2009

Evaluating the Effectiveness of a Short-Duration Reading Intervention on Grade One Phonological Awareness and Word Reading

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EVALUATING THE EFFECTIVENESS OF A SHORT-DURATION READING INTERVENTION ON GRADE ONE PHONOLOGICAL AWARENESS AND WORD READING

by

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Psychology, Brock University, 2000
Religion and Culture, Wilfrid Laurier, 2001

DISSERTATION

Submitted to the Department of Psychology, Faculty of Science

in partial fulfilment of the requirements for

Doctor of Philosophy

Wilfrid Laurier University

2009

Your file Votre référence
ISBN: 978-0-494-49971-9
Our file Notre référence
ISBN: 978-0-494-49971-9

Abstract

The purpose of this project was to evaluate the influence of a summer intervention for children showing early signs of reading delay. The project evaluated two intervention components: a two week camp for children and two training workshops for parents. Data were collected for five groups of participants. Three groups participated in one or more intervention components: parent workshops only group, child camp only group, and both parent workshops and child camp group. All children who participated in the interventions were identified by teachers as having difficulty in phonological awareness and word reading skills at the end of senior kindergarten. Two additional groups served as comparisons. Children in the 'low' comparison group had early literacy skills similar to children in the intervention groups. The 'average' comparison group included children that were identified by teachers as normally achieving in early literacy. The intervention programs sought to improve children's word reading ability by providing explicit instruction in phonological awareness and opportunities to practice other emergent literacy skills.

Children participated in pre- and post-test assessments measuring literacy skills and general cognitive skills. Children in all three intervention groups showed positive change following the intervention compared to a comparison group of children with similar initial abilities who did not receive any intervention. Children who received both intervention components showed the most positive change following a follow-up assessment at the end of grade one. The frequency of home literacy activities with parents was related to positive improvement in children's phonological awareness and word reading skills. The quality of home literacy activities is also thought to be important. Results are presented in the context of the response-to-intervention framework for identifying children with reading disabilities.

Acknowledgements

Thank you to Dr. Gottardo for many years of support, and to

Dr. Roberts and Dr. Wood for encouragement and helpful suggestions throughout.

Thanks also to Dr. Loomis you was a wonderful mentor and friend.

And finally, a special thank you to my husband and family

for being more important than they know.

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Introduction

Learning to read is arguably the most important skill of early education because the task of "learning to read" in the early school years, leads to "reading to learn" in later grades (Chall, 1996). Poor reading skills, therefore, can limit learning in other academic areas (Lonigan, Burgess & Anthony, 2000). An estimated one in three children experiences problems in learning to read (Adams, 1990). Children who show early reading problems are more likely to continue experiencing reading problems throughout the school age years (Baydar, Brooks-Gunn & Furstenberg, 1993; Juel, 1988) and into adulthood (Bruck, 1998).

Early reading ability, therefore, is an important marker of later achievement. Advances in our understanding of the core deficits of reading disabilities allow researchers to identify young children who may be at risk for later reading delay (Wagner et al., 1997). Several research studies have evaluated the effectiveness of different remedial support programs for young children, from preschool (ages three and four) through elementary grades, who experience early reading delays or who are at-risk for later reading delay (e.g. Denton, Fletcher, Anthony, & Francis, 2006; Lundberg, Frost, & Peterson, 1988; Schnieder, Roth, & Ennemoser, 2000). These programs are often long in duration and expensive to operate.

This project seeks to evaluate the effectiveness of a short-term intervention for improving the reading skills of young children at-risk for future reading delay. The effectiveness of the intervention is evaluated at the group and individual level. In addition, this study examines the relative impact of a parent training component alone, or in supplement to, a child-focused intervention.

Literature from developmental and educational psychology is used to provide rationale for this project's design. The review of literature includes the following five relevant components: the acquisition of reading skill in young children, the importance of the

early home environment for the successful development of reading skill, the theory of the Matthew Effect in reading (Stanovich, 1986), previous early intervention programs for literacy skills, and processes for identifying children with reading disabilities. The Matthew Effect phenomenon provides an argument that early success in reading influences the rate of growth in reading skill and provides evidence for the importance of early intervention programs for children experiencing early reading delays. The last section examines the current process for identifying children with a reading disability. New literature suggests that responsiveness to early intervention programs may be a more valid method of identifying children with true reading disabilities than traditional reliance on standardized test scores.

The acquisition of reading skills

This section discusses the concept of emergent literacy as the new framework for understanding the development of literacy in young children. Phonological awareness is central to early literacy and so this section also reviews the current literature on phonological awareness to provide a background for the current study. Included is a review of other developmental skills related to phonological awareness, the components of phonological awareness, strategies to measure phonological awareness, and the relationship between phonological awareness and word reading. An understanding of this relationship is important for this study because phonological awareness and word reading are the two primary outcome variables in the analyses.

Emergent Literacy

The old model of reading acquisition, called the 'reading readiness' model, made the distinction between 'real reading' that developed from formal instruction and everything that came before (Neuman & Dickinson, 2000); under this model, children are not 'reading' until they read actual words in text. The new model, called emergent literacy, views literacy

related behaviours in preschool as legitimate and important in the process of reading acquisition. Researchers have argued for a continuum of reading acquisition from preschool through the school age years, with no clear boundary between pre-reading and reading skills (Lonigan et al., 2000; Whitehurst & Lonigan, 1998). Emergent literacy skills develop gradually and increase in complexity to become skilled reading ability in the primary grades. A variety of different skills have been conceptualized under the 'emergent literacy' concept: knowledge of print conventions, knowledge of the function of text, receptive and expressive vocabulary, grammar, alphabet knowledge, knowledge of letter names and sounds, and phonological awareness.

There are two dominant conceptualizations of emergent literacy; perhaps most popular is the conceptualization from Whitehurst and Lonigan (1988). They divide emergent literacy into 'outside-in' and 'inside-out' categories. Outside-in skills are sources of information from outside the printed text that support children's understanding of the meaning of print (such as vocabulary, conceptual knowledge, and understanding of story structures). Inside-out skills are sources of information within print that support the translation of print into sounds (such as letter knowledge and phonological awareness.) The 'hyphen' used in the terms outside-in and inside-out is intended to denote the reciprocal flow of information between the two sources of information (Storch & Whitehurst, 2001; Whitehurst & Lonigan, 1998).

The other popular interpretation of the emergent literacy concept comes from Senechal, LeFevre, Smith-Chant, and Colton (2001) who choose to exclude language and phonological awareness skills. They propose two categories of emergent literacy skills: conceptual knowledge about print (such as print concepts and functions of print) and procedural knowledge about print (such as alphabet knowledge). They argue that language

skills (e.g. vocabulary) and phonological awareness (which they categorize as a metalinguistic skill or being able to segment and reflect on sounds in words) should be excluded from definitions of emergent literacy to clarify the relationship between emergent literacy and subsequent reading skill. Despite this alternative conceptualization, language skills and phonological awareness are often included under the emergent literacy concept because they represent skills that develop before reading ability and are part of the emerging knowledge that leads to reading ability (Purcell-Gates, 2001).

Phonological Awareness

From a cluster of emergent literacy skills, reading ability develops. The simple view of reading (Gough, 1996) posits that reading ability is the product of decoding and comprehension; famously written as R = D x C. This model suggests that children will not be successful at reading if they experience delays in either decoding or listening comprehension. Many poor readers experience delays in both domains (Juel, 1988) however, the core deficit of most poor readers is problems with decoding (Stanovich, 1988, Stanovich & Siegel, 1994; Torgesen, 2000).

Decoding is the act of identifying and blending individual sound segments into words. Deficits in decoding are linked to deficits in phonological awareness (Rack, Snowling, & Olson, 1992). Phonological awareness is the ability to recognize and manipulate sounds within speech. It is considered by many researchers to be the single strongest predictor of reading development (Elbro, 1996; Stanovich & Siegel, 1994). There are three types of skills included in phonological awareness: awareness of syllables, awareness of rhymes and awareness of phonemes (the sounds of letter segments; Goswami & Bryant, 1990) that appear to develop in the sequence set out here (Schatschneider, Francis, Foorman, Fletcher & Mehta, 1999; Stanovich, Cunningham, & Cramer, 1984; Yopp, 1988). In normal development,

phonological awareness emerges between the ages of three and four, with improving abilities throughout childhood (Lonigan et al., 2000; Carroll, Snowling, Hulme & Stevenson, 2003).

