University of Alberta

The Effectiveness of Phonological Awareness Intervention for Kindergarten Children with Moderate to Severe Language Impairment

By

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Abstract

This study investigated the effectiveness of a phonological awareness intervention in improving the phonological awareness skills of kindergarten children with moderate to severe language impairment. The study was conducted in 10 full-day kindergarten classrooms in 9 schools in an urban school district in western Canada. All children (N = 30) were not yet reading words and demonstrated deficits in phonological and letter-sound awareness. Children were randomly assigned into 2 groups: (a) a phonological awareness intervention group or (b) a no-intervention control group. Educational assistants were trained to provide phonological and letter-sound awareness intervention in 20-minute lessons, five times per week in groups of 2 children, for 14 weeks. Additionally, all students received classroom phonological awareness programming. Lessons were scripted and contained examples, practice, and review. Children were assessed at pre-intervention on three phonological awareness and three alphabetic measures. Probes were administered at three points during the intervention and at two post-intervention maintenance points. Results indicated statistically significant group performance for children in the intervention group on measures of initial sound fluency, phonemic segmentation, and nonsense word fluency skills using measures designed to show change in these skills over time. There were no statistically significant differences between the groups on the norm-referenced, standardized measures of phonological awareness and print knowledge and on letter naming fluency at the end of the intervention.

The data provide evidence to support the clinical practice of the provision of small group, direct, explicit, and intense phonological and letter-sound awareness intervention supplementary to whole class phonological awareness programming for kindergarten children with moderate to severe language impairment.

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CHAPTER I

INTRODUCTION

Children's reading acquisition has been a focus of educational systems across North America. Research over the past 30 years has provided evidence to support the critical role of phonological awareness in learning to read. *Phonological awareness*, defined as the ability to identify, think about, or manipulate the individual sounds in words, is a powerful predictor of subsequent early reading achievement (Adams, 2002; Ball & Blachman, 1988, 1991; Bird, Bishop, & Freeman, 1995; Ehri, et al., 2001; Goswami & Bryant, 1990; Stanovich, 2000; Stanovich, Cunningham, & Cramer, 1984; Treiman, 1993). Across multiple studies, the specific phonological processing skill of phonemic awareness explains the considerable and unique variance in the reading and spelling abilities of young children (Cunningham, 1990).

Most children at the kindergarten level who have well-developed phonological awareness skills—in the absence of higher level language problems, lack of motivation, or other reasons for reading problems—become better readers and spellers than children who lack phonological awareness skills. Children who lack phonological awareness skills experience a widening academic distancing from their peers because of their inability to access print material (Stanovich, 1986). Results from intervention studies indicate that explicit training in phonological awareness has a positive impact on reading and spelling skills and that phonological awareness can be effectively trained in pre-readers with a subsequent positive impact on reading ability (Blachman, Ball, Black, & Tangel, 1994; Davidson & Jenkins, 1994; Fox & Routh, 1984;

Lundberg, Frost, & Petersen, 1988; O'Connor, Slocum, & Jenkins, 1995; Torgesen, Morgan, & Davis, 1992).

More specifically, evidence from research studies indicates that effective principles for increasing kindergarten children's acquisition of phonological awareness and reading include teaching children to segment and blend sounds and to develop their letter-sound awareness (National Reading Panel Report, 2000). However, there is limited knowledge about the effectiveness of phonological awareness intervention programs for kindergarten children with moderate to severe language impairment. According to the research, children who present with diagnoses of language impairment are at risk of reading failure (Bishop & Adams, 1990; Catts, Fey, Tomblin, & Zhang, 2002; Catts, Fey, Zhang, & Tomblin, 1999, 2001; Scarborough, 1991). Thus, research is necessary to ensure that outcomes in phonological awareness, letter-sound awareness development and subsequent reading acquisition for these children are as positive as possible. Given that implementation of phonological awareness and letter-sound awareness intervention has demonstrated improved outcomes for at-risk readers, the effectiveness of this intervention would be expected to extend to children with diagnoses of moderate to severe language impairment.

REVIEW OF RELATED LITERATURE

A review of the related literature will begin with a brief discussion of links among language impairment, phonological awareness, and reading acquisition will be

followed by a presentation of the nature of language impairment. Components of early literacy interventions related to reading are presented and phonological awareness intervention studies are reviewed. The conditions of instruction, the research rationale, and evidence for the selection of the specific phonological awareness intervention program for the proposed research will be presented. Finally, the purpose of the study and specific research questions will be stated.

Links Among Language Impairment, Phonological Awareness, and Reading Acquisition

Oral language and reading appear to be based, in part, on the same phonological processes (Catts & Kamhi, 1999). Snowling (2005) noted that oral language development leads to phoneme awareness. Impairment in oral language causes a delay in phoneme awareness acquisition. Children with language impairment typically demonstrate depressed phonological awareness skills and are 4–5 times more likely to have reading difficulties than children from the general population (Catts, Fey, Zhang, & Tomblin, 2001). A growing body of research has documented a relationship between oral and written language impairments. This research shows that children with reading problems often have concomitant oral language deficits (Catts & Kamhi, 1999). Further, problems in oral language are typically observable before children begin formal reading instruction, and variables that predict reading outcomes in Grade 2 include phonological awareness ability in kindergarten (Catts et al., 2001).

Catts et al. (1999) examined the contributions of phonological processing and oral language abilities to reading and reading disabilities in young children. The

researchers divided 604 participants into groups of good and poor readers on the basis of reading performance in Grade 2. Reading groups were then compared in terms of kindergarten phonological processing and other language abilities. Results indicated that over 70% of poor readers had a history of language deficits in kindergarten. The researchers found that considerably more poor readers had deficits in phonological awareness (56.0%) than did good readers (16.6%). The authors discovered that the poor readers had a much higher percentage of receptive (57.4%) and expressive (50.3%) language deficits than good readers (11.8% and 12.2%, respectively). Deficits in oral language were as common in poor readers as were deficits in phonological awareness (Catts et al., 1999).

Storch and Whitehurst (2002) followed 626 children originally attending Head Start from preschool through Grade 1. The researchers measured print knowledge and phonological awareness and vocabulary. Decoding and reading comprehension skills were measured from Grade 1 through Grade 4. Results indicated these factors: (a) there was a strong connection between print knowledge and phonological awareness and oral language during preschool, (b) reading skill during the early elementary period was predicted primarily by children's print knowledge and phonological awareness skills, and (c) reading comprehension in later elementary school was significantly influenced by children's oral language skills as well as by print knowledge and phonological awareness.

In summary, children with language impairment typically have depressed phonological awareness skills that place this population at risk for reading difficulties.

The Nature of Language Impairment

Researchers have identified two groups of children with primary language impairment that are differentiated based on nonverbal IQ. The term *Specific language impairment* was applied to children who met the research definition of having a nonverbal IQ score of 85 or greater. In contrast, children with a nonverbal IQ score between 70 and 84 were identified with non-specific language impairment (Catts et al., 2002). The children in the latter group are similar to children with specific language impairment but present with lower nonverbal IQ. From a clinical standpoint there may be no rationale for separating these two groups (Scheule, Spencer, Barako-Arndt, & Guillot, 2007). Both groups require and should receive language and literacy intervention. For example, Cole, Coggins and Vanderstoep (1999) found there was no difference in response to intervention for young children with cognitive performance above language performance and for children with similar delays in both language and cognitive performance. The term *language impairment* includes children with nonverbal IQ scores of 85 or greater and children with nonverbal IQ scores between 70 and 84 and will be used to refer to the participants in the current study.

Much of the research literature has involved only children who met specific language impairment research criteria. The defining elements and characteristics of specific language impairment will be discussed in the following section.

Leonard (1998) stated, "A traditional definition of *Specific language impairment* is exclusionary in nature in that specific language impairment is defined as a form of developmental language impairment occurring in the absence of mental

retardation, sensory disorders, frank neurological damage, serious emotional problems, and environmental deprivation." Further, "this disorder is believed to arise from limited linguistic processing capacity" (Ahmed, Lombardino, & Leonard, 2001, p.1). The Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) recognizes two subtypes of specific language impairment: an expressive form, and a mixed expressive-receptive form (American Psychiatric Association, 1994; Leonard, 1998). These subtypes acknowledge that some children with specific language impairment may have significant limitations primarily in the area of expressive language, whereas others may have major limitations in both receptive and expressive language (Leonard, 1998, p. 402).

It is estimated that 7.4% of 5-year-olds have specific language impairment, with males outnumbering females (8% versus 6%) (Tomblin et al., 1997). Children with specific language impairment are thought to have a genetic predisposition to language problems when a family history of language impairment has been identified (Leonard, 1998; Tomblin, 1989). Varying profiles of children with specific language impairment are noted. Some of these children show subtle weaknesses in other cognitive and motor areas. Other children with specific language impairment show none of these associated weaknesses. This finding has led researchers to consider the possibility that the conditions that cause cognitive and motor problems may co-occur with specific language impairment but that they are not responsible for specific language impairment (Leonard, 1998, p. 402).

For children with language impairment whose language problems are still present at 5 years of age, difficulties with language may continue into adolescence and

even adulthood (Bishop & Adams, 1990). Children with language impairment are at greater risk for reading deficits than children with typical language development (Catts & Kamhi, 2005b). Children with language impairment and low phonological awareness skills differ from their peers as a result of their inability to associate letters to sounds, segment words into individual speech sounds and blends sounds to form words (Adams, 1990; Muter, Hulme, Snowling, & Taylor, 1997; Stanovich, 1986; Torgesen, Wagner, Rashotte, Alexander, & Conway, 1997). Given these challenges with acquiring critical pre-literacy skills, it is essential that children diagnosed with language impairment receive intervention to help them understand that letters of the alphabet stand for sounds that occur in words (Adams, 1990). Understanding the connections between print, speech sounds, and words (i.e., the alphabetic principle) is the first step in beginning reading (Adams, 1990).

The oral language problems observed in specific language impairment include difficulty in most or all areas of language, including semantics, syntax, phonology, and pragmatics (Paul, 2001). There is variability with regard to the degree these areas of language are affected. For example, vocabulary and pragmatic skills may be relative strengths. Phonology and morphology may be relative weaknesses. Again, this profile is not seen in all children meeting the criteria for specific language impairment. Given the diverse nature of this population, Leonard noted that researchers have attempted to determine "whether the differences seen among children with specific language impairments comprise distinct subtypes or instead represent different points on a continuum" (Leonard, 1998, p. 403).

In recent years researchers have investigated the relationship between dyslexia, a developmental written language disorder characterized by a phonological processing deficit underlying word-reading difficulties (Catts, Adolf, Hogan, & Weismer, 2005), and specific language impairment. Given the possible close relationship between dyslexia and language impairment, there is particular concern for children with specific language impairment regarding their ability to learn to read (Catts et al., 2005; Lyon, Shaywitz, & Shaywitz, 2003). Many children with language impairment have phonological awareness skills that are significantly lower than those of typically developing children. Preschool children with a diagnosis of language impairment are at increased risk for reading difficulties because of their language impairments. Early intervention that includes developing phonological awareness would provide the background skills and knowledge necessary to prepare these children for formal reading instruction whether or not they are diagnosed with dyslexia at a later time (Catts et al., 2005a).

Research on children with language impairment identifies a variety of reasons for their language impairment. These may include "information processing deficits, specific cognitive skill deficits, poor working memory, and phonological awareness deficits" (Fletcher & Miller, 2005, p.3). On the other hand, impairments may be focused on grammar itself. The range of these reasons may be because of, for example, differences in the theory of specific language impairment or the diversity of the participants in each study (Fletcher & Miller, 2005). The researchers noted that it is not clear whether children with specific language impairment represent a single group of children defined by the same receptive and expressive language criteria or

whether there are subgroups of children with specific profiles of language difficulties, for example word finding problems or expressive language problems (Fletcher & Miller, 2005).

Heilmann (2004, cited by Fletcher & Miller, 2005) explored participant inclusion criteria for children with specific language impairment in a review of 36 research studies on children with specific language impairment published in 2003 and 2004. Heilmann's review indicated that the studies ranged widely in the language test criteria (from -1 SD to -1.5 SD), and cognitive criteria (IQ scores from 70 to above 85). The differences in participant inclusion criteria in these studies are worth noting because the spread of criteria characterizing specific language impairment suggests that the level of language and cognitive functioning for this population is quite variable.

Many young children diagnosed with language impairment struggle to acquire efficient reading and spelling skills (Gillon, 2004). Deficits in phonological awareness have been found to play an integral part in learning to read and spell (Ball & Blachman, 1993; Bradley & Bryant, 1983; Goswami & Bryant, 1990; Muter, Hulme, Snowling, & Taylor, 1997; Wagner & Torgesen, 1987). The following section will include a discussion of the components of early literacy intervention, beginning with phonological awareness.

Components of Early Literacy Intervention

Phonological Awareness

Phonological awareness is an encompassing term that implies a global awareness of sound structures and is measured by tasks that may involve larger sound units. Phonological awareness activities include rhyming ("Tell me a word that rhymes with *rug*"), segmenting a compound or combined word ("What is *toothbrush* without the *brush*?"), segmenting a word ("What is *candy* without *dee*?"), and segmenting words into their onsets (i.e., the consonants that come before the vowels) or rimes (i.e., the vowel and following consonants that follow the onset). For example, in the word *sit*, the *s* is the onset of the syllable, and *it* is the rime of the syllable; in the word *start*, *st* is the onset and *art* is the rime unit of the syllable. Most commonly, this level of awareness is measured through rhyming tasks, because to understand that words rhyme, children must first be aware that the words share a common ending (rime unit) that can be separated from the beginning of the word (onset) (Ehri et al., 2001; Gillon, 2004).

Under the umbrella term of phonological awareness, the research literature describes an even narrower classification of phonologic skills, known as *phonemic awareness*. Phonemic awareness refers to analysis only at the phonemic level (i.e., the smallest unit of sound) (Torgesen et al., 1999). Phonemic awareness activities include skills such as phoneme isolation (e.g., "What's the first sound in *cat*?" (/k/)), phoneme identity (e.g., "What sound is the same in *bike, boy*, and *bell*?" (/b/)), phoneme categorization (e.g., "Which word does not belong: *bus, bun, rug*?"), phoneme

blending (e.g., "What word is /s/ /i/ /t/?" (*sit*)), phoneme segmentation (e.g., "How many sounds are there in the word *ship*?" (three)), and phoneme deletion (e.g., "What is *smile* without the /s/?" (*mile*)) (Ehri et al., 2001, p. 156-157).

Phonological awareness has been theorized to contribute to the growth of word-reading ability in important ways. The main contribution of phonological awareness is that children who have developed phonological awareness are aware that words are made up of sounds, which helps them to develop letter-sound correspondence. This skill enables children to sound out unfamiliar words, which facilitates word recognition. (Catts & Kamhi, 2005b; Ehri & Nunes, 2002; Share & Stanovich, 1995).

The development of phonological awareness has implications for the sequence of skills to train in intervention. Therefore, an examination of the scope and sequence of development of this skill is warranted.

A Developmental View of Phonological Awareness

Anthony and Lonigan (2004) presented a developmental view of phonological sensitivity as a single ability that develops from sensitivity to words to sensitivity to phonemes. In a systematic investigation of this trend, Anthony et al. (2003) found (when controlling for task complexity) that children generally mastered word-level skills before syllable-level skills, and syllable-level skills before onset-rime-level skills. Anthony et al. also found that children were able to detect phonological information before they could manipulate it, and that they were able to blend

phonological information before they could delete phonological information at the same level of linguistic complexity.

Chard and Dickson (1999) described the sequence of children's phonological awareness development that begins with rhyme and sentence segmentation and moves to segmenting words into syllables and blending syllables into words. The next skill is segmenting words into onsets and rimes and blending onsets and rimes into words. The authors stated the most advanced level is the ability to manipulate phonemes by segmenting, blending, or changing individual phonemes within words to create new words.

In the next section, the role of rhyme in early literacy intervention is presented with the recognition that rhyme continues to be included as a component of most early reading programs. Then, the shift in emphasis from the role of rhyme to the significant contribution of blending, segmenting, and letter-sound awareness to early reading instruction is explored in a discussion of these components.

The Role of Rhyme

Over the years, the role of rhyme as an essential type of phonological awareness for reading has been debated. Regardless of whether rhyme knowledge has predictive power for reading development, it has implications for the choice of skills to train in intervention. It is important, therefore, to carefully examine findings related to rhyme knowledge.

An early form of phonological awareness for many preschoolers is the ability to detect rhyming words (Lonigan et al., 1998). As preschool children begin to hear and distinguish parts of words, some of the word chunks they single out are rhymes—word endings that sound the same, such as the *-at* in *cat* and *mat*, the *-oon* in *moon* and *spoon*, the *-ock* in *sock* and *clock*, and the *-iddle* in *fiddle* and *diddle*.

Chaney (1992) noted that producing rhyming words is more difficult for preschoolers than matching rhyming words. Rhyme sensitivity is predictive of other phonological skills (Anthony & Lonigan, 2004), and preschoolers' memory for nursery rhymes has been related to their later reading ability (Bryant, Maclean, Bradley, & Crossland, 1990; Cronin & Carver, 1998; Maclean, Bryant, & Bradley, 1987).

Bryant et al. (1990) found that sensitivity to rhyme uniquely predicted reading and spelling ability in 6-year-old children after controlling for IQ, socio-economic status, vocabulary, age, and sensitivity to phonemes. In contrast, Muter, Hulme, Snowling, and Taylor (1997) found that sensitivity to phonemes uniquely predicted reading and spelling ability in 5-year-old children after controlling for IQ, letter-sound knowledge, and sensitivity to rhyme (Hulme et al., 2002). Anthony & Lonigan (2004) noted that one interpretation of these results is that sensitivity to rhyme and sensitivity to phonemes are differentially related to reading and spelling. The researchers speculated that other potential interpretations for the relative superiority of different types of phonological skills could be the age of the participants or different methodologies used in the studies.

Learning to recognize and produce rhyming words is not enough to bring children at risk for reading failure to the level of awareness of the phonological structure of words required to learn to read and spell. Beginning readers who have not developed phonological awareness need an explicit program that teaches them how the sound segments are represented in print (Blachman, 2000).

Yeh (2003) evaluated two approaches for teaching phonemic awareness to 4- and 5-year-old children in four Head-Start classrooms. The first approach focused on rhymes, alliteration, and story activities. The second approach focused on phoneme segmentation and blending in the context of sounding out actual words. Results showed that children taught using the second approach showed significantly greater gains in phonemic awareness and letter-sound knowledge when compared to children taught using the first approach.

Nation and Hulme (1997) explored the relationship between measures of phonological awareness and their predictive relationship with reading and spelling ability. The researchers gave children (ranging in age from 5-1/2 to 9-1/2 years) four tests of phonological skill. The researchers discovered performance of the children on tests of phonemic segmentation, rhyme sound categorization, and alliteration sound categorization improved with age. However, all age groups performed onset-rime segmentation at a similar level. Phonemic segmentation was the best predictor of reading and spelling ability followed by rhyme and alliteration. Onset-rime segmentation was not a predictor of reading and spelling ability. The researchers noted that these findings called into question the emphasis that has been placed on rhyming skills as predictors of reading and spelling ability.

