 41-59 |

Table 10

*Individual Student Mean Accuracy Percentages from the Baseline to Intervention phases for the Road to the Code Generalization (RTCg) Measure*

| Student | RTCg Mean Accuracy Percentage (Baseline) | RTCg Mean Accuracy Percentage (Intervention) | Mean Percentage of Change |
|---|---|---|---|
| Evan | 8% | 38% | +30% |
| Marcus | 51% | 77% | +26% |
| Jeff | 63% | 81% | +18% |
| Gillian | 78% | 85% | +7% |
| Elisa | 88% | 84% | -4% |
| Chad | 95% | 99% | +4% |

A visual inspection of the data on the RTCg probe for the low-performing students showed Marcus' and Jeff's data to demonstrate variability in performance across both phases. Evan's data demonstrated a stable baseline followed by a slightly increasing trend during the intervention phase. Marcus' and Jeff's data demonstrated increasing baselines, indicating limited experimental control. Further, their data showed variability throughout the intervention phase with a stable trend, indicating little to no progress.

With regards to the high-performing students, Gillian's and Elisa's data demonstrated stability during baseline, and Chad's data initially showed an increasing trend before stabilizing prior to the implementation of the intervention. Gillian's and Chad's data demonstrated an increasing trend during the intervention phase, while Elisa's data was variable but stable indicating little progress. Taken together, the data set demonstrates adequate experimental control for the high-performing students on the RTCg probe. With regards to mean accuracy, five students showed an increase in mean accuracy from the baseline to the intervention phase. Elisa showed a decrease in mean accuracy from baseline to intervention.

*Evan.* Evan's data demonstrated stability on the RTCg probe throughout the baseline phase. His mean baseline score on the RTCg probe was 2.75 CLS, with a range of 2 to 3 CLS. A visual inspection reveals a small increasing trend during the intervention phase that stabilized towards the end of this phase. Evan's mean score on the RTCi probe during the intervention phase was 10.46, with a range of 4 to 14. Evan's mean accuracy during the baseline phase was 8% and increased to 38% during the intervention phase, indicating a mean gain of 30%.

*Marcus.* Marcus' data demonstrated an increasing trend in his baseline performance on the RTCg probe, with a mean baseline score of 12.86 CLS and a range of 6 to 20 CLS. While there was some variability in his performance, his scores did steadily increase throughout this phase. An examination of the data showed Marcus to demonstrate variability with a stable trend during the intervention phase, indicating little progress on this measure. His mean intervention score was 24.18 CLS, with a range of 19 to 39 CLS. Marcus demonstrated 51% mean accuracy during the baseline phase, which increased to 77% during the intervention phase, a mean gain of 26%.

*Jeff.* A visual inspection of Jeff's data indicated an increasing trend on the RTCg measure during the baseline phase. Jeff's mean score increased from 12.64 CLS and a range of 1 to 19 during the baseline phase to 27.44 CLS and a range of 20 to 34 CLS during the intervention phase. There was a large amount of variability with a stable trend during the intervention phase, indicating little or no progress. Jeff's mean accuracy during the baseline phase was 63%, which increased to 81% during the intervention phase, a mean gain of 18%.

*Gillian.* A visual inspection of Gillian's data indicated stability during the baseline phase on the RTCg probe. Her mean score on the RTCg probe was 18.25 CLS, with a range of 16 to 23 CLS. Though variability is present during the intervention phase, a visual inspection indicates an increasing trend throughout this phase. Gillian's mean intervention score was 28.31 CLS, with a range of 14 to 40 CLS. Gillian's mean accuracy on the RTCg probe during the baseline phase was 78% and increased to 85% during the intervention phase, a mean gain of 7%.

*Elisa.* Following the initial data point, Elisa's performance was relatively stable throughout the baseline phase. Elisa's mean baseline score was 27.43 CLS, with a range of 8 to 34 CLS. A large amount of variability was found in Elisa's performance during the intervention phase, especially towards the end of this phase. Her data demonstrated stability with little or no progress. Elisa had a mean score of 38, with a range of 27 to 41 CLS. Elisa's mean accuracy during the baseline phase was 88%, which decreased to 84% during the intervention phase, indicating a mean change of -4%.

*Chad.* A visual inspection of Chad's baseline data showed an initial increasing trend that stabilized prior to the onset of the intervention phase. He demonstrated an immediate increase in performance at the beginning of the intervention phase, followed by a steadily increasing trend. Chad's mean baseline score was 31.45 CLS with a range of 21 to 40 CLS, and his mean intervention score was 50.33 CLS with a range of 41 to 59 CLS. Chad demonstrated a consistently high level of mean accuracy during both the baseline and intervention phases. His mean accuracy was 95% during the baseline phase and increased to 99% during the intervention phase, a mean gain of 4%.

**Hypothesis 3: Student gains will be larger on the experimenter-developed progress monitoring measure including those letters explicitly taught as part of the *Road to the Code* program than on the experimenter-developed measure including letters not included in the *Road to the Code program.***

Two experimenter-developed probes were created to monitor students' progress with phonological awareness skills when using letters. One of the two experimenter-developed measures, the *Road to the Code* Instructional (RTCi) probe, was comprised of words that included only those eight letters that were taught explicitly as part of the *Road*

*to the Code* program. The second measure, the *Road to the Code* Generalization (RTCg) probe, consisted of words that included the remaining 18 letters of the alphabet that were not explicitly taught as part of the *Road to the Code* program. Table 11 shows the baseline starting points, the intervention starting points, and the intervention end points for all students on both measures. Table 12 shows the mean gain for each student from baseline to intervention across both measures. Results will be reported for the total group (i.e., all six students), low-performing students, and high-performing students.

As stated previously, three students made gains on each measure throughout the intervention phase. However, when looking specifically at the RTCi and RTCg probes, several differences were found between the students' performances, both as a total group as well as for low-performing and high-performing students between the two measures. One difference was the initial and ending performance of the students during both the baseline and intervention phases across both measures. The baseline and intervention starting points, as well as the intervention ending points, were higher on the RTCi probe than the RTCg probe for all groups. Specifically, the average starting baseline point for the total group was higher on the RTCi probe, at 27.83 CLS, than on the RTCg probe, at 10.17 CLS. The mean starting point during baseline for low-performing students was 8.67 CLS on the RTCi probe and 3 CLS on the RTCg probe, and the mean starting point for high-performing students was 35 CLS on the RTCi probe and 17.33 CLS on the RTCg probe.

Table 11

*Baseline Starting Points, Intervention Starting Points, and Intervention Ending Points for the RTCi and RTCg Probes for the Total Group, Low-performing and High-performing Students*

| Student | RTCi Baseline Start | RTCg Baseline Start | RTCi Intervention Start | RTCg Intervention Start | RTCi Intervention End | RTCg Intervention End |
|---|---|---|---|---|---|---|
| Total Group | 27.83 | 10.17 | 27.83 | 24.5 | 35 | 33.83 |
| Low Perf. | 8.67 | 3 | 14.33 | 17 | 26.67 | 25.33 |
| High Perf. | 35 | 17.33 | 41.33 | 32 | 43.33 | 43.33 |

The difference in starting points between the RTCi and RTCg probes continued into the beginning of the intervention phase. Specifically, the mean starting point during the intervention phase for the total group on the RTCi probe was 27.83 CLS and on the RTCg probe was 24.5 CLS. The mean starting point during the intervention phase for the low-performing students was 14.33 CLS on the RTCi probe and on the RTCg probe was 17 CLS, and the starting point during the intervention phase for the high-performing students on the RTCi probe was 41.33 CLS and on the RTCg probe was 32 CLS. However, the difference between students' performance on the two measures decreased by the end of the intervention phase. The mean ending point during intervention for the total group on the RTCi probe was 35.5 CLS and on the RTCg probe was 33.83 CLS. The mean ending point during intervention for the low-performing students on the RTCi probe was 26.67 CLS and on the RTCg probe was 25.3 CLS. The mean ending points during intervention for the high-performing students were even on both measures: on the RTCi probe was 43.3 CLS and on the RTCg probe was 43.3 CLS.

A second difference between performance on the RTCi and RTCg probes was that student mean performance between the two measures was consistently higher on the RTCi probe during both the baseline and intervention phases. Specifically, the mean performance of all six students during the baseline phase was 23.8 CLS on the RTCi probe and 19.34 CLS on the RTCg probe. The mean performance for the total group during baseline was 19.34 CLS. The mean performance for the low-performing students during baseline was 12.68 CLS on the RTCi probe and 10.91 CLS on the RTCg probe, and the mean performance during baseline for high-performing students was 34.91 CLS on the RTCi probe and 27.77 CLS on the RTCg probe.

The mean performance during the intervention phase was also higher on the RTCi probe for both the low-performing students and high-performing students. Specifically, the low-performing students had a higher mean score on the RTCi probe (i.e., 22.52 CLS) than on the RTCg probe (i.e., 19.67 CLS), and the high-performing students had a higher mean score on the RTCi probe (i.e., 40.38 CLS) than on the RTCg probe (i.e., 37.56 CLS).

Table 12

*CLS Mean Gains for Total Group, Low-performing students, and High-performing students on the RTCi and RTCg Probes during the Intervention Phase*

| Group | CLS Mean Gain during Intervention Phase on RTCi probe | CLS Mean Gain during Intervention Phase on RTCg probe |
|---|---|---|
| Total Group | +7.17 | +9.33 |
| Low-performing students | +12.34 | +8.33 |
| High-performing students | +2 | +10.33 |

A third difference was found when examining the mean gain across the total group, the low-performing students, and the high-performing students during the intervention phase. When examining the mean performance for all students during the intervention phase across both measures, all students had higher overall scores on the RTCi probe than on the RTCg probe. However, the gain scores were higher on the RTCg probe for the total group and high-performing students from baseline to intervention. Specifically, a mean gain of 2.83 CLS between the baseline and intervention phase was found for the total group's mean performance during the intervention phase on the RTCi probe, while a mean gain of 4.46 CLS between the baseline and intervention phase was found for the total group's mean performance on the RTCg probe. A larger mean gain was also found for the group of high-performing students at on the RTCg probe (i.e., 10.33 CLS) than on the RTCi probe (i.e., 2 CLS). However, the low-performing students showed a larger mean gain during the intervention phase on the RTCi probe, at 12.34 CLS, than on the RTCg probe, at 8.33 CLS.