Evidence from longitudinal studies suggests that phonological awareness develops from general cognitive ability, speech perception, and verbal short term memory (McBride-Chang, Wagner, & Chang, 1997). The influence of general cognitive ability suggests that children with higher overall cognitive ability may acquire phonological awareness more easily than children with lower cognitive abilities. Speech perception is necessary to hear the differences between sounds in speech and short term memory is required to store the speech sounds until cognitive processing (McBride-Chang, 1995; McBride-Chang et al., 1997). Lonigan et al. (2000) suggest that oral language and letter knowledge are also precursors to phonological awareness. Children with higher oral language abilities are likely to have greater exposure to spoken words which would facilitate their discovery of individual speech segment sounds (Metsala & Walley, 1998). In addition, knowledge of individual letter names would speed the association to letter sounds and the function of individual letters in words (Ehri, 2005).

In the emergent literacy tradition, researchers recognize syllable, rhyme, and phonemic awareness as representing an overall sensitivity to phonological units that vary by linguistic complexity (Lonigan et al., 2000). Awareness of larger units (syllables and rhymes) is believed to develop before awareness of smaller units (phonemes) (Anthony & Lonigan, 2004; Goswami & Bryant, 1990; Stanovich, 1992). In line with this view, for research purposes many investigators report a single phonological awareness variable representing the sum or mean of scores on individual phonological awareness tasks. This approach is supported by several factor analysis studies which have reported that phonological awareness is best described as a single, unitary factor (Anthony & Lonigan, 2004; Lonigan et al., 2000;

Schatschneider et al., 1999; Stahl & Murray, 1994; Stanovich et al., 1984). Supporters of this view suggest that secondary factors that sometimes arise in factor analysis studies can often be explained by method variance created because many phonological awareness tasks have the same format (Anthony & Lonigan, 2004; Schatschneider et al., 1999; Yopp, 1988).

Other studies have reported two or three separate phonological factors. In Hoien, Lundberg, Stanovich, and Bjaalid (1995), a factor analysis of six phonological tasks resulted in a three factor model representing a syllable factor, a rhyme factor, and a phoneme factor. They found that the rhyming factor and the phoneme factor made unique contributions to the prediction of reading ability. Lundberg et al. (1988) demonstrated distinct phoneme and syllable factors; Muter, Hulme, and Snowling (1997) and Carroll et al. (2003) have reported distinct phoneme and rhyme factors. Evidence for this approach comes also from studies that have found no correlation between rhyme and phoneme measures from early readers (Blaiklock, 2004).

Measuring Phonological Awareness

How phonological awareness is measured is another point of debate. A wide variety of tasks have been designed to measure phonological awareness (McBride-Chang, 1995). Some tasks use forced-choice responses while other tasks elicit open-ended responses; tasks range from simple matching of pictures based on rhyme or phoneme to manipulation of individual phoneme units. These tasks vary in their linguistic unit (syllable, rhyme, phoneme), position of the target unit within the word (initial, middle, or final), and whether the target word is a real word or pseudoword (McBride-Chang, 1995)

Schatschneider et al. (1999) applied item response theory to seven phonological awareness tasks comprised of 105 items on a sample of 945 children in kindergarten (approximately age five) through second grade (approximately age seven). They found that

difficulty varied across tasks and within tasks by the position of the target unit within the word. The sound categorization task (or oddity task), selecting the word that does not share a phoneme with the other three, was the least effective task for measuring phonological awareness (for example, which word does not start with the same sound – pig, sat, pat). This task was particularly inefficient because of an apparent confound with the placement of the target word or 'odd' word in the list, whereby the task was much easier when the target word was in the final position (Schatscheider et al., 1999). Additionally, in oddity or categorization tasks, children are not required to 'produce' a response; the correct answer is one of three options presented in the task and children can occasionally guess the correct response (Hulme et al., 2002).

Blending tasks, combining phonemes or word segments into words or pseudowords (for example, what word is created when you put a 's' sound in front of the 'at' word), and phoneme deletion tasks such as deleting a single phoneme from a word (for example, what word is left if you take the 's' sound from the word 'sit'), are the most accurate predictors of phonological awareness (see also Hatcher & Hulme, 1999; Muter et al., 1998; Nation & Hulme, 1997). This may be because children cannot guess the correct response. In tasks that require children to somehow manipulate phonological units (i.e. blending, segmenting, deleting, or substituting) children must 'produce' a response (Hulme et al., 2002). These types of tasks may be necessary to measure differences among children with stronger phonological abilities (Blaiklock, 2004; Hulme et al., 2002; Schatschneider et al., 1999).

Given that phonemic awareness (awareness of individual speech sounds or phonemes) is believed to be the strongest concurrent predictor of reading ability (Castles & Coltheart, 2004; Hulme et al., 2002; Muter et al., 1998; Muter et al., 2004), some researchers use a single measure of phonemic awareness in lieu of a composite phonological awareness score.

Studies have found that phoneme deletion tasks are the most reliable of phonological awareness tasks (Hulme et al., 2002) and are the most discriminating task for assessing children with at least average levels of phonological awareness (Schatschneider et al., 1999). However, research has noted also that phoneme deletion tasks are the hardest for children (e.g. Hulme et al., 2002; Stanovich et al., 1984; Yopp, 1988) and that few children are able to perform a phoneme deletion task until they have started to read (Blaiklock, 2004).

Individual measures of syllable, rhyme, and phonemic awareness may be more or less effective measures of phonological awareness, depending on the ability level of the child (Schatschneider et al., 1999). Rhyme matching, and blending onset and rhyme segments are tasks that appear to be most effective for measuring phonological awareness in very young children (Blaiklock, 2004). Phoneme deletion tasks, which are often very challenging for young children, are subject to floor effects, and therefore, are best for measuring phonological awareness in children with some reading ability (Blaiklock, 2004; Schatschneider et al., 1999). A composite phonological awareness score may be the best representation of phonological skill in a study sample of young or emergent readers.

Relationship Between Phonological Awareness and Word Reading Ability

There are three possible models of the relationship between phonological awareness and reading skill: reading ability may influence phonological awareness, phonological awareness may influence reading ability, or the relation between reading ability and phonological awareness may be reciprocal. Evidence that reading skill influences individual differences in phonological awareness comes from studies that show poor performance on phonological tasks by illiterate adults (Morais, Clay, Alegria, & Bertelson, 1979). This model was soon discarded, however, in light of mounting evidence that phonological awareness was

a strong predictor of word reading (for reviews see Bus & van IJzendoorn, 1999 and Ehri, Nunes, Stahl, & Willows, 2001).

Based on growing evidence, most researchers would now support the reciprocal model of the phonological awareness-reading ability relationship (e.g. Castles & Coltheart, 2004; Fuchs et al., 2001; Hogan, Catts, and Little, 2005; McBride-Chang, 1995; Nation, 2008; Stanovich, 1986; Wagner et al., 1997). Hogan et al. (2005) found that kindergarten phonological awareness predicted grade two word reading, and that grade two word reading predicted grade four phonological awareness. Research has demonstrated that phonological awareness strongly influences reading (Adams, 1990; Goswami & Bryant, 1990; Nation, 2008; Rack, Hulme, & Snowling, 1993; Wagner et al., 1997). As children learn to access and manipulate phonological units with more ease, decoding becomes faster, and word reading improves. Reciprocally, phonological awareness abilities continue to improve with reading practice; as children encounter and decode more words their ability to identify and manipulate phonological units improves. Phonological awareness is largely recognized as the core deficit in children who experience reading delay (Stanovich, 1988, Stanovich & Siegel, 1994; Torgesen, 2000). The influence of phonological awareness on reading ability is known to extend until fourth grade (Catts et al., 2005; Wagner et al., 1997).