Anthony et al. (2002) examined whether rhyme or phoneme sensitivity was most important for reading acquisition. Emergent literacy skills (e.g., letter knowledge, concepts of print and decoding skills) were examined in two groups of children, 149 older children (ages 4;0 to 5;11) and 109 younger children (ages 2;3 to 3;11). A developmental trend was observed in each group demonstrating that the older children scored higher on all phonological sensitivity and print knowledge items than the younger children. They concluded that children's sensitivity to words, syllables, rhymes, onset-rime, and phonemes represent a single, underlying phonological ability of increasing linguistic complexity. The authors noted that the important question is not what type of phonological sensitivity is most important for literacy but which measures of phonological sensitivity are developmentally appropriate for a particular child (Anthony et al., 2002).

Despite the differing results from the studies and a lack of clear direction from the literature, rhyming continues to be an integral component of preschool and early literacy programs. Given the inconclusive results regarding whether rhyme knowledge has predictive power for reading development, the teaching of rhyme was included but was not a focus in the intervention program selected for the current study. Rather, the focus of the intervention aligned with the emphasis in early reading instruction research on the importance of integrated teaching of blending and segmenting at the phonemic level and letter-sound awareness.

Blending and Segmenting

While early studies of phonological awareness intervention tended to include a wide range of phonological awareness tasks (i.e., global phonological awareness), over time researchers have attempted to refine phonological awareness instruction to learn whether or not some tasks are more beneficial than others in supporting children's reading acquisition. Converging evidence indicates that phonemic blending and segmenting are correlated with beginning reading acquisition (Davidson & Jenkins, 1994; Fox & Routh, 1984; O'Connor, Jenkins, & Slocum, 1995; Torgesen, Morgan, & Davis, 1992).

A number of studies have compared the contributions of segmenting and blending instruction to reading acquisition. These studies will be reviewed in subsequent sections that explore the importance of phonological and letter-sound awareness in beginning reading and on kindergarten studies involving children with low phonological awareness skills. The following presentation regarding letter-sound awareness serves to explain the importance of the integrated teaching of blending, segmenting, and letter-sound awareness in beginning reading instruction.

Letter-Sound Awareness

Research provides strong evidence of the importance of phonological awareness, specifically blending and segmenting in beginning reading. However, phonological awareness instruction alone is not sufficient to ensure reading acquisition (Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1989, 1991; Davidson &

Jenkins, 1994; Fox & Routh, 1984; O'Connor et al., 1995; Torgesen et al., 1992). Another contributing factor that influences children's literacy development includes the integration of phonemic blending and segmenting with letter-sound awareness to prepare children to use the alphabetic principle (Adams, 1990; Burgess & Lonigan, 1998; Catts et al., 2001).

Beginning readers need to develop the connection between the individual phonemes in spoken words and the letters of the alphabet to develop alphabetic understanding (Adams, 1990; Ball & Blachman, 1991). Early reading instruction includes teaching children to link individual sounds with their visual representations, the letters of the alphabet (Ehri & McCormick, 1998). In the process of linking speech to print, children begin to relate letters with sounds and sounds with the letters of the alphabet that represent the sounds of spoken language (Adams, 1990; Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1989, 1991; Carnine, Silbert, & Kame'enui, 1997; Kame'enui & Carnine, 1998; Spector, 1995).

Children with moderate to severe language impairment who are at risk for reading difficulties require carefully designed and explicit instruction that will teach them the connections between print, speech sounds, and word reading in order to translate visual symbols into sounds and independently read words (Adams, 1990; Carnine et al., 1997; Foorman & Torgesen, 2001; Hohn & Ehri, 1983; Kame'enui & Carnine, 1998; Simmons & Kame'enui, 1998; Spector, 1995).

A large number of phonological awareness studies have been conducted over the years (Ball & Blachman, 1991; Blachman et al., 1994; Bradley & Bryant, 1983, 1985; Brady et al., 1994; Brennan & Ireson, 1997; Bryne & Fielding-Barnsley, 1989,

1991, 1993, 1995; Castle, Riach, & Nicholson, 1994; Coyne, Kame'enui, Simmons, & Harn, 2004; Cunningham, 1990; Foorman et al., 2003; Fuchs et al., 2001; Hohn & Ehri, 1983; Korkman & Peltoma, 1993; Kozminsky & Kozminsky, 1995; Lundberg et al., 1988; Murray, 1998; Reitsma & Wesseling, 1998; Schneider, Kuspert, Roth, Vise, & Marx, 1997; Tangel & Blachman, 1992; Torgesen et al., 1992; Torgesen, Wagner, Rashotte, 1999; Treiman, 1993; Vadasy, Sanders, & Peyton, 2006). A smaller number examined the integrated teaching of blending, segmenting, and letter-sound awareness with kindergarten children at risk for reading failure.

The purpose of the following section is to examine intervention studies that have investigated the effectiveness of the phonological awareness skills of blending and segmenting and letter-sound awareness to facilitate word reading. The literature search included the following steps: first, the training studies from the meta-analysis conducted by the National Reading Panel (2000), the quantitative review of the 36 training studies by Bus & van Ijzendoorn (1999), and the qualitative review of the 22 training studies by Troia (1999) were reviewed. Second, an electronic search of the databases was conducted to identify relevant research sources. Descriptors included *kindergarten, phonological awareness, language disorders or impairment, specific language impairment, reading acquisition, reading disabilities, intervention, therapy, program,* and *trial.* These terms were entered in a computer search of the following databases: CINAHL, EMBASE, ERIC, MEDLINE, and PsycINFO. Web of Science and Scopus were also included in the computer search. Abstracts of published articles from these databases were accessed through OVID. Third, references in peer-reviewed journal articles and books were examined to identify additional studies.

The Importance of the Components of Early Literacy Intervention

Although training in phonological awareness alone can produce significant improvement in subsequent reading growth, programs that directly teach both phonological awareness and letter-sound awareness consistently produce the largest gains in reading. These skills are necessary to develop the alphabetic principle that will enable children to independently translate a graphic symbol into a sound. Insufficient phonological awareness or alphabetic understanding hinders acquisition of reading (Blachman, Ball, Black, & Tangel, 1994; Byrne & Fielding-Barnsley, 1995; Cunningham, 1990; Fuchs et al., 2001; Hatcher & Hulme, 1999; Oudeans, 2003). Studies that have examined the effects of phonological awareness training only or letter-sound awareness training only will be reviewed in the following section.

Byrne and Fielding-Barnsley (1991) focused on teaching children phoneme identity in both initial and final positions across different words. Sixty-four typically achieving preschoolers averaging 4;5 years of age were trained in groups of 4 to 6 individuals for approximately half an hour per week for 12 weeks. Training consisted of teaching children to classify pictures of items in posters, worksheets, and games on the basis of shared sounds; for example, searching the /s/ posters for the things beginning or ending with that phoneme. The children were also shown an array of pictures on worksheets or cards, and they selected those having targeted sounds. One phoneme in one position was taught in each session. The letter representing that phoneme was introduced as well. The control group consisted of children from the same preschools who were exposed to the program materials for the same amount of

time in similar-sized groups. The children in the control group did not receive instruction in phoneme identity; rather, they learned to classify items on formal or semantic grounds. Byrne and Fielding-Barnsley (1991) found, at the end of training, that children in the phoneme identity group were able to identify substantially more initial and final phonemes in words than were control students. They also demonstrated superior skill in identifying sounds they had not practiced, indicating that phoneme identity transferred to untaught phonemes. Trained students read more words on a word reading task (e.g., When shown a word card and asked, "Does this |sat| say *sat* or *mat*?") than did control students, indicating that the training in phoneme identity improved preschoolers' early word recognition skill.

Bradley and Bryant (1983) studied whether difficulties on one measure of phonological awareness, sound categorization, were causally related to the development of reading skills. At the beginning of their longitudinal study, the sound categorization ability of over 400 four- and five-year old children was assessed before the children started to learn to read. Over three years later, their reading and spelling ability and verbal intelligence were assessed. Performance on the sound categorization task was predictive of later reading scores, even when measures of intelligence and memory were taken into account. The study also included a training component. Sixty-five children with low pre-test scores on sound categorization, scoring at least two standard deviations below the mean, were split into four groups. The children, 6 years old, were randomly assigned to one of four groups matched on IQ, age, sex, and sound categorization ability. Group I was trained in sound categorization. Group II was trained in sound categorization and letter-sound correspondences. This second

group also received exercises relating the sound structure of words to spelling patterns using plastic letters. The study also included two control groups (III and IV). Group III was taught to group words according to semantic categories and Group IV received no training. After training, which was spread over two years, results of the Schonell and Neale Reading test scores indicated that Group II, who had been taught both sound categorization and letter-sound correspondences was 8-10 months ahead of the Group III semantic categorization control group. This group was also higher than Group I and IV on measures of reading and spelling. Group I, who had been taught to categorize sounds only was about four months ahead of the semantic categorization control group in reading, but this difference was not statistically significant.

The authors concluded that training in sound categorization is more effective when it also involves an explicit connection with the alphabet and that sound categorization is causally related to the development of reading skills. This study did not include a letter-training-only group, and thus it was not possible to determine whether it was the combination of sound categorization and letter training or the letter training itself that made the difference in the children's reading scores.

Ball and Blachman (1991) examined the effects of letter-name and letter-sound training on segmentation skills and early reading and spelling ability for typically achieving kindergarten children. Explicit instruction in phonological awareness activities from *Road to the Code: A Phonological Awareness Program for Young Children*, a resource manual created by the authors, Blachman, Ball, Black, and Tangel (2005) was implemented in this study. The study included 89 children who scored 1.5 standard deviations below the mean on the Peabody Picture Vocabulary

Test-Revised (PPVT-R), were not yet reading, and had raw scores below 3 on the Woodcock Reading Mastery word subtest. Children were randomly assigned to one of three groups: (a) phoneme awareness training, (b) language activities group (control group I), and (c) no intervention (control group II). Children in the phoneme awareness training group and children in the language activities group were trained in groups of 5 individuals for 20 minutes 4 times per week for 7 weeks. The phoneme awareness training group received segmentation-related activities and letter-name and letter-sound training. Children who participated in the language activities (control group I) were engaged in activities that included vocabulary development, listening to stories, and semantic categorizations. They also received letter-name and letter-sound training that was identical to the phoneme awareness group. Children in control group II received no intervention. The researchers reported the phoneme segmentation group significantly outperformed the other two groups on post-treatment measures of early reading and spelling skills, emphasizing the importance of combining phoneme awareness instruction with instruction that links the phonemic sound segments to alphabet letters. The researchers concluded from these findings that letter-sound knowledge by itself does not improve segmentation skills. These results relate to the results by Bradley & Bryant (1983), who found that phonological awareness by itself was not enough to significantly affect reading and spelling scores and that training was more effective when it also involved an explicit connection with the alphabet.

Road to the Code: A Phonological Awareness Program for Young Children was evaluated in a second and longitudinal study (Blachman, Tangel, Ball, Black, & McGraw, 1999). The authors investigated a kindergarten phonological awareness

intervention that included the previously mentioned 7-week intervention and expanded it to 11 weeks. The study involved 84 treatment students and 75 comparison students. Children who were in the low-average range of receptive vocabulary, could not yet read, and who knew, on average, only two letter sounds in January received this program in the second half of the kindergarten year. This study was conducted with low-income, inner-city children. Kindergarten teachers and their classroom teaching assistants implemented the program with small groups of children. At the end of kindergarten, results from post-testing indicated that treatment children performed significantly better on tests of phoneme segmentation and letter-name and sound-knowledge. Children in this classroom-based phonological awareness study were followed until the end of Grade 2. The children in the treatment group received 30 minutes of group reading instruction in Grade 1. Some children continued to receive this instruction in Grade 2. The instruction continued to emphasize explicit, systematic instruction in the alphabetic code. In contrast, the children in the control group received 30 minutes of group reading instruction using a traditional basal reader and phonics workbook.

At the end of Grade 1, the children in the treatment group significantly outperformed the children in the control group on measures of phoneme segmentation, letter naming, letter-sound knowledge, and three of four measures of word recognition. By the end of Grade 2, the children in the treatment group were significantly superior on all four measures of word recognition. Results of the research, as noted by Blachman, Tangel, Ball, Black, & McGraw (1999), indicated that phonological awareness instruction that emphasizes explicit, systematic

instruction in blending and phoneme segmentation and letter-sound awareness results in significant improvement in these areas as well as in word recognition.

Vandervelden and Siegel (1997) explored the reciprocal development among phonological skills and early reading and spelling. The researchers used letters and phonemes to help kindergarten children recognize printed matches of spoken words or syllables and to spell words. Thirty children aged 5;1 to 6;0 were selected from two classes (15 children from each) in two different inner-city schools in Ontario. Two groups, an experimental group (n = 15) and a control group (n = 15), were compared before and after a 12-week intervention on tasks that assessed phonological processing skills and reading.

The experimental approach emphasized children's use of phonological recoding to recognize, spell, and read (pronounce) words. First, the children were shown a card with a printed word and told the name of the word. Then, they were directed to put their finger on the first letter of the word while the instructor said the beginning sound of the word. After that, the instructor directed children to keep their finger on the first letter of the word and find the letter for the sound from a small group of letters. Finally, after children had learned several words, they were shown a set of words and asked to read a specific word.

Children in the experimental group demonstrated superior performance on the measures of speech-to-print matching, spelling, and pseudo-word reading. Additionally, compared to controls, children in the experimental group read more words on the word-learning task at post-test. Vandervelden and Siegel (1997) concluded that teaching children to attend to letters in words and relating these letters

to how a word sounds may have made explicit the underlying phoneme structure. The researchers also concluded that including recognition and segmentation of phonemes in reading and writing instruction, rather than as isolated skills, results in more effective development of phoneme awareness and beginning reading and spelling skills.

Combining phonological awareness and reading and spelling instruction has been shown to be beneficial for struggling readers, at least in Grade 1. Hatcher, Hulme, and Ellis (1994) designed their study to test their "phonological linkage hypothesis," defined as the hypothesis that training in phonological skills in isolation from reading and spelling is much less effective than training that forms explicit links between children's underlying phonological skills and their experiences in learning to read. The researchers incorporated the Reading Recovery (RR) program (Clay, 1985) into the training. A total of 125 7-year-old readers experiencing difficulties in the early stages of learning to read were divided into four matched groups and assigned to one of three experimental teaching conditions: RR with phonological awareness, RR alone, and phonological awareness alone. Children in a fourth group, the control condition, received their regular classroom teaching without any additional instruction from the study. Results indicated that the RR plus phonological awareness–trained group made significantly more progress than the control group on five different reading measures. In contrast, the RR-only group outperformed the control group on only one reading measure. While the phonological awareness group showed most improvement on phonological awareness tasks, the RR plus phonological awareness–trained group made the most progress in reading. Assessments completed 9

months after the training program suggested that the improvements in reading skills shown by the group given the RR plus phonological awareness–training were maintained but that improvements achieved by the RR-only group were not. The authors noted this was evidence for the benefits of adding phonological awareness instruction to the RR program.

In recent years, phonological awareness intervention studies that include children who are blind, children who have severe speech and physical impairments and use augmentative and alternative communication, children with severe hearing loss, children with speech disorders/impairment, and children with Down syndrome have been reported in the literature (Dahlgren Sandberg, 2001; Dodd & Conn, 2000; Kay-Raining Bird, Cleave, & McConnell, 2000; Gillon, 2005; Hesketh, Dima, & Nelson, 2007; Ogura, Coco, & Bulat, 2007; Rvachew & Grawburg, 2006; Sterne & Goswami, 2000). However, both Ukrainetz (2006) and Schuele (2008) noted that there has been minimal research investigating the effectiveness of phonological awareness intervention for children with language impairments. Although previous research has not examined the effectiveness of phonological awareness intervention with children with moderate to severe language impairment, there have been intervention studies with kindergarten children with low phonological awareness and at risk for reading failure that included the teaching of blending and segmenting at the phonemic level and letter-sound awareness to increase phonological awareness and beginning word reading skills. These studies have highlighted the phonological awareness skills that are effective and are summarized in the following paragraphs.

Phonological Awareness Intervention that is Effective for Children at Risk for Reading Failure

Phonological awareness intervention has become an accepted method for improving kindergarten children's phonological awareness skills and subsequent reading acquisition and achievement. The varied designs of the intervention studies allowed the researchers to refine phonological awareness instruction to learn whether some tasks are more beneficial than others in supporting children's reading acquisition.

Fox and Routh (1984) found that instructing children in an experimental group in segmenting and blending facilitated their learning a word reading task (8 children out of 10 reached criterion). Torgesen et al. (1992) also discovered that children in a segmenting and blending group learned the post-intervention word reading tasks at a faster rate with overall fewer trials to criterion and fewer errors than children in the blending only or control groups.

While many studies investigated segmentation and blending together, one study (Davidson and Jenkins, 1994) found that teaching kindergarten children who were not yet reading words to segment was as effective as teaching segmenting and blending. In contrast, teaching children only to blend was not effective. However, the researchers noted that instructing children in one kind of phonemic task does not appear to contribute to generalized phonemic awareness.

Fox & Routh (1984), Torgesen et al. (1992), and Davidson & Jenkins (1994), included letter-sound awareness training secondary to phonological awareness

instruction. Including letter-sound awareness training after phonological awareness instruction may have limited the effects of the instruction.

O'Connor et al. (1995) found that children in a blending and segmenting experimental group and children with high phonological awareness skills in a comparison standard group used a comparable number of trials to learn the words on a reading analog test. The researchers noted that even though improvement in phonological skills provided an advantage to children in training over control children in their study, improvement in phonological awareness without improvement in letter knowledge may still have left children who had low phonological skills unprepared to decode simple words.

Ehri and Nunes (2002) noted that results of the meta-analysis of phonological awareness intervention studies from the National Reading Panel indicated that phonological awareness instruction with letter-sound awareness produced an effect size that was almost twice as large as the effect size without letter-sound awareness on reading outcomes. The implication for future research from this finding is that the integration of letter-sound awareness in phonological awareness intervention for children at risk for reading difficulties is essential.

Over the years, training studies have continued to show that explicit and well-designed phonological awareness and alphabetic activities that integrate instruction in phonemic segmentation and blending and letter-sound awareness enable at-risk students to attain a positive development trajectory in phonological awareness. For example, Coyne, Kame'enui, Simmons, & Harn (2004) reported that explicitly teaching oral blending and segmenting and letter-sound correspondences to

kindergarten students at risk for reading failure was effective in increasing the students' skills in these areas and in the development of critical early reading skills. Foorman et al. (2003) found that alphabetic instruction without phonological awareness was not as effective as alphabetic instruction with phonological awareness. The investigators noted that "What seems to matter in effective instruction in phonological awareness and alphabetic coding are activities where phonemes are blended and segmented in speech then connected explicitly and systematically to graphemes in print" (Foorman et. al., 2003, page 317). Fuchs et al. (2001) further explored the issue of teaching phonological awareness in combination with letter-sound instruction. One of the two treatment conditions in this kindergarten study represented an integration of phonological awareness training with beginning decoding instruction. The other treatment condition was phonological awareness training alone. Both treatment groups outperformed a no intervention control group on measures of phonological awareness. The group that received the integrated training outperformed the other 2 groups on measures of early reading and spelling skills. This finding led the researchers to conclude that integrating phonological awareness training with letter-sound instruction is effective in increasing phonological awareness and early reading skills. Torgesen et al. (1999) included a treatment group that received the Auditory Discrimination in Depth Program (Lindamood, 1984) that provided explicit instruction in phonemic awareness. This instruction was integrated with developing phonemic decoding skills. The intervention was effective in increasing phonemic awareness and decoding skills. Vadasy, Sanders & Peyton (2006) provided lesson activities that included letter-sound correspondence, phoneme

segmenting and blending and reading from a decodable book series matched to the lessons for their instructional consistency. Kindergarten children in the intervention had higher growth rates in phonemic awareness and alphabetic knowledge than children who did not receive this intervention.