In conclusion, the data indicated that the total group, the low-performing students, and the high-performing students had higher overall scores on the RTCi probe than on the RTCg probe. Specifically, the low-performing and high-performing students had higher initial starting points during the baseline phase, higher starting points during the intervention phase, and produced higher mean scores during both the baseline and intervention phases on the RTCi probe than on the RTCg probe.

However, with regards to mean gains made on both the RTCi and RTCg probes during the baseline and intervention phases, the data showed mixed results. Specifically, the total group and the high-performing students had higher scores on the RTCi probe

throughout most of the intervention phase, but the mean gains were greater on the RTCg probe for both of these groups. However, low-performing students had higher scores and made greater mean gains during the intervention phase on the RTCi probe. When looking at the individual amount of increase from the beginning to the end of the intervention phases, the data indicate Marcus, Gillian, and Chris to demonstrate a higher increase on the RTCg probe, Evan and Jeff demonstrated a higher increase on the RTCi probe, and Elisa to demonstrate a decreasing trend on both measures.

Overall, the data indicated that, while the students typically had higher overall scores on the RTCi probe through both the baseline and intervention phases, half of them demonstrated higher mean gains on the RTCg probe. Therefore, this hypothesis is not confirmed.

**Hypothesis 4: Students will maintain their gains on all progress monitoring measures when compared to baseline performance when measured during bi-weekly follow-ups continued until the end of the school year.**

A different number of maintenance points were collected for each group due to the amount of time between the group's completion of the intervention program and the end of the school year. Therefore, 4 maintenance points were collected for Group 1, 2 maintenance points were collected for Group 2, and only 1 maintenance data point was collected for Group 3. Due to the difference in the number of maintenance points collected for each group, the following results will be reported within each group rather than across low-performing and high-performing students. Because of the limited amount of maintenance points collected, the following results should be interpreted with caution.

A visual inspection of the students' data (See Figures 1, 2, 3, 4) along with an examination of student scores indicated that all six students maintained gains made during the intervention phase across all four measures. The maintenance data showed three of the four students in Groups 1 and 2 at least maintained their level of performance obtained by the end of the intervention phase, and both students in Group 3 increased performance on the PSF probe from the end of the intervention phase to the one data point collected during maintenance. While the mean scores of all four students in Groups 1 and 2 indicated an increased performance from the intervention phase to the maintenance phase on the RTCi probe, the one maintenance data point collected for both students in Group 3 indicate small decreases from the end of the intervention phase.

When looking at the data for the NWF measure, all students in Groups 1 and 2 increased their mean performance on the NWF probe during the maintenance phase when compared with the intervention phase, and from Group 3, Jeff maintained his performance from intervention to maintenance, and Chad's performance decreased from intervention to maintenance. Finally, data collected on the RTCg probe indicate more inconsistency in the data. All four students in Groups 1 and 2 showed an increase in their scores from the intervention to maintenance phase. However, a visual inspection suggests an increasing trend for both students in Group 1 and a decreasing trend for both students in Group 2 during the maintenance phase. For Group 3, Jeff showed a maintenance of gains for the one data point collected during the maintenance phase, but Chad obtained a maintenance score that was only slightly higher than his performance at the beginning of the intervention phase.

# CHAPTER 5

## Discussion

The purpose of this study was to evaluate the effectiveness of the phonological awareness program, *Road to the Code* (Ball et al., 2000). Specifically, this study examined whether participation in this program would develop, increase, and maintain at-risk, kindergarten students' phonological awareness and early reading skills and in generalizing the effects when in small groups. A multiple-baseline-across-participants design was used to determine whether the effects on students' phonological awareness skills were a result of participation in the *Road to the Code* program. Overall, the results indicated most students made gains on the measured skills throughout the intervention phase that typically carried into the maintenance phase.

The biggest gains for all students except for Evan were found on the Phoneme Segmentation Fluency (PSF) probe. This measure was most closely associated with specific activities completed during each lesson of the *Road to the Code* program. Gains were also found on the RTCi probe, measuring phoneme blending and pseudoword decoding, which consisted of content (i.e., letter-sound combinations) explicitly taught as part of the *Road to the Code* program. Finally, gains were found on the NWF and RTCg probes, each measuring different levels of generalization on the skills of phoneme blending and pseudoword decoding. Specifically, the NWF probe contained content taught within the *Road to the Code* program as well as content that was not included in the program, and the RTCg probe was comprised solely of content that was not explicitly taught within the program.

When examining results from the RTCi, RTCg, and NWF measures, students appeared to begin this study being more familiar with the letters included on the RTCi probe as evidenced by all students except Evan demonstrating a higher initial starting point during the baseline phase on the RTCi probe than on the other two probes. Those designated as high-performing students demonstrated higher initial starting points during the baseline phase and higher ending points by the end of the intervention phase and larger gains throughout the intervention phase than the low-performing students across all measures. However, results for each individual student were mixed with regards to which of the three measures produced the highest gains during the intervention phase. Specifically, Evan and Jeff demonstrated the largest gains on the RTCi probe, Gillian had the largest gains on the NWF probe, and Marcus, Elisa, and Chad showed the largest gains on the RTCg probe.

To determine whether student progress could be attributed to the implementation of the intervention, the trend of each student's baseline performance across each measure was examined during a visual inspection of the data. As stated previously, it is important to obtain a stable baseline that does not show an increasing trend prior to the onset of the intervention phase (Riley-Tillman, & Burns, 2009). However, due to such factors as the number of included progress monitoring measures and the amount of time in which the study was to be completed, some baselines were not completely stable prior to the onset of the intervention phase. This limitation will be further addressed later in this chapter.

Within this chapter, the results of this present study will be discussed in relation to the previous research on phonological awareness training, both generally and in

specific relation to the *Road to the Code* program. Limitations, directions for future research, and implications for practice will also be discussed.

**Hypothesis 1: Development of Phonological Awareness**

Previous researchers have documented the importance of phonological awareness in a student's future reading success (Bryant et al., 1990; Gillon, 2004; Good et al., 1998). Further, it has been shown that phonological awareness training can both increase a young child's phonological awareness skills (Gillon, 2004; Schuele & Boudreau, 2008; Snow et al., 1998), as well as the ease with which they can learn to read (Goswami & Bryant, 1990; Perez, 2008). Training in phonological awareness has also been found to have a positive effect on kindergarten students who demonstrate poor phonological awareness skills and are therefore at-risk for future reading difficulties (Schuele & Boudreau, 2008; Snow et al., 1998). This result is especially true when specific instruction in phonemic awareness is accompanied by practice with related activities (NIL, 2001; Snider, 1995).

Previous studies conducted by the authors of the *Road to the Code* program showed that implementing similar tasks and procedures to those included within the *Road to the Code* program resulted in significantly higher increases on measures of phonological awareness for at-risk kindergarten students (Ball & Blachman, 1991; Blachman et al., 1999). Other researchers have found that phoneme segmentation and phoneme blending can be successfully taught to students as young as kindergarten (Cunningham, 1990; O'Connor et al., 1995). The data collected as part of this study support both of these findings.

Therefore, it was hypothesized that the students in this study who received instruction through the *Road to the Code* phonological awareness program would develop and improve phonological awareness skills as evidenced by gains on the PSF probe and the RTCi probe. Based on the data collected as part of this study, this hypothesis was confirmed for the PSF probe but not for the RTCi probe. It appears that participation in the *Road to the Code* program had a positive effect on the students' phonological awareness skills.

**Phoneme Segmentation Fluency (PSF) Probe**. All students' data indicated gains on the PSF measure through the intervention phase. All six students also demonstrated positive gains in their mean accuracy from the baseline to intervention phase. Further, all students except Ethan demonstrated both the highest gains and the lowest amount of variability in their performance during the intervention phase on the PSF probe when compared to the other three progress monitoring measures. However, Jeff's increasing baseline and Evan's lack of change during the intervention phase indicated limited experimental control for the low-performing students on the PSF probe. Limited experimental control compromises the level of confidence with which it can be stated that participation in the intervention program was the sole reason for the gains observed on this measure.

The five students demonstrating the highest gains reported to prefer the PSF probe over the other three progress monitoring measures and appeared to put forth the most effort on it. For example, Chad, one of the high-performing students, demonstrated the biggest gains on the PSF probe. At the beginning of the baseline phase, he could correctly identify only one sound in a verbally presented word, typically the initial sound.

However, by the end of the intervention phase, he was able to identify the majority of individual sounds within each presented word. He appeared motivated to do well on this measure, and in fact, reported that this was his favorite activity. On the other side of the spectrum, Evan demonstrated the smallest gains on the PSF probe as evidenced by a low performance across all conditions. In contrast to Chad, Evan did not appear to be putting forth effort when completing this measure and was very distractible throughout each administration of this task. He often produced random sounds following the oral presentation of each word.