Longitudinal studies monitoring the development of reading acquisition from preschool through the school age years have identified several skills, in addition to phonological awareness, that influence reading ability. In a study of 216 children from kindergarten to grade three, Wagner et al. (1997) identified oral language, letter knowledge (name and sound), and phonological awareness as predictors of word reading ability. In a younger sample of children from preschool (age four) to grade one, only letter knowledge and phonological awareness were significant predictors of word reading approximately 18

months later (Lonigan et al., 2000). In this study, the influence of oral language on word reading was mediated by letter knowledge and phonological awareness.

Adams (1990) argued that at school entry, knowledge of letter names is the strongest predictor of later reading ability. This finding was echoed by Scarborough (2001) in a meta-analysis of 61 studies exploring factors predicting early reading ability. Other researchers have found that letter knowledge predicts phonological awareness, specifically phonemic awareness (Muter et al., 2004; Stahl & Murray, 1994; Wagner et al., 1994, 1997) and that children must have at least some knowledge of letters to perform phonemic awareness tasks (Blaiklock, 2004; Carroll et al., 2003). It is clear, however, that letter knowledge is only one, among an array of emergent literacy skills, because teaching children the name of letters, solely, does not improve their reading ability (Adams, 1990).

As evidenced in longitudinal studies, in addition to phonological awareness, other emergent literacy skills are important predictors of later reading ability. Oral language, particularly receptive vocabulary (the words children can understand) is thought to be an important component of emergent literacy. Through language, children are exposed to different letter sounds and different patterns of sounds within words (e.g. rhymes). The direct-mapping hypothesis of reading suggests that children develop phonological awareness by associating sounds heard in words to characters of printed words; a larger vocabulary would give children more words on which to map decoding attempts (Rack, Hulme, Snowling, & Wightman, 1994; Share, 1995). In addition, a larger vocabulary might drive the development of phonological awareness by causing children to have more differentiated phonological representations (Metsala & Walley, 1998). Through these processes, oral language would influence reading ability indirectly by influencing phonological awareness (Rack et al., 1994; Senechal & LeFevre, 2002; Whitehurst & Lonigan, 2001).

Reading ability develops gradually, in a series of increasingly complex skills. Knowledge of letter names and sounds, oral language, and phonological awareness are key skills that are important for future success in reading. The current study will examine the influence of a short intervention on these key emergent literacy skills.

Home environment factors influencing emergent literacy

Children's emergent literacy skills develop prior to formal education at schools. The home environment and parent support are understood as important contributors to children's development, in general, and to emergent literacy, specifically. This section provides a brief overview of research on the influence of the home environment of development and emergent literacy. It also describes two different kinds of literacy activities in the home: informal activities like shared book reading and formal activities that include direct teaching of literacy skills. The research presented shows the relationship between informal and formal literacy activities and children's later reading skills.

The influence of the home environment on children's development

Since the introduction of the Home Observational Measurement of the Environment tool by Caldwell and Bradley in 1984, an observational survey that measures seven aspects of the child's home environment, studies have sought to link the characteristics of the home environment to individual differences in children. Overall, high quality home environments, characterized by stimulating learning opportunities, parental warmth and responsiveness, and a safe, clean physical environment, are linked to children's achievement, behaviour, and general well being (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001). Studies using the HOME have found that toys and activities that stimulate learning and parental responsiveness in the home were linked to children's language and literacy outcomes

(Bradley et al., 2001; Molfese, Modglin, & Molfese, 2003; Roberts, Jurgens, & Burchinal, 2005).

Studies not using the HOME scale specifically, often conceptualize the home literacy environment as a composite of parent reading habits, opportunity to engage print (exposure), and child literacy activities. Composite home literacy environment scores have been linked indirectly to children's reading ability through influence on children's language (Leseman & de Jong, 1998; Marjanovic Umek, Podlesek, & Fekonja, 2005) and comprehension (Rashid, Morris, & Sevcik, 2005). Stronger relationships to children's reading ability have been found when examining individual aspects of the home environment.

Parents' own literacy-related behaviours are an important component of the home literacy environment. Seeing parents read may help children develop concepts about the representational function of print (Leseman & de Jong, 1998). As well, parental involvement with print may foster positive attitudes about reading in children and build motivation to learn how to read. It has been estimated that as much as 14% of the variance in children's early language and literacy skills can be accounted for by children's interest in literacy (Scarborough & Dobrich, 1994).

Opportunity to engage or interact with print is the second component of the home literacy environment. A home with many children's books, alphabet or letter posters, and other child-geared print materials is called a 'print-rich' home environment. In most 'print-rich' environments, parents also have many books; they receive one or more magazine subscriptions, and have a library membership (Aulls & Sollars, 2003). In these instances, children have opportunities to interact with print but see parents engaging meaningfully with print too.

Informal and formal home literacy activities

Arguably, the most significant component of children's home environment is children's literacy-related interaction with parents. Research has shown that children's literacy outcomes are strongly influenced by parental involvement in children's learning (Fantuzzo, Tighe, & Childs, 2000; Senechal & LeFevre, 2001; Senechal & LeFevre, 2002). Parents' home literacy behaviours can be classified into two groups: formal literacy activities such as direct teaching of letters and sounds and informal literacy activities such as reading storybooks and reciting nursery rhymes (Senechal & LeFevre, 2002). Interestingly, the frequency of formal and informal literacy activities in the home are not strongly related, suggesting that not all parents engage equally in both types of literacy activities in the home (Senechal & LeFevre, 2001, 2002). Evidence suggests that formal and informal home literacy activities are differentially related to emergent literacy and reading ability outcomes (Evans, Shaw, & Bell, 2000; Senechal & LeFevre, 2001, 2002).

Parent-child book reading is arguably the most common home literacy activity. Studies suggest that most middle-class families begin shared book reading during the child's first year (Celano, Hazzard, McFadden-Garden, & Swaby-Ellis, 1998; Senechal, LeFevre, Hudson, & Lawson, 1996). Some studies have linked the initiation of shared book reading and the frequency of shared book reading to family socio-economic status (Adams, 1990; Peralta de Mendoza, 1995; Raz & Bryant, 1990) but other studies have refuted this claim (Bus, van IJzendoorn, & Pellegrini, 1995). Outside of income, the frequency of parent-child book reading has been consistently related to maternal education (Fletcher & Reese, 2005).

In a meta-analysis of research about shared book reading, Scarborough and Dobrich (1994) found that the frequency of shared book reading during preschool accounted for 7% of the variance in children's emergent literacy skills at school entry and 8% of the variance in

children's reading achievement from kindergarten to grade three. (The authors suggest that the actual amount of variance predicted by shared book reading in young children is higher than that found in their analysis and that the design of studies examining shared book reading limits the statistical power of the meta-analysis.) Book reading has been significantly related to children's print concepts, emergent literacy skills, and reading achievement (Bus van IJzendoorn, & Pellegrini, 1995, Scarborough and Dobrich, 1994) but more recent work has argued that the influence of shared book reading is strongest on receptive vocabulary (Fletcher & Reese, 2005; Senechal & LeFevre, 2001, 2002).

Shared book reading is thought to influence children's language and literacy outcomes through several different processes. First, children are exposed to story structures, grammar of written language, print conventions, and general information about the world (Bus et al., 1995). Shared book reading experiences also provide children with exposure to new words that build vocabulary and provide information about letter-sound relations (Bus et al., 1995; Fletcher & Reese, 2005). Studies of parent-child interactions suggest that story-book interactions expose children to more complex language than other contexts (Crain-Thoreson, Dahlin, & Powell, 2001; Hoff-Ginsberg, 1991). Oral language skills are likely related to reading ability through their influence on early phonological awareness (Lonigan et al., 2000) and later reading comprehension (Senechal & LeFevre, 2001). Finally, enjoyable book reading experiences may help build a general appreciation of literacy which would facilitate children's reading practice when they begin independent reading (Baker, Scher, & Mackler, 1997).

Though shared book reading is arguably the most common parent-child literacy activity in the home, studies suggest that parents' direct teaching of literacy skills, or formal literacy activities, is more directly related to children's reading skill (Evans et al., 2000; Foy

& Mann, 2003; Haney & Hill, 2004; Senechal & LeFevre, 2002). Haney and Hill (2004) found that 86% of parents report directly teaching literacy skills to preschool children; 71% taught letter names, 65% taught letter sounds. The frequency of direct teaching activities in the home has been related to letter knowledge, and phonological awareness in young children, and word reading ability in grades two and three (Evans et al., 2000; Foy & Mann, 2003; Haney & Hill, 2004; Senechal & LeFevre, 2002).