In summary, integrating the teaching of the phonological awareness tasks of phoneme blending and phoneme segmenting with letter-sound awareness has been found to have a positive effect on early reading acquisition and achievement. The evidence suggests, then, that these factors are the most likely to explain variance in preschool phonological awareness and reading acquisition.

Intensity and Conditions of Instruction

In addition to investigating the varying characteristics of the children (the cognitive-linguistic profile, etiology of the difficulty, socio-economic status) and the phonological awareness skills that are predictors of reading achievement, it is important to examine the intensity and conditions of instruction required to prevent reading difficulties in children with moderate to severe language impairment. Questions regarding the optimum length of phonological awareness training and factors determining optimum length invite further research (National Reading Panel, 2000). Torgesen (2000) noted that examination of these factors is particularly critical for children with the most severe phonological disabilities and disabling environmental backgrounds:

> To know what kind of instruction is most effective is not the same thing as knowing how much of that instruction, delivered under what conditions, will lead to adequate development of word reading and passage comprehension skills in children with phonological processing weaknesses (Torgesen, 2000, p. 63).

Blachman et al. (1994) stated that 15 to 20 hours was sufficient to yield increases in phonological awareness. Blachman (2000) noted that phonological awareness intervention for children at risk for reading difficulties needs to be intensive (e.g., 20 minutes per day for an 11-week period). Infrequent periods of training (e.g., 60 minutes in two weeks) are unlikely to produce any rapid change in the performance of these children (Gillon, 2004). Results from the National Reading Panel report (2000) indicated that the length of time allocated for phonological awareness training in the studies reviewed varied from 1 hour to 75 hours across the 52 studies. Intervention was delivered in individual child, small-group, and classroom training units. Cases were grouped into four time blocks to determine whether there was an optimum length of time for teaching phonological awareness. Results indicated that effect sizes were significantly larger for two middle time periods lasting from 5 to 9.3 hours ($d = 1.37$) and from 10 to 18 hours ($d = 1.14$). Periods that were either shorter or longer than these were less effective for teaching phonological awareness. Some caution is warranted with regard to these results because children with moderate to severe language impairment were not clearly identified as participants in these studies.

The significance of the reported effect sizes is also diminished because many studies did not include treatment fidelity data. Without fidelity information, it is not

possible to know the accuracy and consistency with which the training program was implemented or to attribute positive or negative findings to the treatment. Further, these findings run counter to the expectation that more extensive training in phonological awareness should enable children to acquire superior phonemic awareness with stronger benefits for reading and spelling. The National Reading Panel Report (2000) offered reasons why effect sizes may have been smaller when training was extensive. These included the complexity and level of difficulty of the goals of instruction, as well as the varied learning needs of the participants. Two conclusions on length of training were offered from the National Reading Panel findings: that length of training should be regulated by how long it takes students to acquire the phonological skills that are taught, and that the findings from the National Reading Panel should not be translated into any prescriptions regarding how long phonological awareness should be taught. The panel suggested that the best solution to the question of length of training is to pre-test for phonological awareness skills and adjust the amount of instruction to suit individual and class needs (National Reading Panel, 2000).

Children who approach literacy instruction with strong phonological awareness knowledge are likely to succeed in early reading and spelling. In contrast, children who demonstrate very poor awareness of the phonological structure of words are more likely to experience difficulty in acquiring competency in reading and spelling (Gillon, 2004). However, there continues to be a gap between what we know from the research about phonological awareness intervention for children at risk for reading failure and the effectiveness of this intervention in increasing phonological awareness

with a subset of this population—children with moderate to severe language impairment. Research is necessary to determine whether phonological awareness intervention programs result in an increase in blending and segmenting skills and letter-sound awareness for kindergarten children with moderate to severe language impairment. Careful consideration of the phonological intervention program selected for implementation is required to maximize the potential program effectiveness for this population. The following section will include a rationale for the selection of a phonological awareness intervention program for the participants in the proposed study.

Rationale for the Selection of a Phonological Awareness Intervention Program

The conclusions of the National Reading Panel (2000) regarding the principles of effective early phonological awareness instruction serve to guide the selection of a phonological awareness intervention program for children with language impairment. The findings of the meta-analysis conducted by the National Reading Panel indicated that phonological awareness instruction may be most effective when instruction (a) is structured so that it moves from simple to more complex tasks, (b) explicitly and systematically teaches the manipulation of phonemes with letters, and (c) teaches one or two types of phoneme manipulations (i.e., blending and segmenting) instead of multiple types. The results of the meta-analysis also suggested that small-group instruction is more effective than whole-group or one-on-one instruction.

Eight widely used curricula for teaching kindergarten phonemic awareness programs were reviewed by Santi, Menchetti, and Edwards (2004). Four criteria were applied for reviewing the programs: "The primary use had to be the stimulation of phonemic awareness, a direct and explicit approach to phonemic awareness instruction had to be utilized, each program had to have addressed the research-based principles suggested by the NRP as well as other research, and each had to be commercially available" (Santi et al., 2004, p. 190). The programs were compared on the basis of ease of use and delivery of instruction, and the design features of phonemic awareness instruction had to be supported by research evidence (Santi et al., 2004). A program that was favourably reviewed, based on the principles for effective phonological awareness instruction from previous research and the recommendations of the National Reading Panel, was the *Road to the Code: A Phonological Awareness Program for Young Children* (Blachman, Ball, Black, & Tangel, 2005).

Road to the Code was developed over a 10-year period. The authors initially developed the program for Grade 1 children who were having difficulty learning to read. As the authors developed the program, it became apparent that phonemic segmenting and blending activities, taught in combination with letter-sound awareness, could be implemented earlier. The effectiveness of *Road to the Code* was investigated in subsequent studies by the authors (Blachman, Ball, Black, & Tangel, 1994; Blachman, Tangel, Ball, Black, & McGraw, 1999).

Road to the Code was chosen for the proposed research because this phonological awareness training program incorporates principles that include the explicit teaching of one or two types of phoneme manipulations (e.g., initial sound

isolation and/or initial sound identification) and blending and segmenting in each lesson, phoneme manipulation with letters, flexibility for small-group instruction, suggestions for instructional adaptations based on the individual child's needs, and the potential for 20 hours of phonological awareness programming (Blachman et al., 1994; National Reading Panel, 2000; Torgesen & Davis, 1992). This program meets the Reading First criteria, meaning that the instructional design and strategies used in *Road to the Code* are consistent with current scientifically based reading research that is defined as research that applies rigorous, systematic, and objective procedures to obtain valid knowledge relevant to reading development, reading instruction, and reading difficulties (National Reading Panel, 2000).

The research conducted by Blachman and her colleagues (Blachman, Ball, Black, & Tangel, 1994; Blachman, Tangel, Ball, Black, & McGraw, 1999) found phonemic blending and segmenting skills and letter-sound awareness to be the best predictors of reading skills. Although participants were chosen on the basis of low receptive vocabulary scores, their research was conducted with children without identified or well-defined language impairment. Because it is unclear that this research is applicable to children with moderate to severe language impairment, it is worthwhile to investigate whether or not the program would be effective in facilitating the acquisition of phonological awareness skills for this population.

Purpose of the Study

There is increasing interest among speech-language pathologists and educators in learning whether or not an easy-to-implement phonological awareness intervention will result in increasing phonological awareness skills of kindergarten children with moderate to severe language impairment. Currently there is a limited knowledge base regarding the effectiveness of the implementation of phonological awareness intervention for this population. Research regarding the implementation of phonological awareness intervention for children with language impairment is essential to understand the effectiveness of this intervention for these children.

The purpose of this study was to investigate the effectiveness of phonological awareness intervention in improving the phonological awareness skills of kindergarten children with moderate to severe language impairment; specifically, the study assessed segmenting and blending at the phoneme level and the ability to link letters with sounds. Segmenting and blending at the phoneme level and letter-sound awareness are skills predictive of reading achievement according to extant research in the field.

The objective of the study was to compare the phonological awareness skills of a group of children with language impairment who received small group, direct and explicit phonological awareness intervention to the phonological awareness skills of a no-intervention control group with language impairment. Five specific research questions were formulated for this study:

1. Do kindergarten children with language impairment and low phonological awareness skills who receive small-group, direct, explicit phonological

awareness intervention show a greater increase in phonological awareness skills than children with language impairment who do not receive this intervention (no-intervention control group)?

2. Were the effects of the intervention maintained for phonological awareness performance after the intervention was discontinued?
3. Do kindergarten children with language impairment and low phonological awareness skills who receive small-group, direct, explicit phonological awareness intervention show a greater increase in print knowledge, letter-sound awareness, and nonsense word fluency than children with language impairment who do not receive this intervention (no-intervention control group)?
4. Were the effects of the intervention maintained for print knowledge, letter-sound awareness, and nonsense word fluency after the intervention was discontinued?
5. Are the non-responders to the intervention identified through discriminant analysis using the DIBELS subtests of Initial Sound Fluency, Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency?

A discussion of the methodological sequence of the present study will be presented in the next chapter.

CHAPTER II

METHODS

The purpose of this study was to examine the effectiveness of phonological awareness intervention for kindergarten children with moderate to severe language impairment and low phonological awareness skills. Specifically, children receiving a small group, direct, explicit phonological awareness intervention and a no-intervention control group were compared to determine which group showed a greater increase in phonological awareness, letter-sound awareness, print knowledge and nonsense word fluency skills. The methods will be described in the following sections. Appendix A Study Flowchart provides a time line for the events of the study.

Design

A pretest-posttest experimental group design with random assignment of participants to groups was used to examine the effects of the intervention. The performance of these students was compared to the phonological awareness skills of a control group that received no intervention.

Setting

Ten kindergarten classrooms in nine elementary city centre schools in an urban school district in western Canada participated in this study. All participants attended full-day kindergarten programs 5 days per week. Full-day kindergarten is offered at these high-needs schools, where most students come from low-income backgrounds.

Kindergarten students with challenging needs, including those with moderate to severe language impairment, attend these full-day programs in an inclusive classroom setting. Provincial education funding for qualifying students permitted the hiring of educational assistants who provided support and assistance for students with challenging needs, including students with language impairment. The number of students with challenging needs within each classroom varied. Administration and staff responsible for programming for these students reported there was a higher number of children identified as requiring Individualized Program Plans and support for program goals within these full-day kindergarten classrooms when compared with half-day kindergarten programs.

The same teacher taught the same students in each class during the 5-hour, full-day program 5 days per week. The same educational assistants also remained with the same students and classrooms. An outreach team consisting of speech-language pathologists, occupational therapists, and physical therapists provided assessments for the students and programming consultation to the teachers and educational assistants in these settings. The speech-language pathologists assisted the classroom staff and parents with the development and implementation of communication goals for children receiving provincial educational funding, including those students with language impairment.

Participant Characteristics

Table 1 reports the demographic information by group of children in the study (N = 30). Four students began the study at or above 72 months of age (1 at 73 months, 2 at 74 months, and 1 at 75 months). Two of these students were in the experimental group and two were in the control group. Sixteen males and six females were in the experimental group. Six males and two females were in the control group. Ten students (30%) were First Nations (i.e., Aboriginal, predominately Cree) Canadians. Seven First Nations children were in the experimental group and three were in the control group. Three students (10%) in the experimental group were Caucasian and resided in homes where the parents' first language was not English; however, the parents reported that the language spoken in the home was English. The remaining 12 students were Caucasian and spoke English as a first language.

Maternal education has been found to be related to language development (Dollaghan, Campbell, Paradise, Feldman, Janosky, Pitcarin, & Kurs-Lasky, 1999; Hart & Risley, 1995) and was identified as a variable of interest for description of the group. Parents reported maternal education, based on the highest grade completed, on the demographic information form.

Included in this study were children from minority and low socio-economic-status backgrounds; they had significantly delayed language skills and deficits in alphabetic and phonemic skills associated with poor reading outcomes.

Preschool children from lower socio-economic backgrounds demonstrate significantly lower levels of phonological awareness than children from higher socio-

economic backgrounds (Dickinson & Snow, 1987; Lonigan, Burgess, Anthony, & Barker, 1998; Raz & Bryant, 1990).

Because socio-economic status has been shown to be a relevant factor, at least in studies in which children have not been diagnosed with moderate to severe language impairment, this information was collected and confirmed to make sure the groups did not differ on this factor. Socio-economic information was gathered for all participants based on parents reporting occupations, which were then assigned values according to the Erikson and Goldthorpe Scale reported in The International Standard Classification of Occupations (Ganzeboom, Treiman & Donald 1996). A list of numerical values for occupations, weighted equally for education and income, was developed for this scale. Values on the Erikson and Goldthorpe Scale range from 1, general worker (e.g., warehouse worker, taxi driver, construction worker, server in restaurant) to 9, senior official, executive, or large business owner (e.g., legislator, senior civil servant, judge, senior officer, or owner of a large company). The means and standard deviations, based on occupations as reported by the parents on the demographic form, were matched to values on the Erikson and Goldthorpe Scale (Ganzeboom, Treiman & Donald 1996).

Table 1. Demographics of Children by Group (N = 30).

	Experimental	Control
Age		
Mean	66.68	65.63
SD	4.80	4.68
Gender		
Male	16	6
Female	6	2
Race and Language Spoken in the Home		
Aboriginal (English speaking)	7	3
Caucasian (English speaking)	12	5
Caucasian (English spoken in the home)	3	
Total	22	8
Mother's Education Based on Grade Level		
Mean	11.45	11.25
SD	1.40	1.28
Socio-Economic Status		
Mean	3.61	3.43
SD	2.25	1.59

Participant Recruitment

Participant recruitment occurred in five steps. First, the University of Alberta's Health Research Ethics Board reviewed and approved the protocol for the study (see Appendix B). Second, the administrator of the outreach team serving potential participants informed each school's principal and kindergarten teacher of the proposed

study. Third, speech-language pathologists assigned to the schools recommended potential candidates for the study based on the inclusion criteria that had been previously presented to them by the researcher. Fourth, an information package informing parents of the study and requesting their consent for their child's participation was sent. Fifth, the parental consent form and demographic form that was included in the information package was collected from the parents consenting to their child's participation in the study (see Appendix C).

Screening

Children were eligible for the study based on the following criteria: (a) receptive or expressive language percentile rank score cut-offs at or below the 1st through 6th percentile as measured by the Clinical Evaluation of Language Fundamentals (CELF P-2) (Wiig, Secord, & Semel, 2004); (b) hearing within normal limits; (c) nonverbal performance score on the Kaufman-Brief Intelligence Test-2 (KBIT-2) no lower than 70); (d) low phonological awareness score as evidenced by either a score at or below the 25th percentile as measured by the Test of Preschool Early Literacy (TOPEL) pre-published version (Lonigan, Wagner, Torgesen, & Rashotte) Phonological Awareness subtest or the presence of at risk indicators in two or more phonological awareness areas as measured by the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Good & Kaminski, 2002) subtests; (e) may have articulation delay or phonological disorder, as documented by the outreach team speech-language pathologists, but not so severe as to preclude understanding responses; (f) not yet reading words, as reported by the teachers and outreach team

speech-language pathologists; (g) between 5 and 6 years of age; and (h) English spoken in the home. Many of the participants in this study presented with moderate to severe delay in fine motor skills as documented by the outreach team occupational therapists.

From October through mid-December, a norm-referenced, individually administered standardized test, the CELF P-2, was administered to all children referred by the kindergarten classroom teachers to the outreach team speech-language pathologists. The CELF P-2 is used for identifying, diagnosing, and performing follow-up evaluations of language deficits in children ages 3 to 6 years. Test-retest reliability coefficients for the 5;0-5;11 age range are from .79 to .95. Administration of the CELF P-2 served as both a measure to identify children eligible for provincial educational funding and an intake screener for the current study.

Children referred to this study from the cooperating program qualify for services if they present with developmental language scores of 1.5 standard deviations or greater below the mean (Alberta Education, 2005; Alberta Health Standards, 1993). This language score criterion suggests that the participants in this study had slightly more severe language impairment than would be found in the whole population of children with language impairment. Developmental receptive or expressive language percentile rank score cut-offs for this population are at or below the 1st percentile for children in the severe language impairment category and at the 2nd through 6th percentile for children in the moderate to severe language impairment category (Alberta Education, 2005; Alberta Health Standards, 1993).

Seven students presented with nonverbal performance standard scores lower than 85. The number of students and the corresponding nonverbal performance score range for this group of seven was 1 at 75, 5 at 78, and 1 at 83. There was no difference between the groups on this measure (Kaufman Brief Intelligence Test-2 (KBIT-2) Matrices Subtest $p = .405$). Five students with nonverbal performance scores below 85 were in the experimental group, and two of these students were in the control group.

Students with low phonological awareness skills were eligible for this study. Eligibility was determined in one of two ways. Phonological awareness scores at or below the 25th percentile (standard score at or below 90) TOPEL met the first criterion. Children who score at or below the 25th percentile on tests of phonological awareness ability are considered to be at risk for reading difficulties and to be able to benefit from targeted intervention to increase phonological awareness (Robertson & Salter, 1997).

If a student's performance on the TOPEL phonological awareness subtest was at the 26th percentile or above, then the following scores on two of the four subtests of the DIBELS met the second criterion for participation: Initial Sound Fluency (<10 per min); Letter Name Fluency (<15 per min); Phoneme Segmentation Fluency (<7 per min); and Nonsense Word Fluency (<5 per min). According to the DIBELS authors, students with at-risk indicators in two or more areas generally require intensive intervention to meet early literacy goals (Good & Kaminski, 2003).

A parent information package including an information letter, consent form, and demographic information form was sent to parents requesting permission for their child to participate in the study (n = 43). Permission for participation in the study was

obtained for 32 of 43 eligible children. One child failed the hearing screening, resulting in a total of 31 participants.

Assignment of Participants to Groups

Two children were randomly assigned to the experimental group for every one assigned to the control group. This resulted in twenty-two students being assigned to the experimental group and nine to the control group. One child, a boy, in the control group left the school district in the final week of March, resulting in a total of 30 participants in the study.

The size of the sample and the unequal group size of 22 students in the experimental group and 8 students in the control group were due to several factors. First, there was a decrease in the number of students presenting with language impairment and attending full-day kindergarten programs in the schools involved in the study. The outreach administrator and research liaison had advised that implementing the study in full-day kindergartens would more easily permit the implementation of the intervention because of the longer 5-hour program day and, historically, a higher number of children with language impairment were enrolled in these classes. Second, there were a larger number of children than had been anticipated for whom the first language spoken in the home was not English. Third, concomitant factors, such as low cognition, significant behavioural difficulties, and pre-existing medical conditions, further narrowed the list of possible potential candidates. Thus it was decided to include more children in the experimental group to maximize the number who received the intervention.

Data Collection

This study included 6 dependent measures. The DIBELS Initial Sound Fluency, Phonemic Segmentation Fluency, Letter Naming Fluency, and Nonsense Word Fluency measures were administered 7 times during the study. The Phonological Awareness and the Print Knowledge subtests of the TOPEL were administered at pre-intervention and post-intervention.

Data were collected during seven periods of the study: (a) pre- intervention; (b) intervention probes 1, 2, and 3; (c) post-intervention; (d) post-intervention maintenance 1, and; (e) post-intervention maintenance 2. DIBELS progress monitoring measures were administered on days 24, 47, and 65 of the intervention to assess growth on Initial Sound Fluency, Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency. The first DIBELS post-intervention probe was administered 13 instructional days after the study ended. The second DIBELS post-intervention probe was administered 11 instructional days later (see Table 2 for Schedule of Assessments).