Along with student engagement, another possible factor in the success of the five students on the PSF probe may be the fact that this task closely resembles the first activity in every lesson of the *Road to the Code* program. As part of this activity, the students were required to move a tile for each sound they heard within a simple consonant-vowel-consonant (CVC) word that was orally presented to them. The majority of students understood this task quickly and demonstrated consistency in moving one tile for each successfully produced sound. Once students demonstrated understanding of the one-to-one correspondence between the tile and each individual sound in an orally presented word, letter tiles were introduced into the activity. Only those letters that were explicitly taught within the intervention were on the included letter tiles. Students then had to listen not only for the correct number of sounds, but also had to determine where the letter tile should be placed in the word. Most students experienced success with this activity after only a few lessons. Evan, however, experienced consistent difficulty with this activity, especially when letter tiles were introduced.

Evan's lack of progress on the PSF probe throughout all phases of this study mirrored his inconsistent performance on the activities included within the *Road to the Code* program. While he appeared to understand how to segment two letter words, the addition of an extra sound coupled with the inclusion of letter tiles appeared to be difficult for him. Further, Evan's behavior also interfered with his performance on the program activities as he was often distracted and attempting to use the materials in ways other than those outlined in the program. This behavior was also problematic during the administration of the progress monitoring measures, especially during the PSF probe, as this was the one task on which there were no visual stimuli. Instead he was required to sit and listen to the examiner orally present each word.

**Road to the Code intervention (RTCi) probe**. Three of the six students also demonstrated gains on the RTCi probe, the experimenter-developed measure of phonological awareness that consisted of letters that were explicitly taught as part of the *Road to the Code* program. Further, all students except Elisa demonstrated gains in their mean accuracy from the baseline to intervention phases. Previous researchers have shown that those young children who receive phonological awareness training that includes instruction in letter-sound correspondence will often perform better on measures of pseudoword decoding than those children who receive instruction on each skill in isolation (Perez, 2008; Tunmer, 1991). In a study conducted by the authors of the *Road to the Code* program, results showed that those young children who had received phonological awareness training that included instruction in letter-sound correspondence using eight letter-sound combinations (i.e., a, m, t, i, s, r, f, u, b) scored significantly higher on a standardized measure of pseudoword decoding than those students who had

not received such training (Blachman et al., 1999). Another study demonstrated that phonological awareness training that includes explicit instruction in letter-sound correspondence with a using nine letter-sound combinations (i.e., a, m, t, i, s, r, f, b,) resulted in gains on measures of phoneme segmentation and phoneme blending (Ball & Blachman, 1991). These findings were supported by the results from this study.

A visual inspection of the data along with an examination of student scores on the RTCi probe indicated that all students demonstrated higher starting points during both the baseline and intervention phases than on other measures. Higher starting points indicated more familiarity with the content. Therefore, results may have been impacted by a ceiling effect allowing for less room for growth on this measure. Evan, Gillian, and Jeff made gains throughout the intervention phase on the RTCi measure. Chad demonstrated an immediate increase at the onset of the intervention phase, but showed variability with no trend throughout this phase. Marcus and Elisa also demonstrated variability with no trend throughout the intervention phase. These findings indicate Chad, Marcus, and Elisa to demonstrate little progress on this measure. While Chad's and Elisa's lack of progress appears to be due to ceiling effects on the RTCi probe, observations indicated Marcus' lack of progress to most likely be due to decreasing motivation and effort on the progress monitoring measures as the study progressed.

All students except Evan demonstrated variability in their performance throughout the intervention phase on the RTCi probe. For Gillian and Elisa, some of this variability may be attributed to their attempts to blend the individual phonemes into words, slowing their performance. Additionally, the composition of the probes may have been a factor. Specifically, the low-performing students had difficulty with "b," and they

would sometimes mistake it for “d.” Therefore, if words containing those letters were located towards the beginning of the probes, the students often produced fewer correct phonemes. Further, the students often took more time to produce the correct sound for these difficult letters.

**Conclusion.** In summary, results from the PSF measure in this study support the previous research that phonological awareness training increases a young child’s phonological awareness skills (Bus & van IJzendoorn, 1999; Snow et al., 1998). Results from both the PSF and the RTCi probe support research that phoneme segmentation and phoneme blending can be successfully taught to students as young as kindergarten (Cunningham, 1990; O’Connor et al., 1995). Results from the RTCi measure in this study support the previous research, in which it was found that explicit instruction in some letter-sound combinations resulted in gains on measures of phoneme segmentation and phoneme blending (Ball & Blachman, 1991).

**Hypothesis 2: Generalization Measures of Phoneme Segmentation and Pseudoword Decoding**

A second hypothesis generated for this study was that participation in the *Road to the Code* program would result in the students’ ability to generalize their learning to both a standardized measure as well as an experimenter-developed measure of phoneme segmentation and pseudoword decoding. Generalization refers to a person’s ability to accurately and independently respond to a stimulus that is similar, but not identical, to the initial stimulus used in a teaching situation (Daly et al., 2007; Miltenberger, 2004). The value of generalization lies in the fact that it reinforces the importance of understanding and mastering a taught skill so that an individual can successfully use it in another

environment. The process of generalization has traditionally been seen as a passive, or a natural outcome of behavior, in that individuals were taught a new strategy or skill and the hope was that the new learning would transfer to a new environment or context. Stokes and Baer (1977), however, emphasize that generalization is not easily produced, and that it should be actively programmed within an intervention.

An example of actively programming for generalization in previous phonological awareness research is the training of sufficient exemplars, or explicitly teaching a specific number of phonemes. The training of sufficient exemplars is defined as the generalization of trained skills to untrained conditions, environments, and responses (Stokes & Baer, 1977). Those who adhere to this particular generalization strategy within phonological awareness research believe that phoneme identity, or the ability to successfully identify the same sound (e.g., “mat” and “mow” begin with the same sound), no matter the position in the word, is a stable construct once it is achieved. In addition, it is believed that not all phonemes need to be taught for a student to later recognize and identify any phoneme when it is encountered outside of the training situation (Ball & Blachman, 1991; Blachman et al., 1999; Byrne & Fielding-Barnsley, 1990; 1991). Phoneme identity is a critical skill for acquiring the alphabetic principle, knowing how and where to segment words, and successfully demonstrating letter-sound correspondence. Past studies have found that teaching a specified number of phonemes to young children have resulted in significant gains on both trained and untrained phonemes (Byrne & Fielding-Barnsley, 1990; 1991).

The *Road to the Code* program appears to include the strategy of training sufficient exemplars. Specifically, this program provides explicit instruction in eight

phonemes and their corresponding letter. Both the NWF and RTCg probes were included in this study to test the hypothesis that students would be able to generalize their learning of the eight letter-sound combinations taught as part of the *Road to the Code* program to words containing letter-sound combinations that were not explicitly taught as part of the program.

It was hypothesized that the students in this study who received instruction through the *Road to the Code* phonological awareness program would generalize their learning to untaught phonemes as evidenced by gains on the NWF and RTCg probes. Based on the data collected as part of this study, this hypothesis was confirmed for both measures. It appears that participation in the *Road to the Code* program had a positive effect on the students' ability to generalize their learning to novel content. However, there were some differences in the level of generalization across students. Specifically, results showed that the high-performing students were better able to generalize their learning to novel content than the low-performing students.

These differences in performance can be illustrated through the Instructional Hierarchy (IH), which is a stage model of skill development (Daly, Lentz, & Boyer, 1996). Skill acquisition is the first stage of this model and is described as responding that is fairly accurate but occurs at a lesser frequency than when a skill is mastered. The second stage of the IH is fluency, and refers to the ability to perform a skill accurately, rapidly, and proficiently. The third stage of the IH is generalization, in which an individual is able to demonstrate a learned skill or behavior in a different setting and/or context from which it was learned. When applying the IH to student performance on the two generalization measures within this study, it can be surmised that the high-

performing students had already acquired and improved their fluency with skills measured on the NWF and RTCg probes. Further, as the high-performing students' fluency improved, they were able to demonstrate mastery of and to generalize learned skills to novel content. While the low-performing students also showed progress on these measures, their gains were not as large, indicating that they did not have the same level of proficiency as the high-performing students and were not yet able to consistently generalize learned skills.

**Nonsense Word Fluency (NWF) Probe.** The NWF probe, a standardized measure of phoneme blending and pseudoword decoding, was considered to measure a medium level of generalization, as it consisted of words that contained letters that were explicitly taught as part of the *Road to the Code* program and those that were not. A visual inspection of the students' data from this measure indicated Evan, Gillian, and Jeff made progress during the intervention phase. Further, all students except Elisa demonstrated gains in their mean accuracy from the baseline to intervention phases. A close examination of the students' data yielded some interesting additional findings.

First, Jeff and Chad, had an increasing baseline performance. Increasing baselines have a negative effect on the achievement of experimental control, which is a critical factor in demonstrating the effectiveness of an intervention in producing positive change. The increasing baseline data of Jeff and Chad may have been due to the length of time in the baseline phase as continued experience with the probes may have resulted in improving performance. The composition of the probes may have also been a factor. Specifically, each student appeared to be proficient in identifying the sound of at least some letters, and their scores were observed to fluctuate according to which letters were

included towards the beginning of each probe. Such factors as comfort with the examiner and the testing process could have played a role, as well as the transfer of learning from the classroom. Regardless of the reason for the increasing trend, both students' baseline data on this measure continued to increase and would not stabilize. To complete the project, intervention began prior to stabilization of data. This limitation is discussed in more depth later in this section.

Second, Evan, Gillian, and Jeff had increasing trends in the intervention phase. These increasing trends appear to indicate that they had understanding of phoneme blending and pseudoword decoding and were able to generalize that skill to the letter-sound combinations that had not been explicitly taught as part of the *Road to the Code* program. However, a visual inspection does not indicate a clear pattern of performance. First, a small increase in performance was found for the three students showing progress. Second, most students showed variability in their performance as evidenced by each demonstrating several increasing and decreasing trends throughout this phase. Specifically, it was observed that some of the letters included in the first half of the administered probe were known, and the students' familiarity with those letters could have resulted in a more variable performance. In other words, the more letters the students recognized, the higher their scores on the particular probe would be. Because of this variability, which included many overlapping data points between the baseline and intervention phases, it was sometimes difficult to determine through visual inspection alone if a student had truly made gains during the intervention phase, and if so, how large of a gain.