Informal and formal home literacy activities on children's emergent literacy

Two recent studies used longitudinal samples to examine the influence of the home environment and different home literacy activities on children's later reading ability. Storch and Whitehurst (2001) sampled 367 preschool children (age four) who attended Head Start Centres in New York. They measured language and literacy each year from age four, at entry to Head Start, through second grade. A latent 'home literacy' variable was created from questionnaires about the frequency and duration of shared reading, the availability of print materials, children's print motivation, parents' expectations for children's school success, parental reading behaviours, and family characteristics (parental education and language). Using the emergent literacy conceptualization from Whitehurst and Lonigan (1998) latent variables were created for inside-out skills (letter knowledge and phonological awareness) and outside-in skills (vocabulary, understanding of story structures). Structural equation modelling was used to fit a model linking home literacy environment and repeated measures of emergent literacy skills, measured from age four, to grade two reading ability. There was a strong, significant influence of early home literacy on preschool outside-in skills. These outside-in skills strongly influenced inside-out skills across school age assessments. However, the results showed it was the inside-out skills (letter knowledge and phonological awareness) that were related to reading ability at the end of grade two (Storch & Whitehurst, 2001).

In a five-year longitudinal study, Senechal and LeFevre (2001, 2002), measured the frequency of both shared reading activities and direct parent teaching activities. Using data from grades one to three, the 111 participating families were divided into four groups based on home literacy activities: 1) high on teaching (direct teaching) and high on reading (shared reading), 2) high on teaching but low on reading, 3) low on teaching but high on reading, and 4) low on teaching and low on reading. Not surprisingly, children in the high teaching, high reading group showed the best overall reading performance from grades one to three. Children in the low teaching, low reading group showed the worst overall performance. The interesting result lies in the two mixed teaching/reading groups. Children who experienced high levels of direct teaching but low levels of shared reading showed initial high ability in emergent literacy at grade one, but had low reading ability in grade three. Children who had fewer direct teaching activities at home but engaged in a high frequency of shared book reading interactions were initially low in emergent literacy but showed strong, steady growth in reading ability. This group of children almost reached the same level of reading ability as the high teaching, high reading group by grade three (Senechal & LeFevre, 2001).

Senechal and LeFevre (2001) argue for the importance of shared book reading in their interpretation of these results. They suggest that direct parent teaching is important for a strong initial start and that children who have received direct teaching in literacy appear to be able to develop word reading skills more quickly. However, shared book reading may foster an appreciation of reading which leads to more practice once independent reading is established. Other research would suggest that practice leads to rapid increases in word reading ability (Cunningham & Stanovich, 1998; Juel, 1988).

Another view is that early shared reading facilitates vocabulary development which leads to comprehension (Fletcher & Reese, 2005). The effect of stronger vocabulary and

comprehension skills might not exhibit an influence on reading ability until children become independent readers (Senechal, 2006). Thus, children who experienced few direct teaching interactions but frequent shared book reading interactions took longer to develop word reading but because of practice, and strong vocabulary and comprehension skills, they improved more rapidly in reading ability once independent reading began.

These studies are not directly comparable because they used different measures of emergent literacy and different measures of the home literacy environment. In her work, Senechal et al. (2001) uses the procedural versus conceptual categorization of emergent literacy skills which excludes phonological awareness abilities. In his research, Whitehurst uses the inside-out versus outside-in categorization of emergent literacy skills which includes phonological awareness (inside-out). Also, Storch and Whitehurst (2001) use a broad conceptualization of home environment, including measures of the frequency and duration of shared reading, availability of print materials, children's print motivation, parents' expectations for children's school success, parental reading behaviour, and family characteristics. Senechal and LeFevre (2001) measure home literacy activities specifically, focusing on the frequency of informal and formal home literacy activities.

Together, however, the studies suggest a general pattern of influence of home literacy on emergent literacy and later home reading. Shared book reading and general exposure to print influence vocabulary, general knowledge, and print concepts. These skills then influence children's phonological awareness and letter knowledge. Parent teaching activities appear to influence phonological awareness and letter knowledge specifically. Though Senechal and LeFevre (2001) did not include phonological awareness in their conceptualization of emergent literacy, given research on the strong influence of phonological awareness on reading, the influence of direct teaching on phonological

awareness can be inferred by children's quick transition to decoding and word reading in grade one.

Phonological awareness and letter knowledge facilitate the initial transition to reading ability, but vocabulary and comprehension skills, as influenced from shared book reading experiences, contribute to strong growth in reading skills once independent reading is established. As effective parent teaching of literacy skills to young children appears important for children's literacy success, two of the interventions in this study provide parent training opportunities regarding home reading and teaching of phonological awareness.

Influence of initial ability on later reading achievement

This section provides evidence supporting the value of early intervention to support children's literacy. The Matthew Effect is a model of literacy development posited by Stanovich that suggests initial ability influences later ability through reading practice. This model is explained in detail below. Also included is a discussion of how initial ability may influence later educational achievement through socio-emotional consequences.

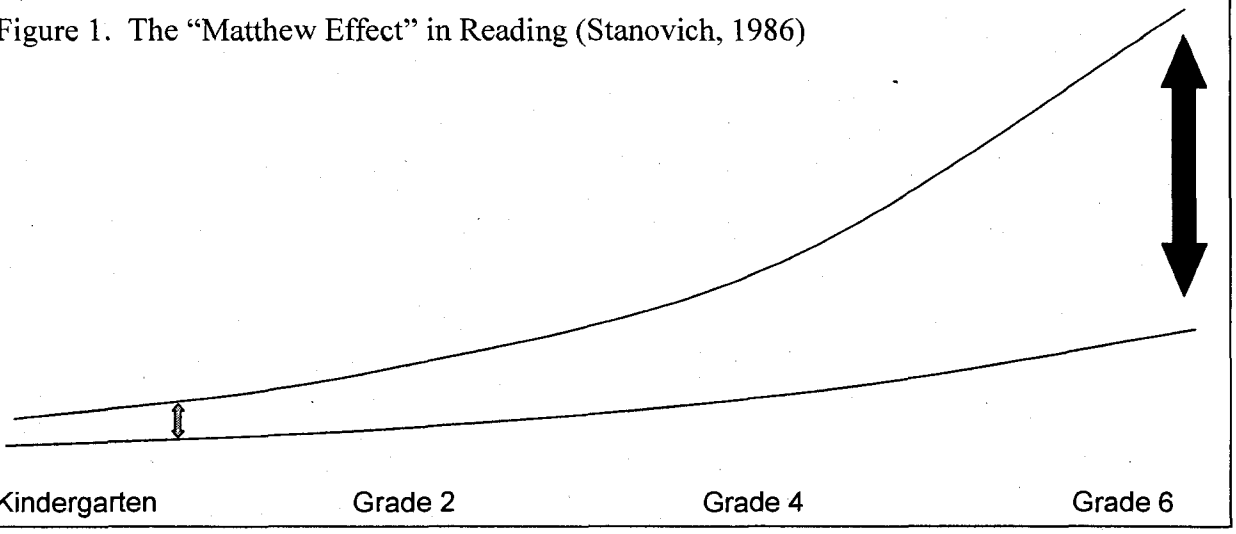
The Matthew Effect

High quality early literacy experiences in the home environment during the preschool and early school years may be particularly important to children's reading growth because initial reading ability may influence the rate of growth. Stanovich (1986) called this pattern of growth in reading the 'Matthew Effect'. The general model of the Matthew Effect in education, suggests that children with 'advantageous early experiences' are able to benefit more from new educational experiences, resulting in large individual differences in educational outcomes (Stanovich, 1986; Walberg & Tsai, 1983). Stanovich applied this model to the development of reading. He argues that children's reading skills develop as a function of their initial ability; that is, children who read well early, will improve at a rate

faster than children who lag behind in early reading skills. An example of this growth curve is depicted in Figure 1.