Pre-intervention Assessments

In late December, four registered speech-language pathologists and three second-year speech-language pathology masters students individually administered the pre-intervention tests to the students who were eligible to participate in the study. The speech-language pathology masters students administered the tests with the

supervision of the researcher, a registered speech-language pathologist. Further information on the assessors and their training will be presented in the assessment fidelity section. The tests were administered in a quiet location in the children's schools. To facilitate the children's participation, the examiners avoided conducting assessments during breakfast, snack, lunch, recess, or at the end of the day.

Assessments are described in the sequence in which they were administered to the students:

1. Hearing screenings were conducted using portable audiometers to screen participating children for normal hearing (20 db level at 1000, 2000, and 4000 Hz) (Hearing Identification Procedures, Speech, Language, Hearing Association of Alberta, 2001). The audiometers were professionally calibrated prior to use in the study to ensure accurate screening. One student who did not pass the hearing screening prior to the initiation of the intervention was not eligible for participation in the study. Parents of this student were contacted by the classroom teacher and provided with information about how to obtain a full hearing assessment for their child.

2. The KBIT-2 Matrices, a brief, individually administered measure of nonverbal intelligence with norms beginning at age 4 years, was given to potential participants. The KBIT-2 is designed for screening to identify high-risk children who require subsequent in-depth evaluation. The Matrices subtest is a nonverbal measure comprising items involving meaningful pictures (people and objects) for children in the 4- to 7-year range. The internal consistency reliability for age 5 years is .78. Test-retest reliability is .76 for children age 4 to 12 years as reported in the KBIT-2 manual.

3. The 36-item Print Knowledge subtest of the pre-published version of the TOPEL was individually administered to measure early knowledge about written language conventions and form as well as alphabet knowledge. All items have accompanying illustrations in the stimulus manual. The examiner asks the child to point to aspects of print (e.g., "Find the picture that has letters in it."), identify letters (e.g., "Which is a letter?"), written words (e.g., "Which can you read?"), point to specific letters (e.g., "Which one is *M*?"), name specific letters (e.g., "What is the name of this letter?"), say the sounds associated with specific letters (e.g., "What sound does this letter make?"), and identify letters associated with specific sounds (e.g., "Which one makes the /b/ sound?"). The internal consistency reliability of the items for the print knowledge subtest of the TOPEL at age 5 years is .96. The test-retest reliability is .89, and the interscorer reliability is .96 as reported in the test manual (Lonigan et al.).

4. The 27-item Phonological Awareness subtest of the pre-published version of the TOPEL was individually administered to measure elision and blending abilities. The first three items of the 12-item elision task included deletion of a word in compound words (e.g., *sun-flower, snow-shoe, see-saw*). The child was asked to point to the picture of the word that remained after one word was taken away (e.g., *flower, snow, see*). For the next three items, the child was asked to point to the picture of the word that remained when the final consonant in the word was taken away (e.g., *lamp* without /p/). The remaining six items in the elision task were presented in the same format as the first six items but without pictures. The first three items of the 15-item blending task included blending of compound words (e.g., *hot-dog, star-fish, door-*

knob). The next three items included blending the initial part of the word with the final consonant (e.g., *Go-t, Ca-t*). The next 7 items in the blending task are presented in the same format as the first 6 items but without pictures. The final two items included blending three sounds in words (e.g., *b-i-ke, f-i-sh*). Responses were scored as correct only if they matched the target responses listed on the test form. The internal consistency reliability of the items for the phonological awareness subtest of the TOPEL at age 5 years is .88. The test-retest reliability score is .83, and the interscorer reliability is .97 as reported in the test manual.

The Print Knowledge and Phonological Awareness subtests of the TOPEL were individually administered according to standardized instructions. Estimated administration time is 10 minutes per subtest. Sufficient time was scheduled so that all the subtests were completed. Additional time was scheduled to allow for a break if the child showed signs of fatigue. The outcome measure consisted of the total number of correct items on the subtests.

Also in late December, ten educational assistants individually administered pre-intervention assessment probes utilizing the DIBELS. Subtest descriptions are presented in the sequence they were administered to the students.

5. The Initial Sound Fluency (ISF) subtest is designed to measure the student's ability to match and produce initial phonemes or blends. In the ISF subtest, the examiner asks the child which item in a group of four pictures begins with a specified sound or to produce the sound for a picture labelled by the examiner. The student answers 16 questions, presented in sets of 4 questions. To answer the first 3 questions in each set, the student selects a picture that begins with a target sound. To answer the

fourth question, the student produces the initial phoneme or blend for a given picture. A formula is used to calculate the student's ISF score. The formula incorporates both the number of questions answered correctly and the cumulative time required to respond to all 16 questions (Farrell, Hancock, & Smart, 2006).

6. The Letter Naming Fluency (LNF) subtest is designed to measure whether or not the student can accurately and fluently name randomly sorted uppercase and lowercase letters. The score is the number of correct letter names the student states at the end of 1 minute. The examiner stops administering the assessment if the student does not accurately name any of the 10 letters in the first line.

7. The Phonemic Segmentation Fluency (PSF) subtest is designed to measure the student's ability to segment one-syllable words with two to five phonemes into component parts. The examiner asks the student to segment each sound in the word (e.g., the examiner says "sat," and the student earns 1 point for each correctly segmented sound: "/s/ /a/ /t/" for three correct points). The student's score is the number of correctly segmented sounds in 1 minute. The examiner stops administering the assessment if the student does not accurately provide any sound segments in the first five words.

8. The Nonsense Word Fluency (NWF) subtest measures two skills: (1) whether or not students can name letter sounds, and (2) whether or not students can blend sounds to read unfamiliar words with short vowels in consonant-vowel-consonant or vowel-consonant syllable patterns. Students were presented with a page of randomly ordered vowel-consonant and consonant-vowel-consonant nonsense words and were asked to say the sounds. One point is awarded for each letter sound in

the nonsense word (blending the sounds is not required), and the total score is the number of letter sounds the student says correctly in 1 minute. The student is given credit regardless of whether the letter is read correctly as an individual sound or is blended into a word or word part. The maximum number of points a student can receive is the number of letters in the word. The examiner stops administering the assessment if the student gives no correct sound segments in the first five words.

Assessment Fidelity

Speech-Language Pathologist Assessor Training

Seven assessors volunteered to provide the pre-intervention assessments for this study. To ensure fidelity of assessment implementation, assessors participated in 5 hours of assessment training. In October, a 3.5-hour assessment in-service on the assessment procedures, practice administration and scoring of the tests, and calculating the test scores was provided to four second-year speech-language pathology masters students and three registered, experienced community speech-language pathologist assessor volunteers. This in-service was conducted by the researcher according to the information provided in the test manuals. Additionally, accredited and experienced audiologists provided a 1.5-hour in-service on the review of hearing identification (screening) procedures and practice administration for the masters students (Hearing Identification Procedures, Speech and Hearing Association of Alberta, 2001).

Educational Assistant Assessor Training and Assessment Fidelity Sessions

Ten educational assistants participated in implementing assessment probes based on their assignment in classrooms that included participants in the study. The educational assistants administered two pre-intervention, three intervention and two post-intervention probes utilizing the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Good et al., 2002). Fidelity of assessment implementation for the DIBELS was facilitated through the educational assistants participating in 4 hours of intensive training on the four DIBELS subtests. In-servicing was conducted by the researcher according to the DIBELS manual (Farrell, et al., 2006) and the DIBELS implementation video (Good & Kaminski, 2004). An overview of each DIBELS subtest was followed by participants viewing examples of administration of the subtests. The educational assistants scored along as the subtests were administered, and compared their scoring with the examples presented in the implementation video. Inter-rater reliability was facilitated through whole-group discussion regarding rationale for scoring the subtest tasks and practice with calculating and recording the subtest scores. Opportunities were provided for the educational assistants to practice administering the DIBELS assessment subtests with their colleagues. The researcher emphasized the necessity for the educational assistants to practice scripted subtest administration and following the scoring rules prior to administering the subtests to study participants to facilitate assessment fidelity.

The researcher filmed and completed one observation of each educational assistant conducting a DIBELS assessment session to ensure the assessment was implemented in the way it was intended. The Observer's Checklist for the DIBELS

was implemented for these fidelity sessions (Farrell, et al., 2006) (see Appendix D). The checklist was discussed with the educational assistant after the filming and the researcher provided feedback regarding the administration and scoring of the tests.

After the administration of the third DIBELS probe, the researcher again met with the whole group of educational assistants to present filmed examples of the educational assistants administering the DIBELS subtests to the participants in the study. Specific aspects of the assessment process, including the consistent following of the script, the accurate use of the stop watch, and the accurate scoring, calculating, and recording the test results, were reviewed with the educational assistants.

The educational assistants scored along side their colleagues as the subtests were administered by the latter. Whole-group discussion regarding the rationale for scoring the subtest tasks and a comparison of the calculation and the recording of the scores followed each subtest administration example. The intent of this session was to address assessment fidelity by ensuring that the administration and scoring of the DIBELS subtests was consistent across educational assistants. These assessment fidelity observations and the use of the DIBELS observer's checklists also served to evaluate the educational assistants' uptake of the DIBELS in-service information.

Post-intervention Assessments

Six assessors volunteered to administer the post-intervention assessments in the final week of the intervention. The same three community speech-language pathologists conducted the post-intervention assessments with the same students they

had assessed for the pre-intervention assessments. Three new student assessors provided post-intervention testing using the TOPEL. In April, a 2.5-hour assessment in-service on the administration of the TOPEL was provided to the group of three second-year speech-language pathologist masters students. All assessors were blind to the assignment of the students to the experimental or control groups. There were 18 weeks between the pre-intervention and post-intervention administration of the Phonological Awareness and Print Knowledge subtests of the TOPEL. Given this interval, it was not anticipated that practice effects would influence the results of the test scores.

Parental consent had been obtained for audiotaping the administration of the TOPEL. Spoken responses were recorded at the time of the administration of the TOPEL subtests by a high quality digital audio recorder (Olympus VN-480 PC).

To establish inter-rater reliability of the scoring procedures, 25% (15) of the total 62 pre- and post-intervention test protocols for the TOPEL were randomly selected for independent scoring by another registered speech-language pathologist (not the researcher or an assessor) experienced with the assessment of language-impaired preschoolers, using the audiotapes. The independent scorer was blind to whether the children were assigned to the experimental or the control group. The percent of point-to-point agreement on whether the responses were scored correctly or incorrectly for the pre- and post-intervention scoring ranged from .99 to 1.00.

The following section provides a description of the components of the phonological awareness intervention program, *Road to the Code: A Phonological*

Awareness Program for Young Children (Blachman, Ball, Black, & Tangel, 2005) selected for implementation in this study, and the implementation procedures.

Phonological Awareness Intervention Components

Say-It-And-Move-It

The Say-It-and-Move-It activity was designed to heighten awareness of the phonemes in spoken words. Each child was given a Say-It-and-Move-It sheet with a picture on the top half of the page and an arrow drawn in a left-to-right direction at the bottom of the page. The students were taught to segment words by first repeating a target word and then moving one disk down from the picture to the arrow for each sound that they said in the word. The educational assistant provided scripted directions for each task. First, children learned to represent single sounds (e.g., 'a'), then double sounds (e.g., 'a-a'), then two phoneme items (e.g., 'at'), and finally three phoneme items (e.g., 'sat'). During the sixth week of instruction, one letter was placed on the disk. The letters were selected from among the eight letters introduced during the intervention (*a, m, t, i, s, r, f, b*). Gradually, children were given enough letter tiles to produce a consonant-vowel-consonant real word. After the word was segmented, it was blended (spoken at normal speed). Each Say-It-and-Move-It activity took 7 minutes of each 20 minute lesson.

Letter Names and Sounds

A letter name and sound instruction exercise was included in each lesson to teach the children that all letters have both a name and a sound. Explicit connections

were repeatedly made between the letter name and sound (i.e., "All letters have both a name and a sound."). Illustrated alphabet cards were used to reinforce initial sounds. After initial introduction, each letter and letter sound was reviewed in subsequent lessons across the remainder of the program. The authors (Blachman, et al., 2005) noted that numerous phonetically regular consonant-vowel-consonant words could be made using these letters and the knowledge of these letter sounds and that knowledge of these sounds would be useful when children begin to read words. A variety of game-like activities (e.g. hand clapping, sound bingo, go fish, concentration, letter-sound matching, and sound boards) enhanced instruction in the correspondence between sound segments in words and the letters that represented the sound segments. Each Letter-Sound activity took 7 minutes of each 20 minute lesson.

Phonological Awareness Practice

The activities in this component of the lesson provided practice with a range of simple phonological awareness tasks. For example, in one activity, the children grouped words on the basis of rhyme or alliteration in a sound categorization task. In another activity, cards with a picture representing the word on the top half of the page were presented to the children. Underneath each picture was a series of boxes representing the number of phonemes in the word. Each box in a box card (Elkonin card) represented one phoneme, or sound. Children learned to say the word slowly and simultaneously move a disk to the appropriate box to represent each phoneme in the word. The children blended the sounds together to create the word. Six minutes of each 20 minute session was spent on this component of the lesson.

The script provided for each lesson activity was read by the educational assistant and served to ensure consistency of instructional language across the groups. The educational assistants set a timer at the beginning and end of each component of the lesson and recorded the total number of minutes of daily programming time for each lesson. The researcher collected this information at the end of each 4-week period. The researcher also recorded the period of time for each component of the lesson and the total session time during the treatment fidelity observations. This provided a check to ensure consistency in the amount of time each component of the lesson was administered across the groups.

Implementation Procedures

Educational Assistants

Ten educational assistants assigned to classrooms with participants in the study implemented the *Road to the Code* program. The educational assistants varied in their formal training and years of experience working with kindergarten children. The range of years of education included one educational assistant with a Grade 12 diploma and three educational assistants with undergraduate university degrees. Two educational assistants reported thirteen years of education. Four educational assistants held diplomas from post-secondary institutions in areas such as early childhood development, educational assistant, and nursing assistant. The range of educational assistants' experience working with kindergarten children ranged from 4 months to 60 months with a mean of 30 months.

To standardize pronunciation, key words identified as helpful in remembering the correct production of the short vowel sounds from the *Road to the Code* manual were reviewed with all of the educational assistants during the in-servicing and as necessary by the researcher during the treatment fidelity sessions. The same educational assistant implemented the intervention with the same students in the intervention groups for 14 weeks. One educational assistant began a partial leave on day 40 (of 67 days) of the intervention. This educational assistant continued to implement the lessons on Thursdays and Fridays. The implementation of the lessons was shared with a second educational assistant, at the same school, who had an early childhood development diploma and background experience in working with kindergarten students. This educational assistant implemented the lessons on Mondays, Tuesdays, and Wednesdays. The transition to and consistency of programming with the new educational assistant was facilitated by the researcher through the provision of in-service training and implementation of treatment fidelity sessions at the beginning of the transition.

Groups

The number of treatment groups formed in each classroom depended on the number of children in each classroom that participated in the study. The goal was to provide an educational assistant–child ratio of 1:2 in each group. Of the 10 classrooms with participating students, 5 had both treatment and control students, 4 had treatment students only, and one had one student who was a control student. Two of the students in this study received individual programming due to one of two reasons: either no

other children in the classroom met the inclusion criteria or parental consent was not secured for other eligible children.

Length of Intervention

Instruction began January 11, 2007 and concluded April 27, 2007. The lessons were implemented for 14 weeks, 20 minutes per day, 5 days per week, for a total of 67 days, which corresponds to $M = 18.45$ hours ($SD = 4.64$) of phonological awareness intervention. The range of hours of intervention was 12 hours and 45 minutes to 21 hours and 30 minutes. Illness on the part of the children or educational assistant or low attendance accounted for the lower number of intervention hours.

Instructional Setting

The setting for instruction was established outside participants' regular classrooms to prevent migration effects that would have occurred if the intervention had been implemented in the classroom and to attempt to provide a quieter, less distracting acoustical environment. Depending on space availability within the school, most students received the lessons in the same room each day. Some students received the lessons in a different location on a few occasions. All students, including the no intervention control group, received classroom phonological awareness programming as reported by the teachers in the kindergarten teacher questionnaire. The results of the questionnaire provided a description of the phonological awareness instruction in the kindergarten classrooms and will be reported in the next chapter.

Scheduling of the Lessons

The authors of *Road to the Code* noted that, depending on the skill level of the students, it was possible that more than 11 weeks would be needed to introduce the program concepts. Blachman et al. (2005) also noted that it was appropriate to repeat a lesson or conduct the identical lesson two or more days in a row, if that is what students required to demonstrate a high rate of correct responses. The researcher developed the lesson delivery schedule in keeping with the principles of instruction appropriate for children at risk for reading difficulties. Intensive scheduling ensuring predictable and extensive opportunities for scaffolded practice and ample opportunities for error correction and feedback were the instructional principles considered when the monthly lesson schedules were drafted (Foorman & Torgesen, 2001). The authors of *Road to the Code* noted that the most important factors contributing to the success of students using this program included proper pacing and a balance among activities that were challenging but not frustrating (Blachman et al., 2005).

The participants in this study presented with moderate to severe language impairment and it was recognized that they would need additional time and many repetitions to develop awareness that spoken words can be segmented into phonemes and that these segmented units can be represented by the letters of the alphabet. Lessons that included a note from the author indicating that the lesson was a major transition point or suggested scaffolded instruction within the lesson's activities were conducted two days in a row. Some examples of lessons that were conducted twice include these: the first time that three-phoneme words were introduced; introduction of

the use of a disk with a letter name on it; the first time both sound categorization by rhyme and by initial sound was introduced in the same lesson; and the introduction of a new activity (i.e., Elkonin cards, Sound Boards) (Blachman et al., 2005).

All forty-four lessons from *Road to the Code* were taught to the children receiving the intervention. Twenty-three complete lessons (52%) were taught on successive days. The entire lesson was repeated rather than taught over the course of two days. Twenty-one lessons (48%) were not repeated, rather each lesson was taught within one twenty-minute lesson period. Each educational assistant followed the lesson schedule so that the lessons were presented on approximately the same day across the groups. In cases of absences, the children were scheduled for two sessions per day until they caught up to the other students. In other cases—when extended or frequent absences occurred, for example—the educational assistants provided as much programming as schedules would permit on the days the children attended school. Lessons were not scheduled during breakfast, lunch, snack, or recess.

Intervention Fidelity

Treatment fidelity is defined as the "degree to which an independent variable is implemented as intended" (Peterson, Homer, & Wonderlich, 1982). Documentation of treatment fidelity strengthens the internal validity of an intervention study (O'Connor, Jenkins, & Slocum, 1995). Parental consent to film instruction for purposes of facilitating treatment fidelity was obtained on the parental consent form. Throughout the 14-week study, the researcher conducted 54 fidelity-of-implementation

observations, representing 10% of the total number of intervention sessions. Treatment fidelity visits consisted of the researcher filming the 20-minute phonological awareness intervention session and, during the filming of the lesson, completing a treatment fidelity checklist (see Appendix E). The researcher then met with the educational assistant immediately after the lesson to review the film. The film was paused at the end of each of the three lesson segments (i.e., Say-It-and-Move-It, Letter-Sound, and Phonological Awareness), and the researcher then reviewed the checklist with the educational assistant and provided feedback for that segment of the lesson. The researcher used an observational checklist that included criteria for the instructional activities. Instructional behaviours were rated on a scale of 0–4, with higher scores indicating better performance. Across the 54 observations, treatment fidelity was 100% per lesson. To establish inter-rater reliability with respect to lesson implementation, 10 filmed sessions representing approximately 20% of the total 54 filmed sessions were randomly selected for independent scoring by a registered speech-language pathologist and independent scorer. The independent observer was asked to observe the sessions and complete the observational checklist with the researcher. Reliability scores on observations indicated 100% agreement. The independent observer noted that, across the filmed sessions, each educational assistant's strict adherence to the script for each component of the lesson contributed to the overall fidelity of implementation.