Third and finally, Gillian and Elisa began occasionally demonstrating the skill of phoneme blending during the intervention phase. Specifically, they attempted to not only produce the sound of each individual phoneme, but also to blend the phonemes together to form the entire pseudoword. While the ability to blend individual phonemes into syllables and whole words is the ultimate goal of phonological awareness training, the performance of this skill affected Gillian's and Elisa's scores on the NWF probe. Specifically, each student was given a score based upon the number of phonemes they correctly pronounced within 1 minute, and the process of phoneme blending slowed the performance of Gillian and Elisa. As they did not attempt to blend phonemes on every probe, variability can be seen in their performance during the intervention phase.

**Road to the Code generalization (RTCg) probe.** The RTCg probe was comprised of words that consisted of the 18 letters that were not explicitly taught as part of the *Road to the Code* program. This probe was developed to measure a higher level of generalization than the NWF probe as it had no overlapping content with the intervention program. Student performance on this measure also tested the findings from previous research that phoneme identity is stable once it is achieved (Byrne & Fielding-Barnsley, 1991; 1995). As mentioned previously, the concept of generalization is important as it highlights one's proficiency with a particular skill when using that skill in a way that varies from the training environment. Some researchers have shown that it may take some time for young children to show progress on measures that do not specifically match the set of skills and content that is being explicitly taught (Daly, Johnson et al., 2008).

A visual inspection of the data along with an examination of student scores indicate the majority of students show variability in their performance on the RTCg measure throughout all phases of this study. Marcus and Jeff demonstrated an increasing baseline, which resulted in limited experimental control for the low-performing students. Evan, Gillian, and Chad demonstrated gains throughout the intervention phase, while Jeff, Marcus, and Elisa showed no trend during this phase, indicating little or no progress. As with the RTCi and NWF probes, all students, except Elisa, demonstrated gains in mean accuracy from the baseline to intervention phases. Elisa's data, indicating a lack of progress with mean accuracy on three of the four measures, may have been impacted by a ceiling effect allowing less room for growth. Both students in Group 1, Evan and Gillian, demonstrated the largest gains during the intervention phase. These gains may be due to the shorter amount of time Evan and Gillian were in baseline, which limited their opportunity for an increasing baseline. Further, they were in the *Road to the Code* program for the longest period of time, giving them more opportunity to practice and master taught skills and phonemes.

As mentioned previously, Elisa's and Gillian's attempts at phoneme blending were again a factor that played a role in the scores that they obtained on this measure. As on the RTCi measure, the composition of the probes may have been a factor on students' performance on the NWF probe, especially for the low-performing students. Specifically, these students experienced difficulty with particular letters, and if words containing those letters were located towards the beginning of the probes, the students often produced fewer correct phonemes. It is interesting to note that overall the students

demonstrated larger mean gains on the RTCg probe than on the RTCi probe, which will be discussed in detail later in this chapter.

**Conclusion.** In summary, findings from the NWF and RTCg measures of phoneme segmentation and pseudoword decoding indicated half of the students to demonstrate gains during the intervention phase on both measures. Specifically, three students showed gains on the NWF probe, and three students demonstrated gains on the RTCg probe. These results appear to support previous research stating that teaching a specified number of phonemes to young children can result in gains on untrained phonemes (Byrne & Fielding-Barnsley, 1990; 1991). However, it is important to note that the data for the students demonstrating progress on either the NWF and/or RTCg probes demonstrated one or more of the following characteristics: (a) Data included several data points that overlapped between the baseline and intervention phases; (b) Data included a good deal of variability during the intervention phase; (c) There was a period of latency following the implementation of the intervention in which no progress was observed (i.e., an increase in Gillian's performance was not seen until the 10$^{th}$ data point); and (d) Data stabilized towards the end of the intervention phase (i.e., Evan's data on both the NWF and the RTCg probes). Further, high-performing students showed more success with generalizing learned skills to novel content when compared with low-performing students. Therefore, while this hypothesis was confirmed and some generalization was found as part of this study, more research should be conducted in this area before stating that the training of sufficient exemplars within the *Road to the Code* program effectively promotes the generalization of phoneme blending and pseudoword decoding to novel content.

**Hypothesis 3: RTCi vs. RTCg**

As the RTCi measure contained only pseudowords that included the eight letters explicitly taught as part of the *Road to the Code* intervention, it was hypothesized that students would show greater gains on the RTCi measure after exposure to this program than on the RTCg probe. Past researchers have supported the notion that students will show significantly larger gains on those measures that directly match the content of what is being taught (NRP, 2000). In other words, a student's familiarity with the content in a measure that is matched to the intervention content should greatly facilitate his success in demonstrating his learning on such a measure. A more recent study further supported this finding (Daly et al., 2004). Specifically, first grade students were more successful when reading nonsense words that included those letters taken from the words on which they were trained after receiving training at the phoneme level rather than at the word level.

The RTCg measure, on the other hand, represented a relatively high level of generalization as it consisted of pseudowords that did not contain any of the letters that were explicitly taught as part of the *Road to the Code* program. In fact, previous researchers have asserted that gains on measures that do not include content taught within an intervention will take longer to observe as there is not a direct match between the measure and the intervention (Daly, Johnson et al., 2008). Success on this generalization measure involves more than skill recall as it requires the student to generalize the use of the skill to content that has not been previously practiced. While student gains were found on both the RTCi and RTCg probes, results from this present study do not support previous research that states students would make greater gains on a measure that was

developed using only content from the training program. In this study, results indicated that students made larger gains on the RTCg measure than on the RTCi measure.

A visual inspection of the data from both the RTCi and RTCg measures indicated that students had higher initial starting points during the baseline phase on the RTCi probe. Further, all students except Chad continued to perform at a higher level at the end of the study on the RTCi probe when compared with the RTCg probe. However, all students except Jeff showed higher mean gains on the RTCg probe during the intervention phase. Based on the data collected as part of this study, this hypothesis was not confirmed. While students typically performed at a higher level on the RTCi probe, both at the beginning and end of this study, five out of the six students demonstrated larger mean gains on the RTCg probe during the intervention phase.

A closer examination revealed interesting findings from the data. First, it was observed that all students knew more of the letters and letter-sound combinations on the RTCi probe than on the RTCg probe. This was evidenced by the fact that five students (i.e., all but Evan) had higher scores on the RTCi probe at the beginning and at the end of this study when compared with the RTCg probe. This finding is not surprising when looking at the letters explicitly taught as part of the *Road to the Code* program: a, m, t, i, s, r, b, and f. These letters comprise many of the CVC words that young children are exposed to in preschool and kindergarten and as they are learning to read. Additional exposure to these letters could have had an influence on the results. As the students already appeared to be more familiar with the content of the RTCi probe than the content of the RTCg probe, it seems logical that most students would continue to receive higher scores on the RTCi probe. Further, initial familiarity with this content combined with

further instruction and practice could result in continued higher overall performance on the RTCi measure.

However, while students continued to achieve higher scores on the RTCi probe throughout the study, all students except Jeff showed larger mean gains on the RTCg probe than on the RTCi probe. When looking at the groups of high and low-performing students, the low-performing students demonstrated higher mean gains on the RTCi probe, but the mean gains for the high-performing students were higher on the RTCg probe students. Larger gains on the RTCg probe measuring the students' ability to generalize is encouraging as it indicates that students may be transferring such skills as phoneme segmentation and decoding that are emphasized during the *Road to the Code* program to novel content. These larger gains could also provide support for the ceiling effect on the RTCi probe that was previously discussed. Specifically, students may be showing larger mean gains on the RTCg probe as they were initially less familiar with the included content and there was therefore more room for growth on this measure.

The ability to generalize a skill or behavior indicates proficiency or mastery of the skill or behavior or that there is a demonstration of stimulus control, during which the learner's response comes under the control of relevant stimuli (Daly et al., 2007; Daly, Martens et al., 2008). Correct responses are reinforced, which prompts continued learning, and later stimulates the generalization of the skill or behavior to novel content when mastered. Similarly, when looking at the Instructional Hierarchy, the ability to generalize indicates an individual has acquired and is fluent with a skill (Daly et al., 1996). The fact that the low-performing students did not make the same mean gains on the RTCg as the high-performing students indicates the low-performing students to not

have the same level of proficiency as the high-performing students, or to not have mastered the skills of phoneme segmentation and pseudoword decoding.

**Conclusion:** The data indicated that all students were more familiar with content on the RTCi probe, both before and after the implementation of the intervention. However, progress was also found on the RTCg probe for three students, two high-performing students, and one low-performing student, indicating the ability to generalize learning to novel content. Further, the data indicated that the low-performing students demonstrated higher mean gains on the RTCi probe during the intervention phase, but that the high-performing students demonstrated higher mean gains on the RTCg probe. Further, there were higher mean gains for all groups on the RTCg probe from the baseline phase to the intervention phase. Taken together, it appears that while some of the data support the hypothesis that larger gains would be found on the RTCi probe, other data do not.

**Hypothesis 4: Maintenance.**

Finally, it was hypothesized that students would maintain all demonstrated gains following the completion of their participation in the *Road to the Code* program. A meta-analysis of studies investigating the effectiveness of phonological awareness training found that gains made by children who participated in such training typically maintained these gains through several occasions of follow-up testing (NRP, 2000). Results from this study support this finding.