The Matthew Effect in reading theory is based on assumptions about the reading acquisition process. Central to these assumptions is the belief that phonological awareness is a critical determinant of reading ability. Early individual differences in phonological awareness result from a combination of individual, environmental, and experiential factors (Lonigan et al., 2000). Early acquisition of phonological awareness facilitates decoding skill (sounding out words) that with practice, leads to automatic word recognition (Cunningham & Stanovich, 1998; Perfetti, 1985). As more words become recognized by sight, less attention is required for the actual deciphering of words and more attention can be used for comprehension processes (Stanovich, 1986).

Figure 1. The "Matthew Effect" in Reading (Stanovich, 1986)



Practice is the key mechanism through which the Matthew Effect in reading is thought to develop (Stanovich, 1986). Early phonological awareness permits earlier acquisition of decoding skill. With practice, laborious decoding of individual words develops into automatic word recognition that allows children to read words more efficiently. Children

with early phonological skill will reach the word recognition stage more quickly. These children can now read most words efficiently, while unskilled readers are still working slowly to decode individual words. Because of these differences, during the same duration of reading practice, skilled readers are reading more words than unskilled readers. Skilled readers get more exposure to words, resulting in even more efficient word recognition, and growth in vocabulary and comprehension. These skills are reciprocally related, meaning that reading facilitates vocabulary and comprehension skills, which in turn facilitate reading. As children know more words, and understand the meaning of words/sentences, they read even more efficiently.

Children who show early delay in phonological awareness show subsequent delays in decoding and automatic word recognition. Early practice at reading is more time consuming, meaning that children are exposed to fewer words; less practice has implications for the growth of vocabulary and comprehension skills. By the time children with early phonological delays have reached the stage of automatic word recognition, they are considerably behind more skilled readers in amount of reading experience. The Matthew Effect suggests that as a result of early individual differences and the reciprocal nature of reading and practice, the disparity between skilled and unskilled readers continues to increase over time.

There is considerable evidence that good readers get more reading practice. In a longitudinal study from first to fourth grade, Juel (1988) found that good readers received more practice both in and out of school. Bast and Reistma (1998) also found that good readers would read more often for pleasure during their leisure time than poor readers. This increase in general print exposure may result in subsequent growth in other academic domains (Cunningham & Stanovich, 1998; Echols, West, Stanovich, & Zehr, 1996). Thus early reading failure could result in more generalized academic problems (Stanovich, 1986).

Evidence for the Matthew Effect is largely derived from studies examining individual components of the model. More adequate support of the Matthew Effect model is provided from Bast and Reitsma (1998). In this study, 235 children were assessed on a range of language and literacy skills from kindergarten through the end of grade three. For the analysis they operationalized the Matthew Effect model as increasing differences in word reading between good and poor readers over time, but with stable ranking of word reading across children over time. If the Matthew Effect model was appropriate for the data, they expected to find that poor readers remained poor readers over time, and that the difference between good and poor readers grew over time. Analyses using structural equation modeling found that the Matthew Effect model was a good fit to the data. Other studies have reported similar findings (Crijnen, Feehan, & Kellam, 1998; McNamara, Scissons, & Dahleu, 2005).

Importantly, a number of studies have refuted the Matthew Effect pattern of growing disparity between early skilled and unskilled readers over time. Wagner et al. (1997) found stability in the level of performance (rank) from kindergarten through grade four but did not find an increasing difference between good and poor readers over time; standard deviations of word reading and phonological awareness were roughly comparable across all grades. Similar findings have been reported by Shaywitz et al. (1995) and Aarnoutse and van Leeuwe (2000).

Though the influence of initial ability on later reading growth can be debated, Stanovich (1986) suggests that early delays in reading also may be significant because of possible socio-emotional and motivational consequences. In Ontario, formal reading instruction begins in grade one (by the end of senior kindergarten in some classrooms), and classroom activities increasingly include reading words and stories, both independently and in groups. Unskilled readers, without phonological awareness or basic decoding skills, may

find even the simplest reading material too difficult, potentially resulting in frustration and decreased motivation for reading practice. Frustration through early grade school may result in less task persistence, lower self-esteem, and a general dislike of school (Juel, 1996). Early interventions to support literacy skills may minimize socio-emotional consequences of early reading difficulties. The current study, therefore, targeted the intervention program for at-risk senior kindergarten children prior to the beginning of formal reading instruction in grade one.

Early interventions for reading delay

The current study will examine the influence of an intervention for young children experiencing early difficulties in emergent literacy. This section describes previous early interventions and their related outcomes on children's emergent literacy. Included is a description of school-based interventions, summer interventions, and interventions targeting parents.

School-based Interventions

The research themes outlined above together provide evidence for the importance of early intervention for reading delay. First, poor phonological awareness is believed to be the core deficit of reading problems (Stanovich, 1988; Stanovich & Siegel, 1994). In most children, phonological awareness develops through early experiences at home (Senechal & LeFevre, 2002). The Matthew Effect model suggests that early individual differences in phonological awareness influence the rate of growth of subsequent reading ability, due in part to the reciprocal relationship between reading, vocabulary, and comprehension skills through reading practice (Stanovich, 1986). Given the importance of early skill development for later success, it seems natural that early intervention in reading would be important for addressing reading deficits. In addition to improving reading skills, early intervention may help mitigate some of the socio-emotional correlates of early reading failure (dislike of school, poor

academic self-concept, and decreased motivation) and prevent the development of poor reading strategies (Baker & Wigfield, 1999; Juel, 1996).

Over the past 20 years, several researchers have examined the effect of early interventions for improving later reading ability. The value of early intervention is made evident through longitudinal studies that support the stability of phonological processes through the school age period (Bus & van IJzendoorn, 1999; Wagner et al., 1997) and advances in the measurement of phonological awareness that allow for early deficits to be detected in the preschool period (Lonigan et al., 2000). Early interventions for reading delay fall into two general categories; those that train for improvements in phonological awareness and those that train for improvements in word reading.

Intervention programs that train for improvements in phonological awareness are most popular in Scandinavian countries where children do not begin formal education until age seven (compared to age five in most countries and age four in parts of Canada such as Ontario where there are two years of kindergarten). A good example of this type of intervention was delivered by Lundberg et al. (1988). They offered daily training sessions to young children, on average six years old at entry, with the goal of helping children discover and attend to the phonological structure of language. Games and activities slowly moved from listening to non-verbal sounds (i.e. a bell ringing), to rhyming and syllable segmenting, and finally identifying initial phonemes. After eight months of training, children in the intervention group showed higher phonological awareness than children in a comparison group (Lundberg et al., 1988). There were no group differences in letter knowledge or listening comprehension.

Most North American studies conduct early intervention programs with the intent of improving word reading ability. Most interventions occur during the kindergarten or grade

one school year using samples of children experiencing early reading delays (e.g. Coyne, Kame'enui, Simmons, & Harn, 2004; Spira, Braken, & Fischel, 2005; Schneider et al., 2000; Torgesen, Morgan, & Davis, 1992) or children from low-socioeconomic status families (e.g. Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Fuchs et al., 2001; Hecht & Close, 2002). Children from economically disadvantaged families have been shown to experience considerable reading delays (Duncan & Seymour, 2000) so intervention with this group of children is seen as a preventative measure of future delays. Evidence suggests that both low-SES and low-ability, at-risk populations benefit from reading intervention programs.

Torgesen et al. (1992) provided two types of intervention to kindergarten children with low phonological awareness abilities. In small group sessions across a period of 8 weeks, one group of children received training in both blending and segmenting phonological units. The other group received training in only blending skills. Only children who received training in both skills made improvements in word reading (Torgesen et al., 1992). Using a similar design, these results were replicated by Wagner et al. (1994).

Schneider et al. (2000) provided three types of intervention to kindergarten children. Participants were children who scored low on screening measures of phonological awareness. One condition taught letter-sound knowledge. The second condition taught phonological awareness skills, including both blending and segmenting practice. The third condition provided both letter-sound training and phonological awareness training. In follow-up assessments at the end of grades one and two, children who received the combined training program outperformed children in the other two training conditions on reading and spelling ability (Schneider et al., 2000).