All educational assistants consented to being included in an email listserv that facilitated an exchange of information when questions or concerns arose regarding assessment administration or program implementation. All educational assistants

consented to having their questions or comments and the researcher's responses posted and sent to all other educational assistants participating in the study. This ongoing communication likely contributed to overall fidelity of implementation.

Data Analysis

Descriptive and inferential statistics were used to examine the effects of intervention on phonological awareness and letter-sound awareness performance for kindergarten children with language impairment and low phonological awareness. Statistical analyses were computed using the Statistical Package for the Social Sciences (SPSS) Version 15.0 (2006).

There were a number of potential ways to analyze the data from this study. Each approach to examining the data was carefully considered. The intent was to determine the most appropriate technique. Use of a trend analysis might have been an appropriate choice for the purpose of finding the most reasonable description (e.g., linear, nonlinear or quadratic) of continuous data based on the number of turns seen across the level of the independent variable (Portney & Watkins, 2000). This analysis was not used because the research questions focused on effects of the treatment, which was most appropriately addressed by a group comparison post-treatment.

A multivariate analysis of variance (MANOVA) is used when the design involves more than one dependent variable. The dependent variables are analyzed simultaneously. Use of a MANOVA for analyzing the data was considered; however, the small and unequal sample size in this study precluded use of the MANOVA.

Further, Brace, Kemp, & Snelgar (2006) note that if the dependent variables are correlated, and MANOVA shows a significant result, then it would be difficult to clarify the contribution of each of the individual dependent variables to this overall effect.

Calculating the difference between the pre-test and post-test scores was considered to determine the extent to which performance changed. However, according the Brace, Kemp, and Snelgar (2006), calculating difference scores would not have eliminated the variation present in the pre-test scores. Eliminating this variation permitted the focus on the effect of the students participating in the phonological awareness intervention.

A conservative approach was taken in order to control for variation present in the pre-test scores. Each dependent variable was analyzed using a separate analysis of covariance (ANCOVA) to examine whether there were statistically significant differences between the two groups. ANCOVA allowed the investigation of the effect of the intervention on each post-test score while removing the effect of the pre-test score by using it as the covariate (Brace, Kemp & Snelgar, 2006).

The between-groups factor, with pretest as covariate, was used for two comparisons for each variable. The first, and main, comparison was effectiveness of intervention during the final week of the intervention, for which the dependent variable was intervention probe 3; the second comparison was the maintenance of the intervention one month after the intervention ended, for which the dependent variable was maintenance probe 2. Additionally, data from the probe given in the last week of the intervention were used to assess the accuracy of classification of children into pre-

existing groups—in this case, children who received the intervention and children in the no-intervention control group—to identify children in the experimental group who did not benefit from the intervention.

The standardized effect size was calculated for each measure to gain more information about the mean difference between the two groups.

Discriminant analysis was used to identify the non-responders to the intervention using the DIBELS subtests. An odds ratio was used to highlight the effects of the phonological awareness measures used to classify children. The results of these analyses are presented in the next chapter.

Ethical Considerations

Approval for conducting this study was obtained through the Health Research Ethics Board, University of Alberta. Approval to conduct the study at the school district level was obtained through the Co-operative Activities Program (CAP) Faculty of Education, University of Alberta and through the research liaison at the school district in which the study was conducted. Parental consent was obtained via a consent form. Participation in the study was voluntary, and consent forms contained assurances of confidentiality and the right of parents and children to withdraw from the study at any time. Child assent for participation in the assessment and intervention was obtained via verbal consent. A script requesting assent was read to each child individually prior to testing and participation in the first lesson of the intervention (see Appendix F).

CHAPTER III

RESULTS

Results are presented in two sections: (a) group equivalence at pre-intervention, and (b) descriptive and inferential statistics that address the research questions for this study.

Group Equivalence at Pre-intervention

A difference between groups at pre-intervention, and whether or not differences in test scores and the size of the groups affected group equivalence, were important concerns. Independent t-test analysis was conducted to examine whether there was a significant difference between the two groups. The results of the analyses revealed no statistically significant differences between the experimental and the control group prior to intervention on eight measures (See Table 4).

Table 4. T-Tests of Pre-intervention Measures

Measure	Experimental Mean	*SD*	Control Mean	*SD*	*t*	*p*
Age	66.68	4.81	65.63	4.69	.536	.654
SES	3.61	2.26	3.44	1.59	.202	.218
Mother's Ed.	11.45	1.41	11.25	1.28	.360	.636
KBIT-2	91.68	11.73	91.25	7.48	.097	.405
TOPEL Print	20.00	9.76	15.88	9.73	1.024	.980
TOPEL PA	14.45	3.26	12.00	4.47	1.650	.268
CELF Rec.	73.86	8.99	74.50	13.25	-.151	.180
CELF Exp.	75.95	9.67	70.38	12.27	1.302	.696

Note: The *df* for all measures is 28. Variances for all comparisons were equal.

Preliminary Analyses

To ensure the accuracy of the data file, all test forms were reviewed and the original data were proofread and compared against the computerized data file. Missing values were noted for the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Initial Sound Fluency, Letter Naming Fluency, Phonemic Segmentation Fluency, and Nonsense Word Fluency subtests at pre-intervention time 1 for five students due to illness or absences. Therefore, data from time 1 were not used. Data from pre-intervention time 2 were used for the first data point to ensure a greater degree of accuracy of phonological awareness and letter-sound awareness skill level prior to beginning the intervention. There were no other missing values for any of the other test measures after pre-intervention time 1.

Fundamental to some multivariate procedures and most statistical tests of their outcomes are the assumptions of multivariate (a) normality, (b) linearity, and (c) homoscedasticity (Tabachnick & Fidell, 2007). Given there were only 2 groups, the relationship will always be linear. These assumptions were examined across all the dependent variables prior to running the main analysis and are reported as follows.

Two components of normality, skewness and kurtosis, were used to assess normality of variables. Histograms and the Kolmogorov-Smirnov statistic were also used to assess normality. Results indicated that the variables were non-normal in different ways (i.e., some positively and some negatively skewed). Kurtosis values were both above and below zero and had the potential to produce an underestimate of the variance of a variable.

Homegeneity of regression tests whether or not 2 variables have similar regression lines and is used to note whether a variable can be used as a covariate. Homogeneity of regression was conducted using SPSS version 15.0 (2006) to examine whether there were differences between the groups. The results of the analyses revealed the assumption of homogeneity of regression was violated on two dependent measures: Phonemic Segmentation Fluency Intervention Probe 3 and Nonsense Word Fluency Intervention Probe 3.

Tabachnick and Fidell (2007) noted that transformations of the data are a remedy for outliers, and failures of normality, linearity, and homoscedasticity. Caution must still be employed in the use of transformations due to the increased difficulty of interpretation of transformed variables. However, transformations may improve the analysis and reduce the impact of outliers. Thus, transformation of variables is recommended in all situations of departure from normality unless there is some reason not to do so (Tabachnick & Fidell, 2007). Variables differ in the extent to which they diverge from normal. A square root transformation was applied to 4 variables in which homogeneity of regression was violated. These included two covariates: Phonemic Segmentation Fluency Pre-intervention and Nonsense Word Fluency Pre-intervention, and two dependent variables: Phonemic Segment Fluency Intervention Probe 3 and Nonsense Word Fluency Intervention Probe 3. The transformation resulted in homogeneity of regression. Homogeneity of variance was noted, meaning that the variability of scores for each of the groups was similar.

A square root transformation was applied and resulted in homogeneity of regression. Homogeneity of variance was noted, suggesting that the variability of scores for each of the groups was similar.

Analyses of the Data

As noted in the previous chapter, each dependent variable was analyzed using a separate analysis of covariance (ANCOVA) to examine whether there were statistically significant differences between the two groups.

Standardized effect size provides an estimate of the magnitude of differences between groups, independent of statistical significance. The larger the effect size, the greater the effective difference between the groups. Interventions that result in large changes are more likely to produce significant outcomes than those with small or negligible effects (Portney & Watkins, 2000). The standardized effect size, Cohen's *d,* was computed by dividing the mean difference by the pooled standard deviation (Cohen, 1988). Conventional guidelines consider effect sizes as "large" if the intervention versus control difference is at least 0.80, "moderate" if the impact is 0.50 to 0.80, and "small" if the impact is 0.20 to 0.50. These guidelines state that anything smaller than 0.20 is considered trivial (Becker, 2000; Cohen, 1988; Meline & Wang, 2004). These adjectives are used throughout the following section to characterize impacts from the phonological awareness intervention.

Organization of Results

For each variable, the results related to differences at the end of the intervention are provided first, followed by statistical analyses for the effects of the intervention at the second maintenance probe. Table 5 provides a summary of the results of ANCOVA analyses. The results were obtained to answer the following research questions:

Research Question One

Do kindergarten children with language impairment and low phonological awareness skills who receive small-group, direct, and explicit phonological awareness intervention demonstrate a greater increase in phonological awareness skills and letter-sound awareness than children who do not receive this intervention?

Research Question Two

Were the effects of instruction maintained for phonological awareness and letter-sound awareness performance one month after the intervention was discontinued?

Differences Between Groups on Measures of Phonological Awareness

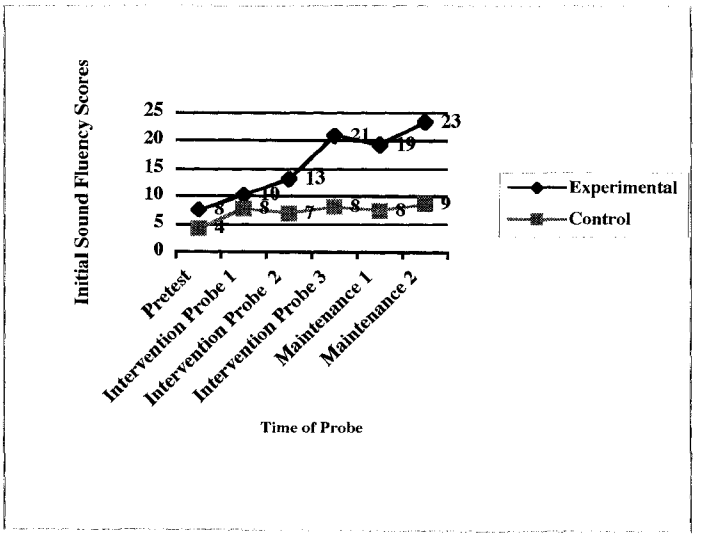
Initial Sound Fluency (ISF)

The probe data for ISF is displayed in Figure 1. ANCOVA was used to examine the effect of the intervention on the children's ability to quickly recognize and produce the initial sound of a word. The independent variable was group (experimental or control), and the dependent variable was the ISF Intervention Probe 3

scores or the Maintenance Probe 2 scores. The pre-intervention scores of the ISF measure were entered as the covariate.

At Intervention Probe 3, the analysis revealed a statistically significant difference between the groups on Initial Sound Fluency, $F(1, 27) = 16.316$, $p < .001$, $d = 1.714$. The effect size indicates a large effect of the intervention on this variable. At Maintenance Probe 2, the analysis revealed a statistically significant difference between the groups on Initial Sound Fluency $F(1, 27) = 7.978$, $p = .009$, $d = 1.142$. The effect size indicates a large effect of the intervention on this variable. Figure 1 illustrates the difference between children in the experimental group and in the control group on this measure.

Figure 1. Children's Performance on the Initial Sound Fluency Measure from Pre-intervention to Maintenance Probe 2.



Kindergarten students are expected to achieve an Initial Sound Fluency score of 25 or higher by the middle of kindergarten in order to be on track to meet the Phonemic Segmentation Fluency benchmark score at the end of kindergarten. Thus,

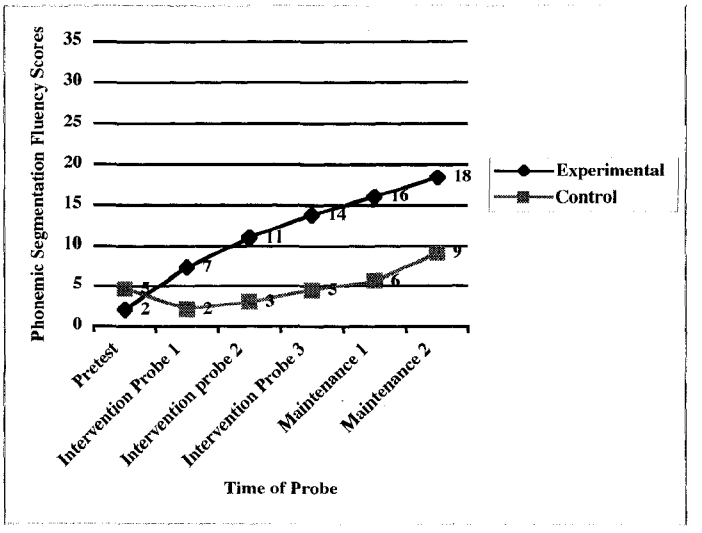
for typically developing children, ISF would not be administered past midyear. However, for the children in the present study whose language was moderately to severely impaired, the ISF measure was administered beyond the middle of the year because the students had not yet demonstrated an established skill in this area. Goals and indicators of risk for the ISF measure at the middle of kindergarten are: 0–9, Deficit; 10–24, Emerging; 25+, Established. The benchmark scores were chosen by the DIBELS authors based on findings regarding the predictive utility of students meeting later reading goals as derived from a study of all schools participating in the DIBELS Data System from the 2000–2001 and 2001–2002 school years. The authors noted that the calculations to determine the goals remain consistent no matter how much data is added to the system (Good, Simmons, Kame'enui, Kaminski & Wallin, 2002). For example, a student who meets the middle of kindergarten Initial Sound Fluency goal is likely to meet the end of kindergarten phonemic segmentation goal (Good, Simmons, Kame'enui, Kaminski, & Wallin, 2002). Based on the goals and indicators of the DIBELS subtest of Initial Sound Fluency, children in the intervention group maintained and increased their scores to the second maintenance probe. Continued intervention with progress monitoring is warranted to ensure stability of the skill. The group mean for children in the intervention group, who had pre-intervention ISF group mean scores in the "deficit" range, increased to 2 points below the "established" range for the skill at Maintenance Probe 2. The group of children in the non-intervention control group, who also had Pre-intervention ISF group mean scores in the "deficit" range, demonstrated Maintenance Probe 2 group mean scores that remained well within the "deficit" range.

Phonemic Segmentation Fluency (PSF)

The probe data for PSF is displayed in Figure 2. ANCOVA was used to examine the effect of the intervention on children's ability to segment words into individual phonemes. The independent variable was group (experimental or control), and the dependent variable was the Phonemic Segmentation Fluency (PSF) Intervention Probe 3 scores or the Maintenance Probe 2 scores. The pre-intervention scores of the PSF measure were entered as the covariate. As discussed earlier, data for this variable were transformed with the square root transformation.

At Intervention Probe 3, results of the ANCOVA analysis revealed a statistically significant difference between the groups on the PSF Subtest, $F(1, 27) = 11.299$, $p = .002$, $d = 1.228$. The effect size indicates a large effect of the intervention on this variable. At Maintenance Probe 2, the results of the analysis did not reveal a statistically significant difference between the groups on the PSF Subtest, $F(1, 27) = 3.567$, $p = .070$, $d = 0.857$. However, the effect size indicates a large effect of the intervention on this variable. A sample size analysis (Brant, 2007) was conducted to determine if a larger sample size would result in a statistically significant effect. Hypothetically, with a sample size of 21 participants per group, statistically significant differences would be found. Thus, it appears that this test lacked sufficient power to show a statistically significant difference at Maintenance Probe 2; a modest increase in sample size would be likely to yield a significant difference.

Figure 2. Children's Performance on the Phonemic Segmentation Fluency Measure from Pre-intervention to Maintenance Probe 2.



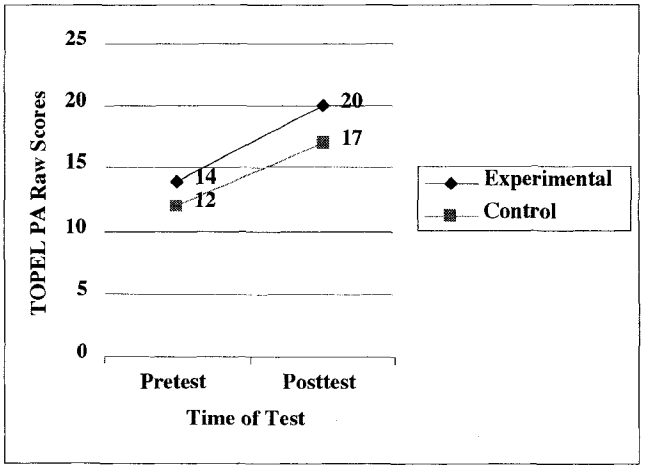
Kindergarten students are expected to achieve a Phonemic Segmentation Fluency score of 35 by the end of kindergarten in order to be on track to meet the Nonsense Word Fluency benchmark score by the middle of first grade. Goals and indicators of risk for the PSF measure at end of the kindergarten year (month 7–10) are: 0–9 Deficit; 10–34 Emerging; 35+ Established. Based on the goals and indicators of the DIBELS subtest of PSF, the group of children in the intervention group, who had pre-intervention PSF skills in the "deficit" range, demonstrated Maintenance Probe 2 skills comparable to children with "emerging" PSF skills. Continued intervention with progress monitoring is warranted to ensure continued growth of the skill. The group of children in the non-intervention control group, who also had pre-intervention PSF skills in the "deficit" range, demonstrated Maintenance Probe 2 skills that remained within the deficit range.

Phonological Awareness Subtest of the Test of Preschool Early Literacy

The pre-intervention versus post-intervention scores for the Phonological Awareness Subtest of the Test of Preschool Early Literacy (TOPEL) is displayed in Figure 3. The Phonological Awareness Subtest of the TOPEL is a measure of children's ability to remove part of a word to form a new word or to blend sounds into words. An analysis of covariance was used to examine the effect of the intervention on scores for phonological awareness from the TOPEL. The independent variable was group (experimental or control), and the dependent variable was the TOPEL Phonological Awareness Subtest post-test raw scores. The pre-intervention scores of the phonological awareness measure were entered as the covariate. Since the TOPEL was only administered once after intervention, no maintenance data are available.

The analysis did not reveal a statistically significant difference between the groups on phonological awareness, $F(1, 27) = 2.043$, $p = .164$, $d = 0.755$. The effect size indicates a moderate effect of the intervention on this variable. However, the mean scores minimally changed from 2 points between groups at pre-test to 3 points between groups at post-test. Thus it does not appear that this measure reflected any effect of the intervention.

Figure 3. Children's Performance on the Phonological Awareness Subtest from the Test of Preschool Early Literacy from Pre-intervention to Post-intervention.



The pre-intervention mean age for children in the experimental and control groups was 67 months and 66 months respectively. The percentile ranks and standard scores for the group mean raw scores were calculated from the 66- through 68-month age range from the TOPEL manual. An experimental group mean raw score of 14 on the Phonological Awareness Subtest of the TOPEL is equivalent to a percentile rank of 9 and a standard score of 80. A control group mean raw score of 12 is equivalent to a percentile rank of 4 and a standard score of 74.