A visual inspection of the data in this study along with an examination of student scores indicated that all six students maintained their gains made during the intervention phase on all four progress monitoring measures, confirming this hypothesis. However,

while these results are encouraging, it is important to note that a limited number of data points were collected during this phase due to the amount of time between the completion of the intervention and the end of the school year. Specifically, there were four maintenance points collected from Group 1, two points for Group 2, and only one point for Group 3. Therefore, these results must be interpreted with caution.

**Limitations**

While there are encouraging findings from this present study with regards to the effectiveness of the *Road to the Code* program in developing kindergarten students' phonological awareness and early reading skills, there are also several limitations that can be identified. Perhaps the most significant limitation revolves around the duration of this study. While the baseline phase of this study began in late February for all six students in the three groups, the intervention phase was started for Group 1 in the middle of March after two weeks when a stable baseline was obtained for both students in this group across the four progress monitoring measures. The intervention phase for Group 2 began in late March after four weeks in the baseline phase, and for Group 3 in late April after six weeks in the baseline phase.

This timeline raised several issues that would affect both the implementation of as well as some of the outcomes of the study. The biggest impact on the achievement of experimental control was the attempt to obtain stable baselines across four progress monitoring measures for each of the six students participating in this study. While the use of multiple measures is often promoted in research due to the difficulty in accurately and completely measuring a construct with a single measure (Kazdin, 2010), it was very difficult to obtain four stable baselines for six students. A multiple baseline design

requires the implementation of the intervention to be staggered after a stable baseline of at least three points is obtained for each group (Riley-Tillman, & Burns, 2000). While a stable baseline was successfully obtained for Group 1 following the collection of four data points, the intervention phase was started for both Groups 2 and 3 before a stable baseline could be obtained for all students on all measures. For example, the data for both students in Group 2 demonstrated stable baselines on the PSF and NWF measures, but only Elisa's data showed stability on the RTCi and RTCg measures.

The difficulty in obtaining stable baselines was most prominent for Group 3. The students in this group were in the baseline phase for six weeks and 11 data points were collected as at least one student consistently demonstrated an increasing trend on at least one of the measures. Specifically, Jeff demonstrated an increasing trend for all measures except for the RTCi probe during the baseline phase. Further, extending the baseline phase to try to stabilize these increasing trends was not effective and instead had a negative impact on Chad's baseline data for the NWF probe as he began to show an increasing trend over the last three data points immediately prior to the implementation of the intervention. It was understood that starting the intervention phase before achieving a stable baseline for all students across all measures would negatively affect the achievement of experimental control on those measures with increasing baselines. However, it was necessary to move the students into the intervention phase as the end of the school year was approaching and there was a minimum amount of time of five weeks that was necessary for each group to complete the 44 lessons included in the *Road to the Code* program.

A second issue related to the timeline of this study was the difference in the number of lessons administered each week, which could have impacted the effectiveness of the study. Specifically, approximately five lessons were administered to Group 1 per week, approximately six to seven lessons were administered on a weekly basis to Group 2, and between seven and nine lessons were administered to Group 3 every week. While students in Group 1 typically participated in the intervention one time per day, which increased to two times per day towards the end of the study, Groups 2 and 3 usually received lessons two times per day with Group 3 participating in three lessons per day over the last two weeks of the intervention phase. While the *Road to the Code* manual does state that the timeline for the implementation of the program is flexible with regards to the number of lessons provided per day and week, this decision is to be based upon student performance and need rather than upon the amount of available time. It is possible that those students who participated in more lessons per week did not have the opportunity to process and internalize the skills taught and reinforced within each lesson. While more time could not be spent on particular lessons that may have been more difficult for one or both students in each group, an attempt was made to compensate for this by focusing more attention on a student and/or skill during each lesson as well as differing the level of difficulty of included tasks for each student.

A related issue is the number of data points collected during the intervention phase. As more lessons were completed within a shorter period of time for each subsequent group, fewer data points were collected for Group 2 and for Group 3. The difference in collected data points could have an impact on the interpretation of the results as there were an unequal amount of data points to compare. Specifically, 13 data

points were collected for Group 1 during the intervention phase, 12 data points were collected for the high-performing student in Group 2 and 11 data points were collected for the low-performing student in Group 2 due to a week of school absences during the intervention phase, and nine data points were collected during the intervention phase for Group 3.

A second limitation of this study was the number of students that participated in this study. A small number of participants poses a threat to the external validity of a study, or the ability to generalize the results to others (Kazdin, 2010). The significance of a multiple baseline design is determined through the achievement of experimental control as evidenced through the stability of baselines and the quality and replication of a performance change following the implementation of the intervention for each student. However, it is possible that the small number of students participating in this current study reduced the ability to generalize these results to other kindergarten students in other environments.

A third limitation is the fact that all six students who participated in this study were either concurrently or had previously received early reading assistance during their kindergarten year. All six students had received a small group intervention through the Title I literacy services that were available at this particular elementary school. Evan was continuing to receive these services during the course of this study, and Elisa was receiving small group literacy assistance from another kindergarten teacher three days a week. This additional assistance did not appear to impact their performance on the progress monitoring measures as evidenced by the stability of Evan’s and Elisa’s baselines on all four measures. However, it is possible that this additional literacy

assistance could have influenced the effectiveness of this intervention in developing and/or increasing their phonological awareness skills. Specifically, it is unknown what strategies and/or skills the students were taught as part of these other interventions and if they complemented or interfered with those taught as part of the *Road to the Code* program.

Similarly, the additional assistance may have had an effect on student behavior throughout the course of this study. Because Evan was continuing to receive Title I literacy services during this study, he was being pulled from his classroom for a total of two hours a day. He was often taken from the classroom during literacy centers, which was a preferred activity. Evan often had difficulty focusing during the *Road to the Code* program lessons, even with verbal reminders and the use of a behavior management program. Therefore, his motivation to be successful during the intervention activities and on the progress monitoring measures was often called into question.

While these identified limitations may have had an influence on the results obtained as part of this study, the data and behavioral observations indicate the students to make gains across the progress monitoring measures after participating in this study. Results indicate that it is probable that the intervention did have a positive effect on the students' learning and performance in the area of phonological awareness.

**Future Research**

While there were encouraging and promising findings from this present study, there were also some issues and questions that can be addressed through future research investigating the effectiveness of the *Road to the Code* program. First, the timeline for completion of this study was relatively short due to a variety of factors, and this

condensed timeline appeared to have impacted experimental control. Specifically, Groups 2 and 3 were moved into the intervention phase before stable baselines could be established for all students across all measures. Within a multiple-baseline-across-participants design, the stability of each participants' baseline is critical for achieving experimental control (Riley-Tillman & Burns, 2009). Experimental control could not be achieved for those with increasing baselines, thereby casting doubt on whether the intervention was the sole cause of the student gains made during this study for these students.

Further, the timeline also impacted the effectiveness of the study. Groups were moved through the intervention phase of the study at different paces. Group 1 students were in the intervention phase for a longer period of time, while those in Groups 2 and 3 were in this phase for fewer weeks and received instruction in several lessons in one day. While the *Road to the Code* program allows for flexibility in the pacing of the included lessons and activities, this pacing should be based upon student needs rather than such factors as time and scheduling. Determining whether or not students maintained their gains was also impacted by the timing of this study as few data points were collected during the maintenance phase.

Therefore, future research investigating the effectiveness of the *Road to the Code* program should allow for more time to complete all phases, including screening, baseline, intervention, and maintenance. Allowing for a longer period of time in which to complete the study would also allow for the extension of the baseline phase for some or all groups if necessary, and for all students to participate in the intervention for the same number of weeks and to receive instruction in the same number of lessons per day or

week. Further, a greater number of maintenance points could be collected, therefore extending the amount of time between completion of the intervention and collection of follow-up data. A greater amount of maintenance data would provide researchers with a better understanding of whether or not students are maintaining their skills over a longer period of time.

A second recommendation for future research revolves around the number of participants included in this study. Only six students participated in this study, which calls into question the generalizability of the results. While a multiple-baseline-across-participants design is one that can be and is often used with a relatively small number of participants, the small sample size remains a threat to the external validity of the study (Kazdin, 2010). However, replication by future research reduces this specific limitation. Future research should consider including more participants, which would increase the confidence with which the results can be generalized to other populations in various environments.

A third suggestion for future research is to replicate this present study with kindergarten students who are more at-risk for future reading difficulties than those participating in this current study. While there were several kindergarten students who were experiencing more difficulties with phonological awareness and other early literacy skills in the classroom, they were not included in this study as they were already receiving additional literacy assistance. Identifying and including those students considered to be the most at-risk would examine the effectiveness of the *Road to the Code* program with this population.

A fourth recommendation for future research is in regards to students receiving outside assistance during the intervention phase. While all students previously had received individual and/or small group literacy assistance at some point during their kindergarten year, two students were concurrently receiving small group reading support outside of the classroom and in addition to participation in this study. This additional assistance brings into question the effectiveness of both the *Road to the Code* program as well as the other interventions in developing and improving the students' early literacy skills. Specifically, it is unclear as to which program had the largest effect, if the programs had a combined effect due to complementary strategies and/or skills, or if one program had a negative effect on the other due to interfering strategies and/or skills. Future research should evaluate the effects of the *Road to the Code* program with students who are not concurrently receiving other assistance beyond regular classroom instruction throughout the duration of the study. Including students who were receiving the same amount and type of services throughout the duration of this study would help to determine the impact of this individual program.