Training in phonological awareness, ideally in combination with letter knowledge, is clearly central to supporting children at-risk of reading delay, but it may be important to

consider how phonological awareness skills are being taught. Foorman et al. (1998) examined the effect of three different phonological awareness training programs for low income children in kindergarten. The direct instruction group (direct code) included explicit training in letter-sound correspondence. The embedded code condition used storybooks (called connected text) and provided less direct instruction in spelling patterns. Finally, the implicit code condition provided implicit instruction in letter-sound knowledge while reading connected text. Children who received direct code instruction had higher word reading skills and a steeper rate of growth at post-test than children in the other two training programs (Foorman et al., 1998).

These few examples are representative of many intervention programs that have been evaluated. The most effective programs provide explicit instruction in phonological awareness usually in combination with letter-sound training (Adams, 1990; Bus & van IJzendoorn, 1999). Some programs attempt to train teachers and the 'intervention' becomes the regular class curriculum (e.g. Foorman et al., 1998; Mathes et al., 2005; Schneider et al., 2000). However this raises concerns about implementation fidelity as some teachers may be resistant to changing their teaching methods (Foorman et al., 1998). Furthermore, within the structure of a classroom it is difficult to provide more intensive support to the small group of children who are experiencing problems in early reading acquisition.

Programs that specifically address children at-risk often use small group instruction (e.g Torgesen et al., 1992) or one-on-one tutoring support (e.g. Spira et al., 2005). These programs are, however, very expensive to operate on a large scale. Additionally, providing special reading interventions during the regular school day means that children are missing out on other learning experiences. With a class-based reading intervention, children often receive less time in other subjects like art or music. For one-on-one tutoring programs,

children are removed from the classroom during non-literacy teaching blocks and therefore, miss out on instruction in other subjects that is received by other children in the classroom (e.g. math). There are at least two alternative strategies to supporting children at-risk of reading delay: a) shorter-duration, intensive programs for children in the summer months between school or b) training parents to support children at-risk of delays at home.

Summer Interventions

There are only a few summer reading intervention programs presented in the published literature (Luftig, 2003; Pokorni, Worthington, & Jamison, 2004; Schater, 2003; Schater & Jo, 2005). Schater and Jo (2005) provided seven-weeks of a summer 'camp' intervention to low socio-economic status children exiting grade one; low initial reading skills were not a condition of participation. Each day, children participated in two hours of literacy-based instruction that included explicit instruction in phonological awareness coupled with reading and writing opportunities. Each literacy period began with teacher-led storybook reading, followed by phonics instruction with the whole class. Children then worked individually on phonics worksheets. Reading practice was achieved with decodable books and basal readers in small groups. Each literacy period ended with writing activities that focused on comprehension skills. Other camp activities included swimming, sports, arts, crafts, and video arcades.

Following the program, children who participated in the intervention program scored significantly higher than a comparison group in reading comprehension and decoding. This finding is particularly strong because children were randomly assigned to intervention and control conditions.

Significant improvements on reading measures were also found after a three-week summer intervention program for economically disadvantaged children reported by Luftig

(2003). Children entering grade one participated in a half-day reading program. The program included small group tutoring using the school's current literacy curriculum which focused on reading readiness and basic phonics skills. Following the program, children who participated in the summer program showed more growth in overall emergent literacy and in comprehension than children in a comparison group (Luftig, 2003).

Luftig (2003) also reports outcomes for children in grades two, three, and four who participated in one of three summer intervention programs: school-based intervention, private agency intervention, or comparison group. Children in the school-based intervention received small group tutoring based on the school's literacy curriculum for an average of seven hours over three weeks. Children in the private agency intervention received small group and one-on-one instruction with an emphasis on phonics three times per week for an average of 32 hours over three weeks. Results indicated that children who received any intervention showed more growth in reading than the comparison group. Interestingly, there were no measurable differences between the school-based and private agency interventions, despite the large difference in hours of intervention (Luftig, 2003). These studies show that a summer reading intervention may be particularly advantageous for economically disadvantaged children, but it does not show if a summer intervention is beneficial to children showing signs of early reading delay.

Pokorni et al. (2004) studied the influence of three different intervention programs offered over a four week summer period. Children who were 7.5 to 9 years of age, reading more than one year below grade level and receiving school-based speech and language services, were assigned to one of three computer-based interventions. Each intervention program consisted of three, one-hour blocks of computer-based games separated by short breaks offered daily for four weeks. Two of the programs were found to influence children's

growth in phonological awareness, but none of the programs significantly influenced language or reading outcomes (Pokorni et al., 2004). Children in this study were identified as having both reading and speech/language delays, so the influence of the computer-based interventions on children with reading delay only is unclear.

Interventions Targeting Parents

Another relatively inexpensive strategy to support young children's reading acquisition is to train parents. In a series of studies, Whitehurst and colleagues (Arnold, Lonigan, Whitehurst, & Epstein, 1994; Whitehurst et al., 1994a; Whitehurst et al., 1994b; Whitehurst et al., 1998, Whitehurst et al., 1999) have examined the influence of training a dialogic reading style. Dialogic reading is a questioning style that encourages the child to be the active participant during book reading. The parent takes the role of the active listener while also questioning, adding information, and prompting the child to provide increasingly sophisticated descriptions of the book's pictures (Whitehurst et al., 1999). Following this kind of intervention, children show significant growth in emergent literacy skills (e.g. print concepts, letter knowledge) but little improvement in reading skill specifically (Whitehurst et al., 1999).

Several studies have found improvements in children's reading skills after a parent training intervention (Faires, Nichols, & Rickelman, 2000; Leach & Siddall, 1990; Saint-Laurent & Giasson, 2005; Wilks & Clarke, 1988). One of these studies is limited in its use because of a small sample size (n=8; Faires et al., 2000) and the other by a lack of information about the training parents received (Wilks & Clarke, 1988). In Leach and Siddall (1990) parents received training in one of four instructional styles: three which focused on improving parent-child reading experiences and one that trained parents to give direct

phonics instruction through pre-planned lessons. Only children who received direct instruction from parents improved in reading skills (Leach & Siddall, 1990).

Finally, Saint-Laurent and Giasson (2005) provided nine workshops that trained parents of grade one children to adapt the support provided in the home to children's increasing reading skill. Workshops covered teaching strategies and activities to support letter knowledge, comprehension, reading, and writing. After the program, children whose parents had attended the workshops had higher scores in reading and writing than children in a comparison group (Saint-Laurent & Giasson, 2005). In addition, parents reported that the workshops changed the reading activities they engaged in with their child at home.

These few examples of summer camp and parent training interventions demonstrate alternatives to the more common school-based interventions. These few studies provide preliminary evidence for the effectiveness of shorter duration interventions for supporting children at-risk of reading delays and provide insights into how to improve the effectiveness of summer programs. First, though the programs by Schacter and Jo (2005), Pokorni et al. (2004), and Luftig (2003) are called camps, the reading intervention component is still very much classroom based and 'feels' more like summer school than summer camp. Under this framework, reading instruction is limited to one or two hour blocks, with the "remainder of the day being dedicated to summer camp activities" like sports, arts and crafts, and video games (Schater & Jo, 2005). But what if reading and literacy activities were the summer camp activities?

The potential consequences of early reading failure include frustration and decreased motivation for reading practice, less task persistence, lower self-esteem, and a general dislike of school (Juel, 1996). If children in the summer camp programs were experiencing some of these socio-emotional consequences, the blocks of reading instruction could be viewed as a

boring chore that they had to endure to get to the fun 'camp stuff'. There is no reason why activities that help to develop reading and reading related skills, like phonological awareness, must be taught in a 'summer school classroom' – literacy related activities can be incorporated into 'fun' summer camp activities. This approach would increase the literacy instruction time from two hours to five or six hours each day and would make reading instruction more interesting to struggling readers.