The post-intervention percentile ranks and standard scores were calculated from the 69- through 71-month age range from the TOPEL test manual. An experimental group mean raw score of 20 is equivalent to a percentile rank of 35 and a standard score of 95. A control group mean raw score of 17 is equivalent to a percentile rank of 16 and a standard score of 85. Given that the test has a mean of 100 and a standard deviation of 15, the average standard score of 95 at post-intervention

for the intervention group is within normal limits. The average standard score for the control group is at the border of one standard deviation.

Differences Between Groups on Measures of Letter Naming, Nonsense Word Fluency, and Print Knowledge

To examine the effect of the intervention on letter naming, letter-sound awareness, and print knowledge, a separate Analysis of Covariance (ANCOVA) was conducted on the DIBELS measures of Letter Naming Fluency (LNF) and Nonsense Word Fluency (NWF). An ANCOVA was also conducted on the Print Knowledge Subtest of the Test of Preschool Early Literacy. Since the TOPEL was only administered once at the end of the intervention, no maintenance data are available. The effect size was calculated for each measure to gain more information about the mean difference between the two groups. The results were obtained to answer the following research questions:

Research Question Three

Do kindergarten children with language impairment and low phonological awareness skills who receive small-group, direct, and explicit phonological awareness intervention show a greater increase in letter naming, ability to decode nonsense words, and print knowledge than children who do not receive this intervention?

Research Question Four

Were the effects of instruction maintained for letter naming and the ability to decode nonsense words performance one month after the intervention was discontinued?

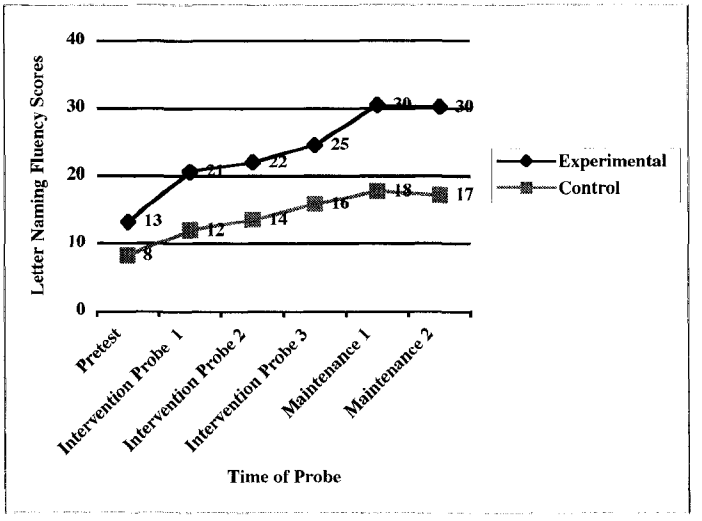
Letter Naming Fluency (LNF)

The probe data for LNF is displayed in Figure 4. ANCOVA was used to examine the effect of the intervention on children's ability to rapidly name letters. The independent variable was group (experimental or control), and the dependent variable was the LNF Intervention Probe 3 or Maintenance Probe 2 scores. The Pre-intervention scores of the LNF measure were entered as the covariate.

At Intervention Probe 3, no statistically significant differences between groups were found on the LNF Subtest. F (1,27) = 1.196, p = .284, d = 0.612. The effect size indicates a moderate effect of the intervention on this variable. A sample size analysis was conducted to determine if a larger sample size would result in a statistically significant effect. Hypothetically, with a sample size of 42 participants per group, statistically significant differences would be found. At Maintenance Probe 2, no statistically significant differences between groups were found on the LNF Subtest. F (1,27) = 3.355, p = .076, d = 0.978. However, the effect size indicates a large effect of the intervention on this variable. The difference between groups increased from 5 points at Pre-test to 13 points by Maintenance Probe 2. A sample size analysis was conducted to determine if a larger sample size would result in a statistically significant effect. Hypothetically, with a sample size of 15 participants per group, statistically significant differences would be found. Given the large effect size and the relatively

small number of participants needed for statistical significance, this measure would be worth pursuing in future research.

Figure 4. Children's Performance on the Letter Naming Fluency Measure from Pre-intervention to Maintenance Probe 2.



Kindergarten students are expected to achieve a LNF score of 40 by the end of kindergarten. Goals and indicators of risk for the LNF measure at the end of the kindergarten year (month 7–10) are: 0–29 At Risk; 29–40 Some Risk; 40+ Low Risk. Based on the goals and indicators of the DIBELS subtest of LNF, the group of children in the intervention group, who had Pre-intervention LNF scores in the "at risk" range, demonstrated Maintenance Probe 2 group mean scores comparable to children with LNF scores in the "some risk" range. The performance of children in both the intervention and non-intervention control groups increased and was maintained to the second maintenance probe. However, the group of children in the non-intervention control group with Pre-intervention LNF scores in the "at risk" range demonstrated Maintenance Probe 2 skills that remained within the "at risk" range.

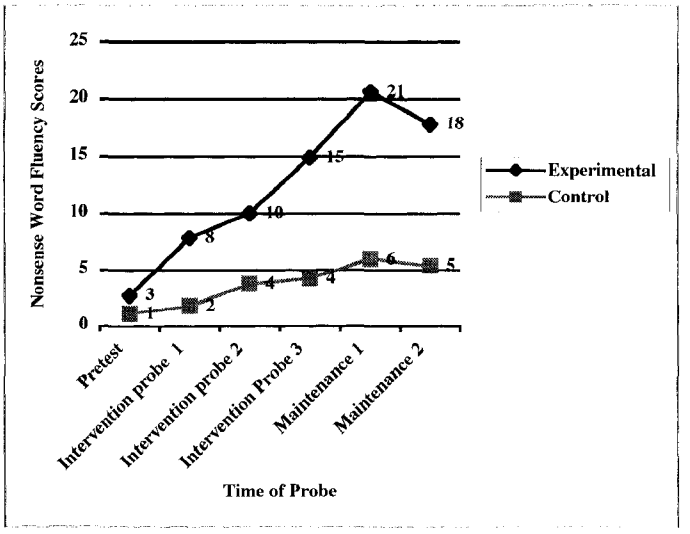
Thus, despite the lack of statistically significant group difference, a large effect of the intervention was noted for the group of children in the intervention group.

Nonsense Word Fluency (NWF)

The probe data for NWF is displayed in Figure 5. ANCOVA was used to examine the effect of the intervention on children's ability to apply letter-sound correspondence to reading words that were not real words. The number of correct letter-sounds produced per minute is used as an indicator of how quickly children translate the print to sounds and sounds into words (Chard, Simmons, & Kame'enui, 1998). The independent variable was group (experimental or control), and the dependent variable was the Nonsense Word Fluency (NWF) Intervention Probe 3 or the Maintenance Probe 2 scores. The pre-intervention scores of the NWF measure were entered as the covariate. Data for this variable were transformed using a square root transformation.

At Intervention Probe 3, the ANCOVA analysis revealed a statistically significant difference between the groups on the NWF Subtest, F (1,27) = 12.727, p = .001, d = 1.420. The effect size indicates a large effect of intervention on this variable. At Maintenance Probe 2, analysis revealed a statistically significant difference between the groups on the NWF Subtest F (1,27) = 6.172, p = .019, d = 1.166. The effect size again indicates a large effect of the intervention on this variable.

Figure 5. Children's Performance on the Nonsense Word Fluency Measure from Pre-intervention to Maintenance Probe 2.



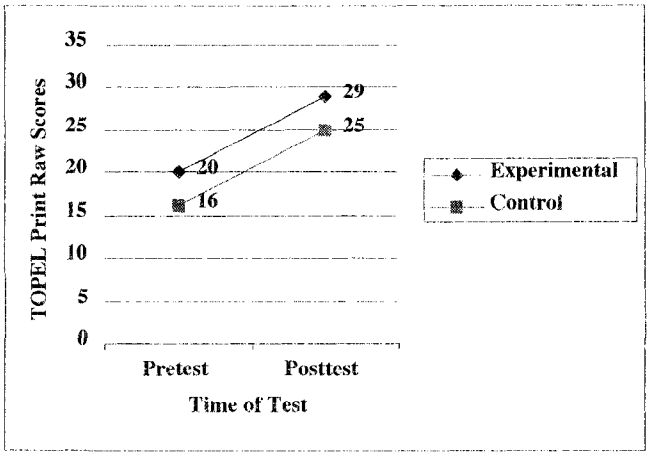
Kindergarten students are expected to achieve a Nonsense Word Fluency score of 25 by the end of kindergarten. Goals and indicators of risk for the NWF measure at the end of the kindergarten year (month 7–10) are: 0–15 At Risk; 15–25 Some Risk; 25+ Low Risk. Based on the goals and indicators of the DIBELS subtest of NWF, the group of children in the intervention group, who had pre-intervention NWF scores in the "at risk" range, demonstrated Maintenance Probe 2 group mean scores in the "some risk" range. The group of children who had received the intervention maintained and increased their scores to the first maintenance probe. Continued intervention with progress monitoring is warranted to ensure stability of this skill. The group of children in the non-intervention control group, who also had pre-intervention NWF scores in the "at risk" range, demonstrated maintenance probe 2 group mean scores that remained within the "at risk" range.

Print Knowledge Subtest of the Test of Preschool Early Literacy

The pre-intervention versus post-intervention scores for the Print Knowledge Subtest of the Test of Preschool Early Literacy (TOPEL) is displayed in Figure 6. The Print Knowledge Subtest of the Test of Preschool Early Literacy (TOPEL) is a measure of children's ability to point to aspects of print, identify letters and written words, point to specific letters, name specific letters, say the sounds associated with specific letters, and identify letters associated with specific sounds. An ANCOVA was used to examine the effect of the intervention on children's print knowledge. The independent variable was group (experimental or control), and the dependent variable was the TOPEL Print Knowledge Subtest pre-intervention to post-intervention raw scores. The pre- intervention scores of the print knowledge measure were entered as the covariate.

The analysis did not reveal a statistically significant difference between the groups on print knowledge, $F(1, 27) = 0.414$, $p = .525$, $d = 0.433$. The effect size indicates a small effect of the intervention on this variable. As is evident in Figure 6, group means were 4 points apart both before and after the intervention, suggesting no effect of the intervention on this variable.

Figure 6. Children's Performance on the Print Knowledge Subtest of the Test of Preschool Early Literacy from Pre-intervention to Post-intervention.



The pre-intervention mean age for children in the experimental and control groups was 67 months and 66 months, respectively. The percentile ranks and standard scores for the group mean raw scores were calculated from the 66- through 68-month age range from the TOPEL manual. An experimental group mean raw score of 20 on the Print Knowledge Subtest of the TOPEL is equivalent to a percentile rank of 23 and a standard score of 89. A control group mean raw score of 16 is equivalent to a percentile rank of 13 and a standard score of 83.

The post-intervention percentile ranks and standard scores were calculated from the 69- through 71-month age range from the TOPEL test manual. An experimental group mean raw score of 29 is equivalent to a percentile rank of 47 and a standard score of 99. A control group mean raw score of 25 is equivalent to a percentile rank of 30 and a standard score of 92. Given that the test has a mean of 100 and a standard deviation of 15, the average standard score for both groups at post-intervention is within normal limits.

Discrimination Between Groups

A discriminant analysis is used to explore the predictive ability of a set of independent variables on one categorical dependent measure—that is, which variables best predict group membership. In this case, whether children in the groups, experimental or control, may be correctly classified based on DIBELS scores obtained at the end of direct, explicit phonological awareness intervention (Brace, Kemp, & Snelgar, 2006; Pallant, 2006; Tabachnick & Fiddell, 2007). The discriminant analysis identifies the non-responders to the intervention based on the DIBELS subtest scores.

There are a small number of children for whom the effect of phonological awareness intervention is very small (Catts & Kamhi, 2005c; Torgesen, 2000). In the research literature, these children are referred to as "non-responders," "non-beneficiaries," or "treatment resisters" (Al Otaiba & Fuchs, 2002; Hesketh, Dima, & Nelson, 2007; Torgesen, 2000). Researchers exploring non-responders have proposed explanations for lack of growth in phonological awareness, including slow performance on rapid naming tasks, poor short-term memory functioning, attention and behaviour problems, lack of print exposure and vocabulary knowledge, low IQ, and low verbal ability (Al Otaiba & Fuchs, 2002; Schneider, Kuspert, Roth, Vise & Marx, 1997). Identifying the children who did not benefit from the intervention permits examination of any characteristics these children may have had in common that would contribute to prediction of students in need of more intensive intervention. The research question for this analysis was:

Research Question Five

Are the non-responders to the intervention identified by the experimental and control group participant scores on the DIBELS subtests of Initial Sound Fluency, Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency?

Discriminant Analysis

A discriminant analysis was performed with group as the dependent variable and DIBELS Initial Sound Fluency, Letter Naming Fluency, Phonemic Segmentation Fluency, and Nonsense Word Fluency subtest scores from intervention probe 3 as predictor variables. The total sample of 30 cases was analyzed. A single discriminant function was calculated, which is a mathematical formula that combines the predictor variables to discriminate between the groups (Brace, Kemp, & Snelgar, 2006). If the discriminant function is statistically significant, then the predictor variables are successfully discriminating between groups.

Results indicated the value of the discriminant function was statistically significant (Wilks = .555, chi-square = 15.293, $df = 4$, $p = 0.004$). The magnitude of the correlations indicates the strength of the prediction of each variable. Correlations between predictor variables and the discriminant function were as follows: Initial Sound Fluency, .811; Nonsense Word Fluency, .759; Phonemic Segmentation Fluency, .631; , and Letter Naming Fluency; .311. Each of these scores contributed to the prediction of group membership.

Discriminant analysis yields measures of accuracy of classification for both groups (in this case, the percentage of children demonstrating phonological awareness performance scores indicative of experimental group or control group membership and classified as such). Accurate classification of children in the experimental group was 86.4%, and accurate classification of children in the control group was 87.5%. Overall, 86.7% of children were correctly classified.

Results of classification are shown in Table 6. The intervention was effective for 19 of the 22 children receiving the intervention. The intervention was not effective for 3 children. Based on the results of the analyses, the DIBELS measures discriminated between the responders and non-responders and identified the specific children who had not benefited from the intervention.

Table 6. Classification Results

	Group	Experimental	Control	Total
Count	**Experimental**	19	3	22
	Control	1	7	8
Percentage	**Experimental**	86.4	13.6	100.0
	Control	12.5	87.5	100.0

Note. Original grouped cases correctly classified = 86.7% (26/30).

Odds Ratio

By computing an odds ratio, the difference in the two groups can be highlighted. Using the scores from the DIBELS measures, children in the experimental group are over 44 times as likely to be categorized as being in the experimental group than are children in the control group (odds ratio [OR] = 44.333), confidence interval (CI = Lower 3.929 and Upper 500.269).

Odds ratios can also highlight the effects of the phonological awareness scores separately in classifying children. Using the scores from the Initial Sound Fluency measure, children in the experimental group are over 6 times as likely to be categorized as being in the experimental group than are children in the control group (odds ratio [OR] = 6.429), confidence interval (CI = Lower 1.026 and Upper 40.261).

By computing the scores from the Letter Naming Fluency measure, results indicated that children in the experimental group are over 4 times as likely to be categorized as being in the experimental group than are children in the control group (odds ratio [OR] = 4.333), confidence interval (CI = Lower .708 and Upper 26.531). Using the scores from the Phonemic Segmentation Fluency measure, children in the experimental group are over 8 times as likely to be categorized as being in the experimental group than are the children in the control group (odds ratio [OR] = 8.000), confidence interval (CI = Lower 1.252 and Upper 51.137). By computing the scores from the Nonsense Word Fluency measure, results indicated that children in the experimental group are over 30 times as likely to be categorized as being in the experimental group than are children in the control group (odds ratio [OR] = 30.000), confidence interval (CI = Lower 3.453 and Upper 260.627). The four DIBELS scores together produce a greater likelihood that children will be categorized into the correct group than any one of the individual DIBELS measures.

CHAPTER IV

DISCUSSION

The purpose of this study was to examine the effectiveness of a phonological awareness intervention program in improving phonological awareness and letter-sound awareness for kindergarten children with moderate to severe language impairment and low phonological awareness skills. Blending and segmenting at the phoneme level and letter-sound awareness are the skills the research literature has shown to predict reading achievement. The objective of the study was to compare change in the phonological awareness skills of a group of children with language impairment who received small-group, intensive, direct, and explicit phonological awareness intervention in addition to classroom phonological awareness programming in comparison to the phonological awareness skills of children in a no-intervention control group.

The discussion is presented in six sections: (a) effects of the intervention on phonological awareness performance; (b) effects of the intervention on letter naming, ability to decode nonsense words, and print knowledge; (c) implications for current practice; (d) limitations of the study; (e) directions for future research; and (f) conclusion.

Effects of Phonological Awareness Intervention on Phonological Awareness Performance

In this study the results of three measures—Initial Sound Fluency (ISF), Phonemic Segmentation Fluency (PSF), and the Phonological Awareness Subtest of

the Test of Preschool Early Literacy (TOPEL)—were used to examine the effect of the intervention on these skills for kindergarten children with language impairment. The ISF measure assessed children's ability to point to or to produce the initial sound in a word. The PSF measure assessed children's ability to segment spoken words into individual phonemes. The Phonological Awareness Subtest of the TOPEL assessed elision and blending skills. The major findings of phonological awareness intervention on the development of these skills emerged when the results of these three measures were examined.

The first major finding was that there was a statistically significant difference between the groups and a large effect of the intervention on Initial Sound Fluency at the end of the intervention and one month after the last instructional day of the intervention. Examination of the maintenance probe data indicated that the initial sound identification skills did not diminish for children who received the intervention. This finding suggests that the intervention provided enough instructional support to maintain initial sound identification skills after the intervention ended.

A second major finding was that there was a statistically significant difference between the groups and a large effect of the intervention on Phonemic Segmentation Fluency at the end of the intervention. Examination of the maintenance probe data indicated that the group difference one month after the intervention ended was not significant. However, the effect size was large, $d = 0.8572$.

Both groups continued to improve in the PSF skill one month after the intervention, indicating it was not that the experimental group lost any of the skill; in fact, their scores went up. The experimental group demonstrated a mean score of 18

while the comparison group achieved a mean score of 9. The reason for the lack of statistically significant difference appears to be that the control group was also continuing to gain on this skill. These results suggest the program effects were maintained from the end of the intervention to one month after the intervention by children with initially low phonemic segmentation skills; however, given the non-significant results at the second maintenance point, the results regarding maintenance of gains relative to the control group are inconclusive.

In recognition of the important contribution of phonemic segmentation to word decoding and recognition, further discussion regarding the factors that may have generally influenced the performance of the children on the Phonemic Segmentation Fluency measure is warranted.

First, given that the experimental group received the same classroom instruction as the control group, the children who received the intervention appeared to have required explicit, consistent instruction and additional intervention time to begin to improve their phonological awareness skills. It is likely that they will continue to require intensive intervention to improve their phonological awareness skills enough to learn to read. For example, children who received the intervention began to achieve scores close to an established level for Initial Sound Fluency, a foundational and precursor skill to phonemic segmentation, at the end of kindergarten. Although initial sound identification had not developed spontaneously, the skill proved responsive to the intervention.

Results of the PSF measure indicate that this population of children with language impairment require direct, explicit, and intense instruction for learning the

more advanced phoneme segmentation task. The Phonemic Segmentation Fluency skill is expected to continue to develop into Grade 1, and the same DIBELS PSF benchmark scores are provided for Grade 1 at the beginning, middle, and end of the year (i.e., the achievement of 35 segments per minute indicates the skill is established).