A fifth issue involves the grouping of participating students. As mentioned previously, there was an initial and consistent difference between the performance of those students who were designated as low-performing students and those designated as high-performing students for the purpose of this study. Findings indicated that high-performing students consistently performed better across all progress monitoring measures throughout all phases of this study. While the purpose of matching a low-performing and high-performing student within each group was to promote greater gains through peer modeling of correct responses, observations during group activities led to

some interesting findings. First, the low-performing students often appeared to be allowing the high-performing student to take the lead while they attempted to copy the high-performing student's response. While individual responses were sometimes required at different times during each lesson, this was not able to be done consistently. Further, the students' difference in skills and performance also affected the pacing of the lesson. While high-performing students were often able to move through each activity and lesson with little difficulty, there were times when the low-performing student could have benefitted from additional attention and practice on a particular skill.

The difference in needed time to practice a skill occasionally led to behavior difficulties during each group. Specifically, the high-performing student was observed to sometimes grow bored and begin distracting the low-performing student, who sometimes became frustrated that he or she was unable to understand how to complete an activity as quickly as his or her peer. Future research evaluating the *Road to the Code* program and including small groups should consider both the advantages and disadvantages of matching students in this way and make the determination of group composition based upon the purpose(s) and research question(s) generated for that particular study.

Similarly, the issue of group size could also be addressed within future studies examining the effectiveness of the *Road to the Code* program. A recent meta-analysis reported that some past researchers have identified small groups of two to four students as yielding similar results to individualized instruction, with smaller mean effects being found as the group size increased (Wanzek & Vaughn, 2007). The authors do state, however, that the results were presented only as a range of effects as the studies that were examined did not include experimental manipulation of group size. As schools are often

lacking resources with which to implement interventions, larger group sizes may be used to accommodate as many students as possible. Investigating the effects of the *Road to the Code* program when presented in groups of different sizes would not only add to the research base on the effects of group size, but would also provide schools with evidence-based information regarding optimal group size for producing the best results.

Sixth, future researchers should examine the type of screening measures that would best help to identify those students that would most benefit from participation in this type of study. A particular concern in this study was the screening measures used to identify students for this study. While the measures did assess those skills taught within the *Road to the Code* program, students were likely to receive low average to average scores even if they answered only a few items correctly. Specifically, as the norms for the Woodcock-Johnson III begin at five years of age, the students' scores would be an inflated estimate of their actual understanding of and performance with included skills. Therefore, it is important to identify instruments that not only assess those skills being taught within the program, but also have a sensitive scoring procedure that reflects the true level of performance of the student on the particular skills(s) being measured. In regards to this study, the TOPA was a more helpful measure than the WJ-III as it specifically shows whether or not a young student possesses the ability to recognize similar and different beginning sounds in a word. However, as each section includes only 10 items, it should be used in conjunction with at least one other screening measure.

Similarly, future researchers should consider the number of progress monitoring measures used within the study. While there was a specific purpose for each progress monitoring measure used as part of this study, including four measures made it difficult

to make condition-change decisions within the multiple baseline design. As mentioned previously, establishing a stable baseline is a critical factor in the ability to achieve experimental control. The fact that several students had increasing baselines on measures limited experimental control and called into question whether or not the intervention was the sole reason for the gains demonstrated by the student. It may be possible to condense some of the measures, or to administer some on a less frequent basis. Again, the amount or frequency with which the progress monitoring measures are administered should be based upon the purpose and expected outcomes of the study.

**Implications for Practice**

There are several implications for practice that can be pulled from the results of this study. It is widely agreed upon that the ability to read proficiently is one of the most critical skills that a person will learn due to its importance both in and out of the classroom. Therefore, schools have made literacy one of their top priorities, especially over the last decade, and have devoted a wide range of resources to developing, increasing, and maintaining students' literacy skills. This is especially true in the primary grades as researchers have shown the importance of early literacy skills due to their contribution to the development of proficient reading (Griffith et al., 2008; Snow et al., 1998).

One of these important early literacy skills is phonological awareness, or an awareness of the various sound units of speech (Heroman & James, 2004; Liberman, 1973). The importance of proficiency in this skill lies in the fact that children must learn and understand the connection between the sounds of oral language and the visual symbols that comprise print, or letters (Liberman, 1973). Numerous research studies

have been conducted over the past several decades to determine whether or not phonological awareness can be explicitly taught, and many studies have found that it can successfully be taught to young children, even at the phoneme level (e.g., Cunningham, 1990; NIL, 2001; NRP, 2000; Snider, 1995).

First, phonological awareness is a skill that is emphasized in many standardized programs that are available for schools to purchase and implement with their students due to its importance to future reading success (Gillon, 2004; Good et al., 1998). Because of the plethora of available intervention programs, it can be overwhelming for schools to determine which program may be the best fit and produce the best results for their students. A good amount of time and energy should be devoted to examining those programs that have repeatedly demonstrated the best results for all students. Such programs are often referred to as scientifically based research programs as they are not only based on sound research in the literacy field, but the efficacy of these programs has been verified by the results of such research (Moats, 1997).

The *Road to the Code* program is considered a research-based program as its development was based upon research within the field of phonological awareness (Blachman et al., 2000). The preface of the *Road to the Code* manual presents the work and prior research of the program's authors and discusses the past successes of activities and procedures that are similar to those in the current program. The manual cover states that the *Road to the Code* program has been *based* upon scientifically based research and then describes the characteristics and benefits of such research. Further, numerous references to previous research studies and bodies of work that provide the foundation for the current *Road to the Code* program are included in the manual. The information

provided within the manual coupled with the promising results from this current study can be encouraging to educators as they are looking for effective programs that will assist in developing and improving young children's early literacy skills.

Second, the *Road to the Code* program also includes instruction in phonemic awareness, which is the recognition that each word is comprised of a sequence of individual sounds, or phonemes (Ball & Blachman, 1991; Ball, 1997; Snow et al., 1998) and is considered to be the skill that is most closely related to future reading success (Adams, 1990; Gillon, 2004; Perez, 2008). The *Road to the Code* program also contains explicit instruction in letter-sound correspondence, which has been found to increase the overall effectiveness of a phonological awareness program (Ball & Blachman, 1991; Bus & van Ijzendoorn, 1999; Good et al., 1998). In fact, previous researchers have found that when explicit instruction in letter-sound correspondence is combined with phonological awareness training, children often perform better on measures of early reading, including letter naming, vocabulary, and pseudoword decoding than when either of these skills are taught in isolation (Perez, 2008; Tunmer, 1991).

Third, the format of the *Road to the Code* program facilitates the ease with which it can be implemented into the classroom. Specifically, the lessons within the *Road to the Code* program are scripted, contain detailed instructions with regards to the implementation of the activities, and provide some flexibility with regards to the pacing of each lesson. Programs that incorporate important literacy concepts and include activities that are enjoyable for the students are typically more preferred and more likely to be used. The *Road to the Code* program contains numerous types of games and activities that include rhyming and identifying onsets, which are the initial sounds in a

word that precede the first vowel in a syllable, and rimes, which are comprised of the rest of a syllable (Ball, 1997; Heroman & Jones, 2004).

Fourth, the packaging and presentation of the program itself is also important to educators, as is the attractiveness and cost of the materials. The *Road to the Code* program includes many of the necessary materials within the manual itself, while the remaining items are those that can be easily obtained with little cost to the educator or school. Further, the manual itself is also relatively inexpensive and can be easily found through many companies that provide educational resources. Taken together, the encouraging results of this present study, the scripted lessons, activities that incorporate skills that span the phonological awareness continuum as well as instruction in letter-sound correspondence, and would require limited resources by the teacher and/or school, makes this program an attractive option when focusing on developing and increasing a young child's phonological awareness and early literacy skills.

A fifth implication is that the *Road to the Code* program can be used with all students, both those that are demonstrating early reading skills that are considered to be at grade level as well as those that are identified as being at-risk for future reading difficulties. Previous research conducted by the authors of the *Road to the Code* program that incorporated similar tasks and procedures to the current program found positive results for students who were identified as already demonstrating early reading skills and those that were not (Blachman et al., 1991; Blachman et al., 1999).

These findings are important in light of the fact that the current education system is continuing to shift to a Response to Intervention (RtI) model. RtI is a process that involves monitoring a student's responsiveness to evidence-based interventions to assist

in making instructional decisions with the goal of bringing about desired changes in a student's performance or behavior (Daly et al., 2007). The purpose of RtI is to provide remediation through the use of evidence-based interventions to those students that continue to experience learning difficulties even after receiving classroom instruction and/or supplemental intervention (Nebraska Department of Education [NDE], 2006). These students are identified as being in need of more intensive intervention.

Sixth and finally, the challenge facing educators is identifying acceptable interventions for students with this higher level of need. Some guidelines for minimally acceptable interventions have been identified (NDE, 2006). For example, an acceptable program should offer scientific evidence of its effectiveness, be based upon sound research, include a structured and organized sequence for each lesson, should allow for flexibility as the intensity of the program increases so educators can make decisions about future lessons based upon student need, and should contain at least 24 lessons so that educators can make an informed and valid determination of the program's effectiveness. The *Road to the Code* program meets many of these guidelines. Specifically, the tasks and procedures have been found by this study as well as past studies by the authors of the program (i.e., Blachman et al., 1991; Blachman et al., 1995) to be effective in increasing the early literacy of young children, the difficulty or intensity of the skills and activities in each lesson increases as the program progresses, educators are provided flexibility when introducing certain skills and concepts, and it contains 44 lessons, which exceeds the minimally acceptable number of 24.

**Conclusions**

Overall, the results of this study indicate that the participation of at-risk kindergarten students in the *Road to the Code* phonological awareness program had a positive effect on the development of important early literacy skills. The greatest and most consistent gains were found on the PSF probe that most closely resembled an activity in the *Road to the Code* program, indicating the activities in the program to be successful in increasing a young child's phonological awareness skills and confirming the first hypothesis that participation in the *Road to the Code* program would result in increases in a student's phonological awareness skills.