The most effective summer program is likely a combination of a short, intensive, summer intervention program with parent training (Schater & Jo, 2005). Parent involvement is important to children's academic achievement (for a review see Jeynes, 2005) and the limited evidence available suggests teaching parents about phonological awareness and about how to improve home literacy activities positively influences children's growth in reading (Leach & Siddall, 1990; Saint-Laurent & Giasson, 2005). In a successful summer intervention, the program would provide children with intensive, focused instruction in phonological awareness and reading, and parents would be instructed in how to continue supporting children's reading growth in the home. The children's program must provide the literacy instruction in a fun, engaging style so children develop an appreciation for reading. The parent training must provide information in clear, easy to understand language that includes practical examples of how parents can translate knowledge about early literacy to activities that support children's literacy development at home. The combination of a children's program with parent training has not been tested as an early reading intervention model. Therefore, the current study incorporated a parent training component into two of the intervention conditions. Analyses will examine the relative contribution of parent training on children's emergent literacy skills.

Potential mediators of intervention on children's emergent literacy skills

The previous section highlighted examples of early intervention program that had positive impacts on children's early literacy skills. Emerging literature suggests that there may be child characteristics that influence the impact of early intervention supports on literacy skills. This section reviews three common variables associated with children's phonological awareness and word reading skills in other studies: listening comprehension, naming speed (processing speed), and memory. It will be important to consider these variables in the analysis when examining the influence of the intervention on children's phonological awareness and word reading.

Listening Comprehension

As discussed above, the simple view of reading posits that reading ability is the product of decoding and listening comprehension (Gough & Tunmer, 1986). The 'reading' outcome referred to in the simple view model is not simple word identification, but word reading with interpretation of the text (comprehension). Following from this model, linguistic comprehension or listening comprehension factors are most often linked to reading comprehension ability (deJong & van der Leij, 2002; Lerkkanene, Rasku-Puttonene, Aunola, Nurmi, 2004; Nation & Snowling, 2004; Senechal & LeFevre, 2002). In support of the simple view model, studies have found that children with average decoding ability (word identification) but poor reading ability (word identification + text comprehension) also demonstrate poorer listening comprehension (Catts, Hogan, & Fey, 2003; Megherbi, Seigneuric, & Ehrlich, 2006). Few studies have linked listening comprehension directly to word reading ability (word identification) (Lerkkanen et al., 2004; Nation & Snowling, 2004) but many studies still include measures of listening comprehension in reading studies.

Listening comprehension may influence reading growth by maximizing children's learning through shared reading or direct instruction.

Naming Speed

Naming speed or rapid automatic naming (referred to as RAN hereafter) is thought to be another factor influencing reading acquisition. It is commonly interpreted as reflecting the speed with which item names can be retrieved and articulated (Share, 1995; Wagner et al., 1997). RAN tasks involve naming a continuous series of letters, numbers, colours, or objects as quickly as possible and have been strongly related to early word reading (e.g. Compton, 2003; de Jong & van der Leij, 1999, 2002; McBride-Chang, 1996; Scarborough, 1998; Torgesen et al., 1997; Wagner et al., 1994). Correlations between RAN and word reading tend to be higher for children with reading difficulties (McBride-Chang & Manis, 1996; Compton, DeFries, & Olson, 2001).

There are two dominant theories about the role of RAN in reading acquisition. First, based on evidence that struggling readers often display slower naming speed in addition to poorer performance on language, memory, and phonological awareness tasks, researchers have suggested that RAN be interpreted as representing phonological processing efficiency and that it is part of a latent phonological processing difficulty that underlies word reading problems (Share, 1995; Stanovich, 1991; Wagner et al., 1994). Further evidence of this theory comes from studies that find no independent influence of RAN on word reading beyond other measures of phonological awareness (Cardoso & Pennington, 2004; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Wagner et al., 1997).

The second dominant theory suggests that RAN represents orthographic processing, rather than phonological processing efficiency (Bowers, Sunseth, & Golden, 1999; Cardoso-Martins & Pennington, 2004; Wolf & Bowers, 1999; Wolf et al., 2002). This approach argues

that children with slower RAN are unable to identify graphemes (letter characters) quickly enough to support decoding, during early reading, and reading fluency, in later reading (Bowers & Wolf, 1993; Wolf, 1999). Supporters of this theory have coined the term 'double deficit' to indicate poor readers who experience difficulties in both phonological awareness (phonological processing) and RAN (orthographic processing). However, in a meta-analysis of 36 studies relevant to the double deficit hypothesis, Vukovic and Siegel (2006) concluded there was not enough evidence to support a core deficit in naming speed.

RAN of letters and numbers may not be reliable in predicting reading ability among young children because RAN is confounded by knowledge of letters and numbers (Pennington & Lefly, 2001; Schatschneider et al., 2004). RAN tasks assume that names of test items are overlearned or automatic but young children or children experiencing early reading problems may not even know all of the letter names. Researchers could use RAN tasks with colour or object items but these have been found to be less strongly correlated with later reading ability (Wolf, 1999).

Memory

In addition to listening comprehension and RAN, memory processes also have been explored as factors influencing early reading acquisition. Phonological memory is short-term memory for sound-based information. This type of memory may be particularly important during early reading ability as children are required to decode individual letters. Through this process, children must temporarily store the decoded letter sounds in memory before blending the phonemes together to produce the word (Wagner & Torgesen, 1987). Phonological memory has been linked to phonological awareness in young children, and through phonological awareness, indirectly related to word reading (Dufka, Niemi, & Voeten, 2001; Gathercole & Baddeley 1993; Share, Jorm, Maclean & Matthews, 1984). Other studies

have noted correlations between poor phonological memory and poor reading ability (Gathercole & Baddeley 1993; Hulme & Mackenzie 1992; Mann, Liberman & Shankweiler 1980; Nation & Hulme, 1997; Siegel & Linder 1984; Swanson 1994).

Some researchers suggest that working memory, requiring both storage and processing of information, would be more strongly related to reading ability (Oakhill & Kyle, 2000). In short-term memory, information is held, passively, for only a few seconds. In working memory, information is held while simultaneously processing other information (Baddeley & Logie, 1999). For some, the working memory model of storage and processing better describes early word decoding. Preliminary studies have reported that good readers outperform poor readers on working memory tasks (De Jong, 1998; Hasher & Chiappe, 2000; Passolunghi & Siegel, 2001; Swanson, 2003; Swanson, Howard, & Saez, 2006). Though working memory continues to be investigated as a possible factor influencing reading ability, some studies have found the independent contribution of working memory tasks on reading to be quite small (Goff, Pratt, & Ong, 2005).

Some researchers have suggested that naming speed accounts for the relationship between working memory and reading ability (Johnston & Anderson, 1998; Kail, 1993). Because working memory is time-related, faster processing of information would reduce demands and/or increase capacity of the working memory system (Salthouse, 1996). In relation to reading, faster processing speed would mean that children could access phonological representations more quickly during decoding, thereby reducing demands on working memory.

Given evidence that listening comprehension, RAN, phonological memory, and working memory have been linked to reading ability tasks measuring these factors should be included in a comprehensive battery of reading performance across time. Analyses will

consider these factors as potential mediators of the intervention on children's emergent literacy skills.

Response-to-Intervention

Early intervention and the characteristics related to children's responsiveness to early intervention have practical implications for the education system and the formal designation of reading disabilities. Researchers and policy advisors who focus on education now support an approach called 'response-to-intervention' (RTI) to identify children with reading disabilities. This section contrasts the RTI approach with the previous approach called IQ-discrepancy. As RTI is a relatively new approach, this section describes the RTI method and research studies that have used the RTI approach to identify children with reading disabilities. The section concludes with a review of statistical approaches to measure RTI.

Response-to-Intervention Overview

Since the mid-1970's children whose reading ability was significantly lower than their intelligence were labelled 'reading disabled'. This is called the IQ-achievement discrepancy approach. The other category of unskilled readers were often called 'garden variety poor readers'; children who exhibited delays in both reading ability and intelligence (Goswami & Bryant, 1990; Stanovich, 1986). In many areas, only children with the reading disabled designation were eligible for special education support (Fuchs, 2003).

Researchers quickly argued that the IQ-discrepancy approach could not reliably distinguish between the two sub-groups of unskilled readers, thus calling into question the validity of this method for identifying children who qualify for extra education services (Fuchs et al., 2003). In the last 15 years, mounting evidence suggests that both groups of unskilled readers, with and without discrepant IQ, perform similarly on several cognitive tasks and exhibit the same core phonological processing deficit (Foorman, Francis, &

Fletcher, 1995; Siegel, 1989a; Siegel, 1989b; Stanovich & Siegel, 1994). Furthermore, Stanovich (1999) argues that we are obligated to provide support to all children experiencing educational delays, rather than choosing to support only those children who evidence average intelligence.