Notwithstanding that assumption, research has not established that it is necessary to master one level of phonological awareness before developing skills in another (Gillon, 2006). The goal of phonological awareness intervention for this population was to ensure that the children were exposed to and were developing the phonological awareness skills they required as a foundation to contribute to early reading development. Thus, instruction that incorporated the predictors of reading acquisition, including phonemic segmentation, was provided as a means to increase this skill. As the intervention progressed, the children practised segmenting words with two and three phonemes. Provided with a placement in a Grade 1 classroom with a literacy program that includes systematic instruction in phonological and alphabetic principles for children at risk for reading failure, with regular monitoring of progress, children in the intervention group could possibly meet the established benchmark goal for PSF during the Grade 1 year.

A second factor for consideration for the PSF results is the auditory format of the subtest. The child is required to listen to a word and segment the word into sounds without picture or letter cues. Observation of the filmed assessment sessions indicated the children, in the absence of visual support, used gestures such as raising or tapping a finger, or a head nod, for each sound as they segmented the word. Use of these

compensatory strategies may indicate the PSF task was challenging for this population of children with a diagnosis of moderate to severe language impairment; these children entered the study with low phonological awareness and demonstrated challenges with auditory attention, memory, and retrieval. Additionally, educational assistants reported that children were more proficient with the segmentation task if the words they were segmenting were familiar to them. This observation underscores the need to continue to investigate the relative contribution of vocabulary knowledge to segmentation at the phonemic level for this population.

A third major finding of this study was that the difference between the groups on the Phonological Awareness subtest of the Test of Preschool Early Literacy was not statistically significant; however, the moderate effect size suggested that the intervention had a moderate effect on the skills measured on this test, namely, the ability to remove part of a word to form a new word and to blend sounds into words.

The lack of a statistically significant difference between groups both post-intervention and at maintenance probe 2 on this measure leads to the question of whether the results indicate a true lack of change or whether the difference is due to another reason, such as (a) the task items represent advanced phonological awareness skills, (b) the use of a norm-referenced, standardized test is not a sensitive enough measure of change for this brief intervention, or (c) the possibility of a lack of power due to the size of the sample. Each of these issues is discussed below.

Some implicit awareness of word structure can be demonstrated in very young children (Ballem & Plunkett, 2005). However, the conscious ability to reflect on word

structure may be expected to emerge later for children with language impairment. We would not expect children at an early stage of phonological awareness development to demonstrate later developing phonological awareness skills (Hesketh, Dima, & Nelson, 2007). The intervention program provided practice in phonological awareness skills, particularly at earlier developing levels (e.g., sensitivity to the initial consonants of words). The intervention improved these skills and the students demonstrated improvement on the more advanced skills of phonemic segmentation and nonsense word fluency. However, the use of a norm-referenced, standardized measure to assess phonological awareness skills may have been insensitive to important changes in phonological awareness skills for this population presenting with language impairment.

Norm-referenced, standardized tests are useful in identifying children low in phonological awareness skill development; however, norm-referenced, standardized tests are not recommended for use in documenting change after intervention. McCauley & Swisher (1984) and McCauley (2001) noted the barriers to the effective use of norm-referenced, standardized tests include the tendency for these measures to be more sensitive to large differences in knowledge between individuals than to small differences. This issue will be discussed in more detail later.

The influence of sample size on the power of a test is critical. The larger the sample, the greater the statistical power the test will have. Smaller samples are less likely to provide good representations of population characteristics and, therefore, true differences between groups are less likely to be recognized (Portney & Watkins, 2000). A larger participant sample and equal group sample sizes would yield

additional data and increase the statistical power of the test. Additional data on the measures used to assess the phonological awareness skills for this population would be of particular interest.

In summary, the findings from the phonological awareness measures suggest that the intervention was effective in helping children approximate a critical Initial Sound Fluency goal by the end of the study and to demonstrate growth in the more difficult skill of Phonemic Segmentation Fluency. The results suggest that, given a longer intervention into Grade 1 and the continued rate of growth, children in the intervention could possibly meet the Grade 1 proficiency benchmark criterion for Phonemic Segmentation Fluency. Overall, the results indicate that kindergarten children with moderate to severe language impairment who receive direct, explicit, intensive, small group phonological awareness intervention demonstrate significantly better phonological awareness skills than kindergarten children with moderate to severe language impairment who receive no direct, explicit, and intensive small group intervention.

Effects of Phonological Awareness Intervention on Letter Naming, Ability to Decode Nonsense Words and Print Knowledge Performance

Children's responses on three measures of alphabetic skills were used to examine the effect of phonological awareness intervention on letter naming, nonsense word decoding, and print knowledge. The major findings regarding the effect of the intervention on each of these areas emerged from the analyses.

The first major finding was that there was no statistically significant difference between the groups on Letter Naming Fluency at the end of the intervention. The lack of a statistically significant difference between the groups on Letter Naming Fluency requires further discussion regarding the possible factors that may have influenced the performance of the groups on this measure. First, letter-naming continues to be an integral component of kindergarten programs. The focus placed on the development of this skill in the kindergarten setting may have contributed to the lack of statistical significance between the groups. Second, letter naming was not a focus of the intervention. Thus, assessing letter naming proficiency may not have been an appropriate choice for evaluating the effects of an intervention focusing on phonological awareness and letter-sound awareness. Third, interestingly, despite the lack of statistical significance between the groups one month after the intervention, a large effect of the intervention was noted at maintenance time 2, suggesting that the intervention may have been effective. It is possible the intervention had a sleeper effect on letter naming, resulting in superior performance for the group of children in the intervention one month after the intervention concluded; however, given the lack of statistical significance, the results are inconclusive.

A second major finding was that there was a statistically significant difference between the groups and a large effect of the intervention on Nonsense Word Fluency at the end of the intervention and one month after the last instructional day of the intervention. This result suggests that the focus on initial sound identification and phonemic segmentation skills provided during the intervention positively influenced children's performance on the Nonsense Word Fluency measure. A review of the

scoring sheets for the Nonsense Word Fluency measure indicated that each of the students in the intervention decoded the words phoneme by phoneme. This finding was confirmed during the assessment fidelity sessions, during which the students were observed pointing to each letter and providing an associated sound. These observations suggest that explicit instruction in initial sound identification and phoneme segmentation, as well as in instruction in connections between letter sounds, helped children to apply their phonological awareness skills and letter-sound knowledge more effectively to the phonemic decoding of nonsense words. These results are consistent with research suggesting that the effectiveness of phonemic awareness is enhanced when combined with letter-sound instruction (Bus & Ijzendoorn, 1999; Byrne & Fielding-Barnsley, 1989; Davidson & Jenkins, 1994; Fox & Routh, 1984; O'Connor et al., 1995; Torgesen et al., 1992).

The test items on the non-word decoding task were measuring nonsense words, and children were required to use phonological information to correctly sound them out. Children who had received the intervention showed superior performance on this task.

The third major finding indicated that there was no significant difference between groups on the Print Knowledge subtest of the Test of Phonological Awareness. There was a small effect of the intervention on Print Knowledge. However, 21 of 36 items on the Print Knowledge subtest required the child to point to or name letters. The lack of group differences on the Print Knowledge subtest may have been due to the amount of focused instruction on letter naming in the classroom. Given the small effect of the intervention on this variable, it may not be worthwhile to

administer this particular subtest to children with moderate to severe language impairment for the purposes of investigating treatment effects if related DIBELS measures (i.e., Initial Sound Fluency, Phonemic Segmentation Fluency, Letter Naming Fluency) are administered.

The intervention was effective in helping children phonemically decode nonsense words. Follow-up is required to answer definitively whether or not there is generalization from the ability to decode nonsense words to real word recognition as these children begin to receive formal reading instruction and assessment in Grade 1.

Noting that direct, explicit, intensive, small-group phonological awareness intervention is effective in increasing letter-sound awareness best summarizes the results. Because they provide evidence of the effect of the intervention on the transition to decoding, the Nonsense Word Fluency results, in particular, provide evidence to support the practice of providing direct, explicit, and intensive letter-sound awareness instruction to increase efficiency in decoding at the phonemic level for kindergarten children with language impairment.

Use of the Dynamic Indicators of Basic Early Literacy Versus Test of Preschool Early Literacy Measures

Interestingly, the DIBELS results revealed significant differences between the groups on the subtest measures of Initial Sound Fluency, Phonemic Segmentation Fluency, and Nonsense Word Fluency. The TOPEL results did not reveal significant differences between the groups on the subtest measures of Phonological Awareness and Print Knowledge.

Norm-referenced, standardized tests document large changes in skills during treatment (McCauley & Swisher, 1984). However, smaller changes in phonological awareness skills over a longer period of time appeared typical for this population of children with moderate to severe language impairment.

Use of the standardized, individually administered DIBELS measures may have been superior to norm-referenced measures for purposes of examining the effects of the intervention. Although the specific items were different, the DIBELS subtest measures were administered in the same way each time, measured the same skills, and addressed very specific questions about growth in phonological awareness skills that coincided with the focus of the intervention. The DIBELS measures were specifically designed to monitor growth over time; they include numerous exemplars of a single skill. In contrast, standardized tests are designed to permit comparison of individuals to normative samples; items are selected on their ability to discriminate among individuals and are not intended to test a single skill thoroughly. Thus it can be argued that a measure such as the DIBELS is inherently better than standardized tests for measuring growth over time.

Implications for Current Practice

Results of the present study have important implications for children with moderate to severe language impairment and low phonological awareness skills. The findings were that when direct, explicit, intense, and small-group instruction in initial sound identification, phonemic segmentation and blending, and letter-sound awareness

was provided, children with moderate to severe language impairment and low phonological awareness skills demonstrated superior performance in their ability to identify, segment, and map the sounds to letters in a word when compared to a no-intervention control group. Although these findings are consistent with prior research suggesting that children with low phonological awareness skills can develop phonological awareness when explicit instruction is provided, much of the research into phonological awareness intervention has excluded children with a diagnosis of moderate to severe language impairment.

Studies of phonological awareness interventions demonstrate their effectiveness for children at risk for reading difficulties. The knowledge that phonological awareness and letter-sound awareness are strong predictors of later reading skills (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Storch & Whitehurst, 2002; Snow, Burns, & Griffin, 1998) and that effective kindergarten phonological awareness intervention in these skills helps children attain a positive phonological awareness skill trajectory (Blachman et al., 1994; Foorman, Francis, Fletcher, Schatschneider & Mehta, 1998) informs clear directions for school policy.

One implication for practice based on the results of the current study is that it is possible to provide intensive, direct, and explicit phonological awareness and letter-sound awareness intervention for children with moderate to severe language impairment who are at risk for reading failure and that this intervention will increase these skills even though the children's language skills remain impaired. These children should be considered primary candidates for early intervention programs designed to prevent or limit reading disabilities. Identifying and referring these children for

intervention that includes developing phonological awareness prior to formal reading instruction in Grade 1 would limit the impact of a potential reading disability.

A second implication for practice suggested by intervention results is that both the content of the intervention program and the conditions under which the intervention is taught to kindergarten children with moderate to severe language impairment appeared critical to their progress in developing phonological awareness and letter-sound awareness. The phonological awareness intervention in this study focused on developing skills on a phonemic level and included activities that made explicit the strategies that effective readers use to recognize sounds in words, associate sounds with letters, and blend sounds into words. Instruction was of an intensive nature and provided in small groups. However, to confirm that the intensive and small group conditions contributed to the positive effects of the intervention, future research should include another condition that would compare on these factors.

A third implication for practice is that reallocation of staffing resources would permit the type of intensive intervention that was effective in this study. Additionally, ongoing instructional support and mentoring is essential for classroom staff that express commitment to such intervention. Reallocation of resources will require long-term planning. Administration for the school district, during the year the current study was conducted, reported a kindergarten registration of 5,006 students. As noted earlier, an estimated 7.4% of the kindergarten population presents with specific language impairment (Tomblin et al., 1997). Each year, potentially 370 students, or 3,700 students over 10 years, could present with diagnoses of specific language impairment in the district in which this study took place. This incidence estimate does not include

students with language impairment presenting with non-verbal performance scores of less than 85, nor does it take into account the anticipated continued accelerated growth of the population base in the urban district in which this study took place. Instructional support for students with language impairment will require an estimate of resources required and the will to implement evidence-based practice for students at risk for reading failure.

A fourth implication for practice is that educational assistants trained to a standard procedure obtained the findings reported here. The strength of the present study is that it provides an example of the implementation of phonological awareness and letter-sound awareness instruction under routine school conditions. The intervention was practical in terms of materials, duration, and training requirements. The model provides an option for schools wishing to supplement instruction for their students with moderate to severe language impairment.

Limitations

These findings are constrained by several limitations. First, a small sample was used. Replicating the findings of this study with a larger participant sample and equal group sample sizes would yield additional data and increase the statistical power. When very small samples are used ($n < 30$), as is often the case in clinical research with special populations, power is substantially reduced (Portney & Watkins, 2000).

Second, the intervention program used for this study represents only one of the many possible intervention programs available for use with this population of children

with a diagnosis of language impairment and low phonological awareness skills. While the intervention program selected for use with this population was effective, implementation of another intervention program may prove more effective, require less time, or be appropriate for larger groups. Further research into the effectiveness of phonological awareness programs for children with language impairment would be of benefit.

Third, the generalizability will be limited to intensive small-group treatment using the same or similar intervention program.

Directions for Future Research

This study began to explore the effect of a direct, explicit, and intense phonological awareness intervention on the phonological awareness skills of segmenting and blending at the phonemic level and letter-sound awareness for kindergarten children with moderate to severe language impairment. To evaluate the effectiveness of prevention efforts, it is necessary to examine the subsequent reading progress of the children who took part in this study to determine if the phonological awareness intervention had a lasting (or delayed) effect for decoding and/or reading ability. Analysis of absolute reading achievement levels at appropriate follow-up points during the Grade 1 year would facilitate determining whether the children who received the phonological awareness intervention were making progress with word and connected-text reading.

More research is needed to examine efficient and effective ways to teach phonological awareness to children with moderate to severe language impairment. For example, children in the current study had not developed initial sound fluency skills on their own by the typical time of emergence—the middle of kindergarten. Although initial sound identification had not yet developed spontaneously, the skill proved responsive to intervention offered, and this corresponds with the findings for a similar task by Gillon (2005) and Hesketh, Dima & Nelson (2007). Additional research is needed to examine whether the same pattern of results would occur if (a) children received increased initial sound identification, phonemic segmentation and blending instruction in the classroom in addition to supplemental small-group, direct, and intensive treatment; (b) classroom teachers provided explicit reinforcement of skills taught in the small groups during direct and centre time classroom instruction; (c) small-group, direct, and intensive intervention began early in the fall term and extended to the end of the kindergarten year; (d) the small-group, direct, and intensive intervention is provided within the classroom to increase classroom staff awareness of the program content and to thus facilitate the generalization of the phonological awareness skills the children are learning across the kindergarten curriculum; and (e) the schools in the current study utilized the results of the study to guide decisions about supplemental phonological awareness and letter-sound awareness instruction for kindergarten children requiring this intervention in Grade 1. Controlling or adjusting the type of instruction that students receive after completing an intervention program will enable them to maintain intervention gains (Coyne, Kame'enui, Simmons, & Harn, 2004). For example, in order to maximize the effect of the intervention,

children in the current study require a literacy program in first grade that systematically addresses developmentally appropriate phonological and alphabetic instructional principles.

Kindergarten children who present with moderate to severe language impairment should be clinically viewed as being at risk for long-term reading and spelling difficulties. Further research is necessary to determine whether or not identified subgroups of kindergarten children with language impairment (e.g., based on the nature of their language impairment or genetic or environmental influences) may be more at risk for persistent difficulty in using phonological information to aid reading (Gillon, 2004). Careful examination of individual development of and environmental influences on children with language impairment who fail to benefit from interventions that prove effective for the majority of children is needed. Further in-depth profiling of a larger sample of non-responders may contribute to this investigation. Wanzek (2005, cited by Haager, Klingner, & Vaughn, 2007) summarized intervention studies of students at risk for reading difficulties that included descriptions of students who were unresponsive to intervention. The researcher found that non-response to intervention was defined in varied ways, and no standard way of examining non-responders exists at present.

Conclusion

Children with moderate to severe language impairment experience challenges in the acquisition of phonological awareness skills. Difficulty with listening attention,

limited receptive language skills, challenges with auditory memory and retrieval, struggles with following unfamiliar and multi-step instructions, effortful sentence formulation, and difficulty asking questions to seek clarification from an instructor are common characteristics of children with language impairment. The phonological awareness difficulties present in kindergarten children with moderate to severe language impairments require direct intervention with a focus on teaching the skills that are the predictors of reading acquisition so that these deficits do not persist over time (Bird, Bishop, & Freeman, 1995; Gillon, 2006; Korkman & Peltomma, 1993; Snowling, Bishop, & Stothard, 2000).

The results of the current study presented one picture of the effectiveness of phonological awareness intervention for children with language impairment and may help spur the discussion and debate necessary to move educators and speech-language pathologists towards a common vision for this area of practice. A common vision may have an impact on school board and provincial programming and on policies for children with language impairment. This picture could also provide direction for a longitudinal study for participants in the current study, and for future studies of the implementation of phonological awareness intervention on a larger scale.

Findings from this study may be useful for those providing or undergoing professional training in speech-language pathology and education in university training programs. Without a clear picture of the effectiveness of phonological awareness intervention for children with moderate to severe language impairment, it is difficult for training programs to accurately convey to students the importance of the implementation of this programming.

The results of this study could assist school districts in developing programming that results in positive literacy outcomes for children with language impairment. The ultimate hope for this study is that it has provided valuable information that would help to improve the effectiveness of early literacy service delivery to children with language impairment. Ideally, this will ensure that families and educational systems have the support they need to assist these children in developing to their fullest language, literacy, and learning potential.