Gains were also found on the progress monitoring tasks measuring phoneme segmentation and pseudoword decoding, as well as their ability to generalize their learning to novel content, supporting the second hypothesis that participation in the *Road to the Code* program would result in a student's ability to generalize learned skills to novel content. While students consistently obtained higher scores on the RTCi measure including content that was explicitly taught in the *Road to the Code* program, the largest mean gains for most students were found on the RTCg measure that consisted of content that was not explicitly taught within the program. This data does not confirm the third hypothesis that larger gains would be found on the RTCi measure when compared with the RTCg measure. However, it is encouraging to see such results as the RTCg task was designed the students' ability to generalize skills learned during participation in the program to novel content.

The fact that experimental control was compromised on several measures due to increasing baselines and/or little change made during the intervention phase, especially

for the low-performing students, is a concern as it affects the confidence in the ability to state that student gains can be solely attributed to participation in the *Road to the Code* program. Students did maintain gains made on all measures throughout the intervention phase, confirming the fourth hypothesis that students would maintain their gains following the conclusion of the *Road to the Code* program. However, maintenance results should be interpreted with caution due to the small number of data points obtained during this phase.

Participation in the small group appeared to change the students' attitude toward the progress monitoring measures. For example, a change was observed in Chad's level of effort on all of the probes, especially the PSF probe, once the intervention was implemented. Similarly, it became more difficult to keep Marcus focused and engaged on the progress monitoring measures during each administration session following completion of the intervention. Incorporating a behavior management program was also helpful in boosting the students' motivation and effort, which was especially necessary during the administration of the progress monitoring measures.

Research has shown that proficient reading is a critical skill for success both in and out of the classroom (Lonigan et al., 2000; Nevills & Wolfe, 2009; Snow et al., 1999). As many children start school with few early literacy skills due to limited text exposure in the home, it becomes increasingly difficult for educators to help them close the gap with their typically developing peers (Good et al., 1998; Moats, 1999). Researchers have indicated that the outlook for the reading development of these children is often grim. Specifically, students with continued reading difficulties by third-grade are at greater risk for special education placement (Lonigan et al., 2000: Whitehurst &

Lonigan, 2001), typically remain in the bottom quarter to third of readers, and are less likely to receive a high school diploma (Snow et al., 1998). Such statistics indicate a critical need for evidence-based instruction and intervention in reading, beginning at a young age. The promising results from this study indicate that the *Road to the Code* phonological awareness program can have a positive impact on the development of a young child's early literacy skills. Providing young children with an early start and a solid foundation in the area of literacy has the potential to promote a promising future for our children.

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# Appendix A

## Research-based Components of an Effective Phonological Awareness Program

| Component | Source(s) |
|---|---|
| Scaffold linguistic complexity | Adams, 1990; Gillon, 2004; Good et al., 1998; Smith et al., 1998; Stahl & Murray, 1994 |
| Skills proceed from basic to more difficult, or complex | Good et al., 1998; Schuele & Boudreau, 2008; Smith et al., 1998; Snider, 1995 |
| Rhyming | Anthony & Lonigan, 2004; Bryant et al., 1990; Goswami & Bryant, 1990; Nation & Hulme, 1997 |
| Integration of instruction in letter-sound correspondence | Ball & Blachman, 1991; Bradley, 1988; Bus & van IJzendoorn, 1999; Good et al., 1998; NRP, 2000; Perez, 2008; Snow et al., 1998; Tunmer, 1991 |
| Phoneme segmentation | Ball 1993; Ball & Blachman, 1991; Liberman, 1973; Lundberg et al., 1988; Nation & Hulme, 1997; NRP, 2000; Snider, 1995 |
| Phoneme blending | Adams, 1990; Daly et al., 2004; NIL, 2001; NRP, 2000; Perez, 2008 |
| Combination of phoneme segmentation and phoneme blending | Cunningham, 1990; O'Connor et al., 1995; Torgesen et al., 1992 |

Appendix B

Sample Phoneme Segmentation Fluency (PSF) subtest from the DIBELS

**Benchmark 2**
**Phoneme Segmentation Fluency**

| | | | | |
|---|---|---|---|---|
| trick | /t/ /r/ /i/ /k/ | cat | /k/ /a/ /t/ | _____/7 |
| that | /TH/ /a/ /t/ | pick | /p/ /i/ /k/ | _____/6 |
| mine | /m/ /ie/ /n/ | noise | /n/ /oi/ /z/ | _____/6 |
| coat | /k/ /oa/ /t/ | spin | /s/ /p/ /i/ /n/ | _____/7 |
| meet | /m/ /ea/ /t/ | ran | /r/ /a/ /n/ | _____/6 |
| wild | /w/ /ie/ /l/ /d/ | dawn | /d/ /o/ /n/ | _____/7 |
| woke | /w/ /oa/ /k/ | sign | /s/ /ie/ /n/ | _____/6 |
| fat | /f/ /a/ /t/ | wait | /w/ /ai/ /t/ | _____/6 |
| side | /s/ /ie/ /d/ | yell | /y/ /e/ /l/ | _____/6 |
| jet | /j/ /e/ /t/ | of | /o/ /v/ | _____/5 |
| land | /l/ /a/ /n/ /d/ | wheel | /w/ /ea/ /l/ | _____/7 |
| beach | /b/ /ea/ /ch/ | globe | /g/ /l/ /oa/ /b/ | _____/7 |
| | | | TOTAL: | _____ |

(https://dibels.uoregon.edu/measures/psf.php)

Appendix C

Sample Nonsense Word Fluency (NWF) subtest from the DIBELS

Probe 1 - Examiner Copy

| | | | | | |
|---|---|---|---|---|---|
| boj | sim | uk | bod | naf | _____ / 14 |
| mik | lut | bil | fer | zel | _____ / 15 |
| dap | nek | kog | pim | ret | _____ / 15 |
| jom | fom | neb | vum | gim | _____ / 15 |
| et | zik | dij | fek | pol | _____ / 14 |
| kej | rit | jul | bec | waz | _____ / 15 |

Total correct letter sounds (CLS): _____

Total words recoded completely and correctly (WRC): ___

Error Pattern:

Probe 1 - Student Copy

| | | | | |
|---|---|---|---|---|
| boj | sim | uk | bod | naf |
| mik | lut | bil | fer | zel |
| dap | nek | kog | pim | ret |
| jom | fom | neb | vum | gim |
| et | zik | dij | fek | pol |
| kej | rit | jul | bec | waz |

(https://dibels.uoregon.edu/measures/nwf.php)

# Appendix D

Nonsense words developed from the content of the *Road to the Code* program

| | | | | | |
|---|---|---|---|---|---|
| ab | af | ar | maf | mas | _____/12 |
| mab | mit | mis | mir | mib | _____/15 |
| mif | tam | tas | taf | tib | _____/15 |
| tif | ir | im | sar | sab | _____/13 |
| saf | sim | sib | sif | ras | _____/15 |
| rab | raf | rit | ris | rif | _____/15 |
| fam | fas | fab | fim | fis | _____/15 |
| ib | baf | bas | bif | bim | _____/14 |
| bir | bis | | | | _____/6 |

Appendix E

Nonsense words developed from letters not included in the *Road to the Code* program

| | | | | | |
|---|---|---|---|---|---|
| cug | dop | pel | noy | zok | _____/15 |
| hun | nup | jow | gok | kep | _____/15 |
| cov | ven | hed | dek | kon | _____/15 |
| gux | von | nup | heg | wop | _____/15 |
| kup | zod | wup | gon | nek | _____/15 |
| zud | op | ek | ud | cuk | _____/12 |
| og | ep | ud | hok | gup | _____/12 |
| od | jed | pud | jox | ug | _____/13 |
| uk | pok | | | | _____/5 |

Appendix F

Sample Lesson from the *Road to the Code* program

# Lesson 1

## 1. Say-It-and-Move-It

Materials: 1 *Say It-and-Move-It* sheet per child
2 disks or tiles per child

Today you will work on single sounds and single sounds repeated:
/a/, /s/, /t/, /t/ ^ /t/ ( ^ indicates a slight pause)

To begin the lesson, each child has one *Say-It-and-Move-It* sheet facing the children, so it is actually upside down for you.

For this first lesson, when you give directions or ask questions, it is expected that the children will respond as a group.

Teacher (T) says:
**We are going to play a game called *Say-It-and-Move-It.* What's the name of the game?** Wait for the children to respond with *"Say-It-and-Move-It."*

**T: Watch me and listen. I'm going to say a sound. /a/.**
Remember to use the short sound of a as in apple.

**T: Now I'm going to say it and move it.**
Demonstrate for the children by placing your finger on a disk, drawing out (holding) the /aaa/
sound, and simultaneously moving the disk below the thick black line to the black dot at the
left hand side of the arrow at the bottom of the *Say-It-and-Move-It* sheet. Then point to the
disk and say,

**T: /a/, one sound.**

**T: Now I'm going to sweep the disk back to the _____ (clown, boat,**
**or whatever object is pictured).**
Move the disk back to the pictured object.

**T: Now it's your turn. Listen first.**

**T: Say /a/.**

**T: What sound?**
Wait for a response from the children,

**T: Now, say it and move it.**
If the children have difficulty, this is a good time for you to model the correct response again.
Say, **Watch me,** and then demonstrate *Say-It-and-Move-It*, just as you did earlier. The
children should then repeat the activity with /a/, as described above.

**T: Let's try some different sounds.**
Use the same procedure as above for introducing /s/ and /t/. Hiss with the /s/, and be careful with the /t/. Don't elongate the /t/ when you say it and move it. Say it quickly.
Sometimes it is helpful to refer to these stop sounds as "hot sounds" so that the children
"get off" of these sounds quickly.

**T: Now we're going to try something even harder.**
Take a second disk.

**T: Are you ready? Listen and watch me. I'm going to say a sound, but I may say it more than once.**

**T: /t/ ^ /t/**

**T: Now I'm going to say it and move it. /t/ ^ /t/**
Move one disk below the line as you quickly say the first /t/, and move the second disk
as you say the second /t/.

Move your finger from left to right under the two disks and say,

**T: Two sounds.**
Sweep the disks back to the picture. Give each child a second disk.

**T: Now I want you to try it.**

**T: Ready? Listen. Say, /t/ ^ /t/.**
Wait for the children to respond.

**T: Now, say it and move it.**
Again, wait for the children to respond and then say,

**T: How many sounds?**

If the children don't respond correctly, you should say, **Two sounds.**

Have the group or individual children try various combinations of /a/, /t/, and /s/, presented as single sounds or sounds repeated.

## 2. Letter Name and Sound Instruction

*Introducing the Letter a*

Materials: Large alphabet picture card of a

Introduce the large alphabet picture card of the letter a (both large and small picture cards are in the **Materials Section** of the manual). It will add interest if you have colored this card before you show it to the children. If you do color the card, make sure that you retain a black and white copy of the picture card that can be photocopied for the children to color later lessons.

You might tell the children that **one sound that this letter makes is /a/ (as in apple, ant, and ask).** Talk about what you see in the alphabet picture card. Point to various parts of the picture and isolate the /a/ sound in *ant* and *apple* (e.g., **"Apple, do you hear the /a/ in *apple*?").** Help the children think of other words that start with the /a/ sound.

Take turns asking children the letter's name. Take turns asking the children the letter's sound. Then mix the two (letter name and sound).

## 3. Phonological Awareness Practice

*Sound Categorization by Rhyme*

Materials: 3-5 sets of Sound Categorization by Rhyme cards
Recipe box (optional, see **Teacher Notes**)
Index tabs (optional, see **Teacher Notes**)

To Play: Select a set of Sound Categorization by Rhyme cards. The players must determine which one of four pictures does not belong in a set. Place the four pictures on the table in front of the children while singing or saying the following verse:

**One of these things is not like the others.**
**One of these things does not belong.**
**One of these things is not like the others.**
**Which of these things does not belong?**

After the cards have been placed on the table and the song has been sung, ask the children to name each picture. You may need to name the pictures along with the children. Then ask the question, **"Which one does not belong?"**

Have the children tell which card doesn't belong and have them tell why (or supply the rule). For example, if the objects pictured were *hat, cat, fish,* and *bat* all rhyme or end the same, but *fish* doesn't."

In developing categorization by rhyme, the children may attempt to classify by some other principle, for example, by color or semantic category (e.g., farm animals). Acknowledge the correctness of their observations, and continue with a statement such as, **"Yes, that's right, but I'm thinking of a different rule. Can you think of my rule?"**

# Appendix G

## Phoneme Segmentation Fluency (PSF) Subtest Instructions (from DIBELS)

Say these specific directions to the student:

***I am going to say a word. After I say it, you tell me the sounds in the word. So, if I say 'Sam', you would say /s/ /a/ /m/. Let's try one.*** *(one second pause)* ***Tell me the sounds in 'mop'.***

Give the student the first word and start your stopwatch. If the student does not say a sound segment after **3 seconds,** give the student the second word and score the first word as zero segments produced.

As the student says the sounds, mark the student response in the scoring booklet. Underline each **different, correct,** sound segment produced. Put a slash (/) through sounds produced incorrectly.

**As soon as the student is finished saying the sounds,** present the next word promptly and clearly.

The maximum time for each sound segment is **3 seconds.** If the student does not provide the next sound segments within **3 seconds,** give the student the next word. If the student provides the initial sound only, **wait 3 seconds for elaboration** before presenting the next word.

If a student has done the examples correctly and does not respond correctly to the words, say, "Remember to tell me the sounds in the word." This prompt can be given once.

At the end of **1 minute,** place a bracket (]) after the sound produced, stop presenting words and do not score further responses. Add the number of sound segments produced correctly. Record the total number of sound segments produced correctly according to scoring rules on the bottom of the scoring sheet.

# Appendix H

## Nonsense Word Fluency (NWF) Subtest Instructions (from DIBELS)

Say these specific directions to the student:

***Look at this word.*** (point to the first word on the practice probe) ***It's a make-believe word. Watch me read the word: /s/ /i/ /m/.*** (point to each letter and say sound and then run your finger fast beneath the whole word as you read the word). ***I can say the sounds of the letters, /s/ /i/ /m/*** (point to each letter), ***or I can read the whole word "sim."*** (run your finger fast beneath the whole word).

***Your turn to read a make-believe word. Read this word the best you can*** (point to the word "lut"). ***Make sure you say any sounds you know.***

Place the student copy of the probe in front of the student.

***Here are some more make-believe words*** (point to the student probe). ***Start here*** (point to the first word) ***and go across the page*** (point across the page). ***When I say "begin," read the words the best you can. Point to each letter and tell me the sound or read the whole word. Read the words the best you can. Put your finger on the first word. Ready, begin.***

Start your stopwatch when student says the first sound or word.

Follow along on the examiner copy of the probe and underline each letter sound the student produces correctly, either in isolation or read as a whole word. Put a slash (/) through incorrectly read letter sounds.

At the end of **1 minute,** place a bracket (]) after the last letter sound provided by the student and say, ***Stop.***

Count the number of letter-sounds provided correctly for the total score.

# Appendix I

## Road to the Code Instructional Probe (RTCi) Instructions

Say these specific directions to the student:

***Look at this word.*** (point to the first word on the practice probe) ***It's a make-believe word. Watch me read the word: /i/ /p/*** (point to each letter and say sound and then run your finger fast beneath the whole word as you read the word). ***I can say the sounds of the letters, /i/ /p/*** (point to each letter), ***or I can read the whole word "ip."*** (run your finger fast beneath the whole word).

***Your turn to read a make-believe word. Read this word the best you can*** (point to the word "tul"). ***Make sure you say any sounds you know.***

| CORRECT RESPONSE: | INCORRECT OR NO RESPONSE: |
|---|---|
| **That's right. The sounds are /t/ /u/ /l/ or "tul."** | **Remember, you can say the wounds or you can say the whole word. Watch me: The sounds are /t/ /u/ /l/** (point to each letter) or **"tul"** (run your finger fast beneath the whole word). **Let's try again. Read this word the best you can** (point to the word "tul"). |

Place the student copy of the probe in front of the student.

***Here are some more make-believe words*** (point to the student probe). ***Start here*** (point to the first word) ***and go across the page*** (point across the page). ***When I say "begin," read the words the best you can. Point to each letter and tell me the sound or read the whole word. Read the words the best you can. Put your finger on the first word. Ready, begin.***

Start your stopwatch when student says the first sound or word.

Follow along on the examiner copy of the probe and underline each letter sound the student produces correctly, either in isolation or read as a whole word. Put a slash (/) through incorrectly read letter sounds.

At the end of **1 minute,** place a bracket (]) after the last letter sound provided by the student and say, ***Stop.***

Count the number of letter-sounds provided correctly for the total score.

Appendix J

Road to the Code Generalization Probe (RTCg) Instructions

Say these specific directions to the student:

***Look at this word.*** (point to the first word on the practice probe) ***It's a make-believe word. Watch me read the word: /o/ /b/*** (point to each letter and say sound and then run your finger fast beneath the whole word as you read the word). ***I can say the sounds of the letters, /o/ /b/*** (point to each letter), ***or I can read the whole word "ob."*** (run your finger fast beneath the whole word).

***Your turn to read a make-believe word. Read this word the best you can*** (point to the word "tul"). ***Make sure you say any sounds you know.***

| CORRECT RESPONSE: | INCORRECT OR NO RESPONSE: |
|---|---|
| **That's right. The sounds are /w/ /a/ /p/ or "wap."** | **Remember, you can say the wounds or you can say the whole word. Watch me: The sounds are /w/ /a/ /p/** (point to each letter) or **"wap"** (run your finger fast beneath the whole word). **Let's try again. Read this word the best you can** (point to the word "wap"). |

Place the student copy of the probe in front of the student.

***Here are some more make-believe words*** (point to the student probe). ***Start here*** (point to the first word) ***and go across the page*** (point across the page). ***When I say "begin," read the words the best you can. Point to each letter and tell me the sound or read the whole word. Read the words the best you can. Put your finger on the first word. Ready, begin.***

Start your stopwatch when student says the first sound or word.

Follow along on the examiner copy of the probe and underline each letter sound the student produces correctly, either in isolation or read as a whole word. Put a slash (/) through incorrectly read letter sounds.

At the end of **1 minute,** place a bracket (]) after the last letter sound provided by the student and say, ***Stop.***

Count the number of letter-sounds provided correctly for the total score.

Appendix K

Procedural Checklist for a lesson from the *Road to the Code (RTC) Program*

Group: _____

RTC Lesson Number: _____

| **Steps** | **Completed Correctly** |
|---|---|
| 1. Reviewed group rules. | |
| 2. Reviewed marble jar procedures. | |
| 3. Reviewed previous lesson or activity(ies). This could be completed through a review of the previous lesson as a whole, or within each individual activity (e.g., reviewing how to categorize sounds when it is the Phonological Awareness activity for the lesson). | |
| 4. Completed all steps of Say-it-and-Move-it Activity. | |
| 5. Completed all steps of Letter-Sound Correspondence Activity. | |
| 6. Completed all steps of Phonological Awareness Activity. | |
| 7. Used praise and encouragement throughout session. | |
| 8. Periodically added marbles during session or reminded students as to why they were not being added. | |