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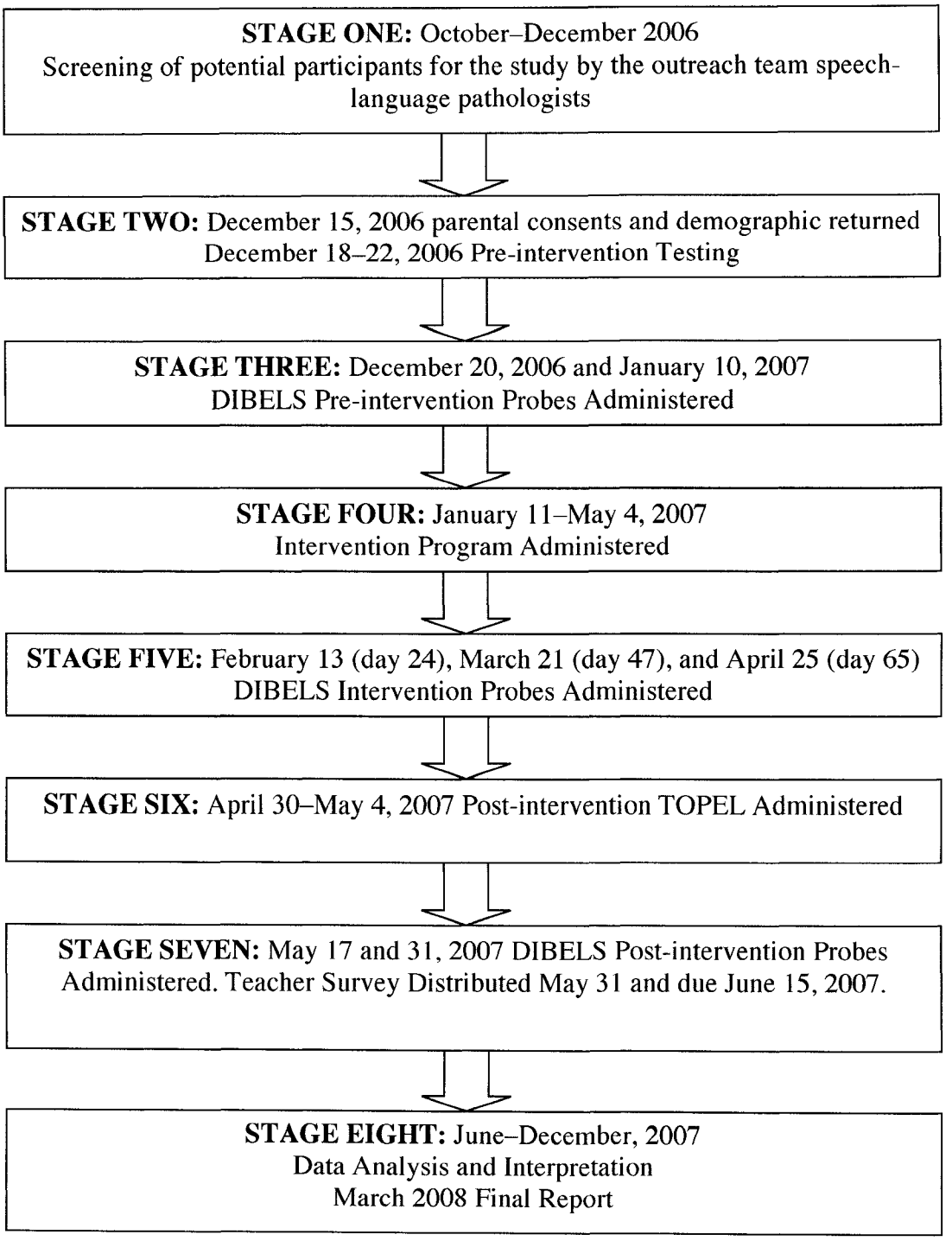
Appendix A

Study Flowchart



Appendix B
Health Ethics Review Board Report

HEALTH RESEARCH ETHICS APPROVAL FORM

Date of HREB meeting: April 7 2006

Name of Applicant: **Dr. Phyllis Schneider**

Organization: **University of Alberta**

Department: **Speech Language Pathology**

Project Title: **Effectiveness of a Phonological Awareness Intervention Program with Kindergarten Children with Language Disorders**

The Health Research Ethics Board (HREB) has reviewed the protocol for this project and found it to be acceptable within the limitations of human experimentation. The HREB has also reviewed and approved the subject information letter and consent form.

The approval for the study as presented is valid for one year. It may be extended following completion of the yearly report form. Any proposed changes to the study must be submitted to the Health Research Ethics Board for approval. Written notification must be sent to the HREB when the project is complete or terminated.

Special Comments:

Glenn G Griener

Dr. Glenn Griener, PhD
Chair of the Health Research Ethics Board
(B: Health Research)

MAY 0 1 2006
~~APR 7 6 2006~~

Date of Approval Release

File Number: B-010406

UNIVERSITY OF ALBERTA

Capital Health

CARITAS HEALTH GROUP

Appendix C
Information Letter for Parents

Title: Effectiveness of a Phonological (Sound) Awareness Intervention with Kindergarten Children with Language Disorders

Investigators: Cecelia Hund-Reid, Graduate Student
Faculty of Rehabilitation Medicine
University of Alberta
Dr. Phyllis Schneider, Professor
Department of Speech and Language Pathology
University of Alberta

Background: The ability to read is important. Over the last 20 years we have come to better understand how some skills help a child learn to read. Sound awareness has been found to be one of the best predictors of reading success. Now there are many sound awareness programs on the market. We need to understand if these programs increase the sound awareness skills that children need to learn to read.

Purpose: We want to look at the sound awareness of kindergarten children with language impairment. We want to learn if the training program will increase the sound awareness skills children need to learn to read.

Procedures:

We are asking for your consent for your child to participate in the study. Your consent is voluntary. If you consent for your child to be in the study, please return the consent form in the attached, self-addressed envelope by December 15, 2006.

All of the children whose parents agree for them to take part will be assessed for sound awareness. This will happen two times. One time in December. This will take about 45 minutes.

The second assessment will be in April. This will take about 30 minutes. Breaks will be provided or the session will be rescheduled should your child become

tired during the session. Appointment times will be arranged with your child's teacher. The sessions will take place in a quiet setting within your child's school during class time. A speech and language therapist will do this assessment with each child. The sessions will be audiotaped so that another speech and language therapist can check the results. A nonverbal test and a hearing test will also be done. All of the children will receive a short sound awareness test every three weeks from the beginning of January to the end of May. Each session will take about 4 to 7 minutes.

Your child will be randomly assigned, like the flip of a coin, to the group that will receive the training or the group that will not receive the training. All of the children will continue to receive the same training in sound awareness they normally receive in the classroom if the study was not going on.

The children in the training group will participate in sound awareness training for 20 minutes each day. This will be during school time. This will be from January 10 to April 27, 2007. Your child will be scheduled so that he/she will not miss the same activity every day. Your child's session may be videotaped and viewed by another speech and language therapist. This will be to check that the lesson plan is followed.

Test results will be available to you upon request. You will be contacted if your child does not pass the hearing screening. You will be given information on how to obtain a full hearing test for your child. Your child will not be included in the study if he/she does not pass the hearing test. Results of all the testing will be shared with school staff. This information may help the staff to continue to work on sound awareness skills with your child after the study is finished. This may better prepare your child for learning to read.

Your child's school is one of the schools that will serve as sites for the study. Children participating in the study must turn five years old before September 1, 2006. Your child must not yet be able to read words.

Benefits/Risks: This study will help us understand how to better prepare kindergarten children for learning to read. There is a risk that your child could become tired due to the length of testing. Breaks will be provided or the session will be rescheduled if your child becomes tired. There are no other known risks.

Confidentiality: There is a consent form included with this letter. If you agree that your child can take part in the study, your written consent is required. No names will be included on any records, and no names will be used in any papers or presentations. All information collected will be kept in a locked filing cabinet at the University of Alberta. This information will be kept for five years after the study is done. Only the research team will have access to the information. All information will be held private, except when professional codes of ethics or the law requires reporting. Some background information is needed for each child. A form has been attached to collect this information. Confidentiality of the information is protected because your child's name will not appear on this form. Information on your child's birth date and gender is requested. Parental occupation, education, and language spoken in the home is requested. All of this information will be used to learn if the groups in the study are similar. The information gathered for this study might be looked at again in the future to help us answer other study questions. If so, the ethics board will first review the study to make sure the information is used ethically.

Freedom to withdraw: Even if you consent to your child's being in the study, you or your child have the right to choose not to participate in the study at any time without affecting his/her program. If this happens, your child's information will not be included.

If you are willing to allow your child to be in the study, please complete the attached consent and background information forms. Put them in the envelope and give this to your child's teacher. You will be given a copy of this consent form.
If you have questions about the study, please call Cecelia Hund-Reid. If there are concerns, Dr. Paul Hagler, Associate Dean of Research, may also be contacted. Dr. Hagler is independent from the study investigators.

Thank you very much for your consideration of this request.

Consent Form

Consent Form

Title: Effectiveness of a Phonological Awareness Intervention with Kindergarten Children with Language Impairment.

Part 1: Researcher Information

Name of Principal Researcher: Dr. Phyllis Schneider, Ph.D.
Affiliation: University of Alberta, Faculty of Rehabilitation Medicine

Name of Co-Researcher: Cecelia Hund-Reid
Affiliation: University of Alberta, Faculty of Rehabilitation Medicine

Part 2: Consent of Subject

	Yes	No
Do you understand that your child has been asked to be in a research study?		
Have you read and received a copy of the attached information sheet?		
Do you understand the benefits and risks involved in your child taking part in this research study?		
Do you understand that you can contact the researcher to ask questions and discuss the study?		
Do you understand that you are free to refuse to participate or withdraw from the study at any time? You do not have to give a reason. Your child's education will not be affected.		
Do you understand what will be done to keep your child's information confidential?		
Do you understand who will have access to your child's records/information?		

Part 3: Signatures

I agree to take part in this study. I have received the consent form.
Please check the following:
____*Yes* ____ *No I agree to have my child's session video taped to check that the lesson plan is being followed.*

____*Yes* ____*No I agree to release the test results to my child's school staff. This information may help the staff to continue to work on sound awareness skills with my child after the study is finished.*

Signature of Parent/Guardian: _____

Printed Name: _____

* A copy of this consent form must be given to the parent/guardian to keep.

Demographic Information

ID Number (assigned by researcher) _____

The following items are to be completed by the child's parent or guardian:

Child's birth date _____ **Mother's level of education**_____
Child's gender (circle): Male Female
Language spoken in the home _____**Father's level of education**_____

Parental Occupations – What kind of job does the child's mother (or female guardian) have and father (or male guardian) have?

If the child's mother or father is not working now, please think about the job the person had for most of the time when they were working. Also think about the kind of work the person does, not who they work for.

(Mark X in only ONE category for mother and ONE category for father.)

	Mother	Father
General worker (e.g., warehouse person, taxi driver, construction worker, server in restaurant)	O	O
Plant or machine operator or production worker (e.g., truck driver, factory or plant worker)	O	O
Farmer/fisher/logger/hunter/trapper	O	O
Sales or service worker (e.g., clerk, secretary, salesperson)	O	O
Trades or crafts person (e.g., carpenter, mechanic)	O	O
Technologist or associate professional (e.g., medical technologist, computer programmer or analyst, pilot)	O	O
Manager (e.g., small business owner/operator, manager in a large business or government office)	O	O
Professional (e.g., lawyer, accountant, engineer, doctor, professor, teacher, police officer)	O	O
Senior official, executive, or large business owner (e.g., legislator, senior civil servant, judge, senior officer, or owner of a large company)	O	O
Home duties	O	O
Other (please specify) _____	I do not know	

Appendix D
Dynamic Indicators of Basic Early Literacy
Observer's Checklist for Initial Sound Fluency

Observer's Checklist
Initial Sound Fluency (ISF)

Check one box for each category. Provide comments when "no" box is checked.

CLIPBOARD
Held clipboard so child could not see scoring.
❑ yes ❑ no – comments:

DIRECTIONS
Gave directions exactly as written.
❑ yes ❑ no – comments:

This is mouse, flowers, pillow, letters (point to each picture while saying its name). ***Mouse*** (point to mouse) ***begins with the sound /m/. Listen, /m/, mouse. Which one begins with the sounds /fl/?***

CORRECT RESPONSE If student points to or says flowers, you say	INCORRECT RESPONSE: If student gives any other response, you say
Good. Flowers begins with the sounds /fl/.	***Flowers*** (point to flowers) ***begins with the sounds /fl/. Listen, /fl/, flowers. Let's try it again. Which one begins with the sounds /fl/?***

Pillow (point to pillow) ***begins with the sound /p/. Listen, /p/, pillow. What sound does letters*** (point to letters) ***begin with?***

CORRECT RESPONSE If student says /l/, you say	INCORRECT RESPONSE: If student gives any other response, you say
Good. Letters begins with the sound /l/.	***Letters*** (point to letters) ***begins with the sound /l/. Listen, /l/, letters. Let's try it again. What sound does letters*** (point to letters) ***begin with?***

Here are some more pictures. Listen carefully to the words.

TIMING
Started timer immediately after asking each question.
❑ yes ❑ no – comments:

Stopped timer immediately after student answered each question.
❑ yes ❑ no – comments:

ASKS QUESTIONS EXACTLY AS WRITTEN
Asked questions exactly as written in Scoring Booklet.
❑ yes ❑ no – comments:

DISCONTINUE RULE
Stopped assessment if student did not get any of the first 5 answers correct and recorded score of 0 (zero).
❑ not applicable ❑ yes ❑ no – comments:

SCORING
Asked all 16 questions, unless discontinue rule was used.
❑ yes ❑ no – comments:

Circled 1 for correct answers and 0 for incorrect answers.
❑ not applicable ❑ yes ❑ no – comments:

Accurately recorded time.
❑ yes ❑ no – comments:

Accurately added correct answers.
❑ yes ❑ no – comments:

Accurately used formula to calculate answer. ISF- box # correct / # seconds
❑ yes ❑ no – comments:

HESITATION RULE AND PROMPT
Gave next question after student did not respond or struggled with response for 5 seconds.
❑ not applicable ❑ yes ❑ no – comments:

Gave additional prompt once if student gave letter name instead of sound: *"Remember to point to or tell me a word that begins with the sound* (name stimulus sound)."
❑ not applicable ❑ yes ❑ no – comments:

SHADOW SCORING
Number of correct answers is within 1 point of total recorded by other examiner.
❑ not applicable ❑ yes ❑ no – comments:

Time recorded is within 2 seconds of other examiner.
❑ not applicable ❑ yes ❑ no – comments:

CHECK ANY OF THESE FREQUENTLY OBSERVED MISTAKES MADE BY EXAMINER:
❑ Named letter instead of sound when reading questions.
❑ Inserted the words "a," "the," or "and" when reading questions.
❑ Cleared timer before recording time in student booklet

Appendix E
Road to the Code Lesson Fidelity Checklist
Dissertation Study: January 10–April 27, 2007

Educational Assistant: ____________________ Date: ___________________

School: _____________________________Group #: __ Lesson #: __________
Time Lesson Started: ______Time Lesson Ended: ________ Total: _______

PART I Say-It-and-Move-It activity 7 minutes (# minutes: _____)

1. Introduction: Say-It-and-Move-It activity.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

2. Educational Assistant models Say-It-and-Move-It.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

3. Educational assistant provides practice opportunities during activity.

									10										20										30										40
									10										20										30										40
									10										20										30										40

Practice opportunities: _______

4. Educational assistant provides scaffolded instruction.

1	2	3	4
Not at all	Some of the time	Most of the time	Consistently included

5. Child is positioned in front of the teacher to direct attention and provide visual cues.

1	2	3	4
Not at all	Some of the time	Most of the time	All of the time

PART II Letter Name and Sound activity 7 minutes (# minutes: _____)

1. Introduction: Letter Name and Sound activity.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

2. Educational assistant models Letter Name and Sound activity.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

3. Educational assistant provides practice opportunities during activity.

								10							20						30						40
								10							20						30						40
								10							20						30						40

Practice opportunities: _____

4. Educational assistant provides scaffolded instruction.

1	2	3	4
Not at all	Some of the time	Most of the time	Consistently included

5. Child is positioned in front of the educational assistant to direct attention and provide visual cues.

1	2	3	4
Not at all	Some of the time	Most of the time	All of the time

PART III Phonological Awareness Practice activity 6 minutes (# minutes: _____)

1. Introduction: Phonological Awareness Practice activity.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

2. Educational Assistant models Phonological Awareness activity.

1	2	3	4
Not at all	Somewhat included	Mostly included	Consistently included

3. Educational assistant provides practice activities during activity.

Practice opportunities: _____ (supply #)

							10								20							30								40	
							10								20							30								40	
							10								20							30								40	

4. Educational assistant provides scaffolded instruction.

1	2	3	4
Not at all	Some of the time	Most of the time	Consistently included

5. Child is positioned in front of the educational assistant to direct attention and provide visual cues.

1	2	3	4
Not at all	Some of the time	Most of the time	All of the time

Additional comments regarding the fidelity of this treatment session:

Appendix F

Script for Child Assent for Assessment/Intervention Program

The proposed script to present to the student before assessing/intervention is as follows:

> "Hello (student's name). Today we are going to look at some pictures and have some talking time. Then we will come back to class. We are going to [assessor/educational assistant explains where they will be going (e.g., educational assistant's work room, the room next to the classroom/office, or another pre-determined room for the testing/intervention session)]. Do you want to come with me?" If the student assents, state: "Here we go!" If the student does not assent, due to conflicting activities that capture the student's attention, such as gym time, for example, or a birthday party, etc., state: "It's OK if you don't want to come with me now." He/she will be approached later. The same script will be used the second time. If the student does not assent the second time, then request for assent will not be pursued again.

Plan: If at any time the student indicates that he/she needs to take a break, as indicated by restlessness, inattention to task, requesting a bathroom break or a drink of water, then testing/programming will cease and a break will be provided.

Table 2
Schedule of Assessments

MEASURE	SCREEN	Pre Intervention Probe	Intervention Probes	POSTTEST	Post Intervention Probes
		Jan. 10	Feb. 13, Mar. 21, April 25 (Days 24, 47, 65)		May 17, May 31
Hearing Screening	X				
KBIT-2 Matrices	X				
TOPEL Print Knowledge*	X			X	
TOPEL Phonological Awareness*	X			X	
ISF*		X	X		X
LNF*		X	X		X
PSF*		X	X		X
NWF*		X	X		X
CELF P-2 REC	X			X	
CELF P-2 EXP	X			X	

* = Dependent Measures
TOPEL = Test of Preschool Early Literacy
KBIT-2 = Kaufman Brief Intelligence Test-2
ISF = Initial Sound Fluency
LNF = Letter Naming Fluency
PSF = Phonemic Segmentation Fluency
NWF = Nonsense Word Fluency
CELF P-2 REC = Clinical Evaluation of Language Fundamentals Preschool-2 Receptive
CELF P-2 EXP = Clinical Evaluation of Language Fundamentals Preschool –2 Expressive

Table 3
Number of Treatment Groups

Classroom	Treatment Number of Groups of 2 (Total)	Treatment Number of Groups of 1	Control
1.	2 (4)		3
2.	1 (2)		
3.	1 (2)		1
4.	1 (2)		1
5.		1	
6.		1	
7.	2 (4)		1
8.	2 (4)		1
9.	1 (2)		
10.			1
Total Number of Children	20	2	8

NOTE: The number in ( ) represents the number of treatment groups.

Table 5

Results of the ANCOVA Analyses

Group	Measure	*M*	*SD*	*p*	Cohen's *d*
Experimental	ISF (IP3)	20.95	8.655	0.001	1.7140 (large)
Control		8.13	6.081		
Experimental	ISF (MP2)	23.36	16.253	0.009	1.1420 (large)
Control		8.63	8.280		
Experimental	PSF (IP3)	3.422	1.485	0.002	1.2282(large)
Control		1.581	1.510		
Experimental	PSF (MP2)	18.45	12.523	0.070	0.8572 (large)
Control		9.13	8.919		
Exp. TOPEL	PA (Posttest)	19.82	3.500	0.164	0.7555(moderate)
Control		16.63	4.838		
Experimental	LNF (IP3)	24.55	13.773	0.284	0.6129 (moderate)
Control		16.25	13.307		
Experimental	LNF (MP2)	30.18	16.823	0.076	0.9785 (large)
Control		17.13	8.526		
Experimental	NWF (IP3)	3.554	1.543	0.001	1.4203 (large)
Control		1.151	1.828		
Experimental	NWF (MP2)	17.82	12.105	0.019	1.1667 (large)
Control		5.38	8.991		
Exp. TOPEL	Print (Posttest)	28.50	6.624	0.525	0.4332 (small)
Control		24.63	10.756		

ISF = Initial Sound Fluency
PSF = Phonemic Segmentation Fluency
PA = Phonological Awareness Subtest
LNF = Letter Naming Fluency
NWF = Nonsense Word Fluency
Print = Print Knowledge
IP3 = Intervention Probe 3
MP2 = Maintenance Probe 2

Effect Size

Cohen's *d* .20 small, .50 moderate, .80 high Cohen (1988)