Many researchers and policy makers are now promoting a 'responsiveness-to-intervention' method for identifying children with learning disabilities (including reading disabilities specifically). Under this method, students are monitored by classroom teachers. Those students who do not respond to regular classroom instruction receive 'something else' from either their teacher or 'someone else' (Fuchs et al., 2003). Student progress through this stage is monitored as well, and children who do not respond to this extra support either qualify for special education classes or qualify for a more detailed educational evaluation (Fuchs et al., 2003). Response-to-intervention (RTI) models differ in the number of steps or tiers of support offered before children quality for special services (Fuchs, 2003) and in the type of remedial support that is provided to students (Fuchs, 2003; Fuchs, Fuchs, & Compton, 2004).

Vaughn, Linan-Thompson, and Hickman (2003) provided three levels of intervention to children in second grade. Children who were at risk of reading delay, as determined by teacher nominations and a literacy skills screening instrument, were given 10 weeks of supplemental reading training in small groups. Children who met a pre-determined cut-point were removed from the program and remaining students received an additional 10 weeks of instruction. The cycle was repeated once more, then children who still did not meet the criteria for dismissal were eligible for special education services (Vaughn et al., 2002). Almost 25% of students did not meet dismissal criteria after 30 weeks of supplemental instruction.

In a similarly designed study, Vellutino et al. (1996) offered an intervention consisting of one-on-one tutoring. Grade one children scoring below the 15th percentile on reading tasks of real words or pseudowords received 15 weeks of one-on-one instruction. Children who still scored below the 40th percentile on word reading tasks at the beginning of grade two received 10 weeks of additional tutoring. Forty-one percent of children remained below the 30th percentile in word reading after 65 hours of one-on-one, supplemental instruction.

Measuring response-to-intervention

Torgesen (2000) estimates that between 4% and 6% of the general population of children are non-responsive to intervention and will continue to exhibit reading delays after receiving high-quality, supplemental instruction. This estimate is based on children who fall below the 30th percentile on standardized instruments after receiving intervention. However, determining response-to-intervention from a measure of final ability may be a limited approach (Fuchs, 2003). Consider a child who begins below the 5th percentile and makes consistent progress such that he/she is reading just below the 30th percentile following intervention – this child would be labelled non-responsive. A second child, who begins at the 25th percentile in word reading progresses to the 31st percentile following intervention. Which child has been more responsive to the treatment program?

Another measure of response-to-intervention is growth, or slope. Vellutino et al. (1996) deemed children 'difficult to remediate' if their slopes were in the bottom half of the distribution. This is a limited approach, but without the establishment of clear benchmarks, it is as valid as other arbitrarily determined markers (Fuchs, 2003). 'Dual discrepancy' is another method of identifying non-responders (Fuchs, 2003; Fuchs et al., 2003; Fuchs et al., 2004). Under this approach, children are only identified as non-responsive-to-intervention if

they show delay in growth and final ability after intervention. Without established criteria for determining 'responsiveness', researchers are free to use any of the three approaches – benchmark, slope, or dual discrepancy. For thoroughness, the current project uses all three methods to examine responsiveness to the intervention.

Torgesen (2000) argues that without clear benchmarks of adequate reading ability, some portion of the population will always be identified as poor readers and non-responsive-to-intervention. Even if mass interventions prove successful and all children's reading abilities are improved, the standards for 'adequate' reading ability will be raised as well. Future work should establish absolute performance standards (benchmarks) against which we can truly evaluate the effects of reading intervention programs (Fuchs, 2003; Torgesen, 2000).

More work is necessary also to understand the factors that might be influencing responsiveness to treatment. Memory, naming speed, and listening comprehension have been studied as factors related to growth in reading and phonological awareness. In the current study, these factors are considered as individual difference variables potentially mediating the influence of early intervention on growth in phonological awareness and/or reading.

Summary

Evidence suggests that phonological awareness is the core deficit of poor readers, regardless of general intelligence, and that interventions can effectively teach phonological awareness to young children. Intervention programs also may have an increasingly important role in differentiating children with reading disabilities from children who have simply not had opportunities to develop emergent literacy skills, through either poor early home environments or poor early instruction at school (Fuchs et al., 2003).

Most interventions that target early reading abilities are improvements to classroom curricula or expensive small-group and one-on-one tutoring designs. There is, however,

limited evidence suggesting that shorter duration, intensive summer programs and parent training interventions can significantly influence children at risk of reading delays. This project seeks to evaluate the effectiveness of a short, two-week intervention for children with, and without, a parent training component.

To reduce the cost of providing the intervention program, we established a partnership with local stakeholders. The local school boards (public and Catholic) contributed space in their schools to host the summer program and provided the salary for one teacher in each program. The local Ontario Early Years Centre (OEYC) was the other key stakeholder in the area. Early Years Centres provide free programs to children from birth to six years and their parents/caregivers across the province. The local OEYC provided program materials (craft supplies, books, toys, etc) and provided the salary for one teacher in each program. Our role as researchers was to conduct the pre- and post-testing assessments of child participants and to provide the salary for the third program staff. In collaboration with our other partners, we developed a program curriculum that was based on current research, that was compatible with the school board's literacy objectives, and that would be enjoyable for young children.

The purpose of this project was to evaluate the effectiveness of the two-week summer reading intervention for young children exiting senior kindergarten, who were identified as at-risk of reading delay by kindergarten teachers. The two-week intervention component for children was designed to target basic skills of letter knowledge and phonological awareness through games, crafts, and songs. Given the short duration of the program for children, we sought to supplement the summer program by training parents to continue teaching literacy activities in the home. We hypothesized that children who received both the intensive, summer program for children and the parent training would show the largest improvement in

children's emergent literacy. The effect of the intervention was assessed via the growth and final ability of children's phonological awareness and reading skills.

Method

Study One: Pilot Project

The purpose of the pilot project was to conduct an initial evaluation of the two week reading intervention program. Data collection for the pilot study was completed in 2004. Children were recruited for two small groups: an intervention group and a comparison group. We hypothesized that children participating in the summer intervention would have higher post-test scores in phonological awareness than children in the comparison group.

Participants

Children from two small towns in a mostly rural county in south-western Ontario were recruited to test the effectiveness of the reading intervention program. Both towns have construction, manufacturing, and agriculture as their predominant industries.

At the end of the senior kindergarten year, we asked teachers to refer children who were at risk of reading delay. Specifically, teachers were asked to select children "that were behind other children in phonological awareness but were otherwise normally developing".[1] Children with identified behavioural problems were excluded from participating. In each town, there were four senior kindergarten classes across two schools. Within schools, teachers were asked to work together to select eight to ten students.

Seventeen children (aged 5 years 6 months to 6 years 5 months, mean age = 5 years, 10 months) from one town were recruited to participate in the intervention; 17 children (5 years 5 months to 6 years 4 months, mean age = 5 years 8 months) from a similar town were

[1] Teachers already complete a number of diagnostic literacy tools and checklists as part of the school board's current focus on early literacy. So as not to overburden teachers, we asked them to refer children based on their observations and assessments over the course of the school year instead of assigning a specific measure to select child participants.

recruited to participate as the comparison group. All families spoke English at home. Most parents were currently married or in a common-law relationship (n=24, 70%). Almost half of the parents (n=16, 48%) listed a college or trades diploma as their highest level of education; 15% (n=5) had not completed high school and 6% (n=2) had completed a university degree. The median income was $30 000 - $50 000; however, 25% (n=8) of families reported incomes less than $30 000. Groups were not matched for age, sex, or family characteristics.

Procedure

Senior kindergarten teachers distributed information packages and consent letters to families of children "that were behind other children in phonological awareness but were otherwise normally developing". Teachers in this school are trained in the components of phonological awareness and conduct informal screening of phonological awareness for internal planning so they were comfortable with the recruitment criteria. Children with identified behavioural problems were excluded from participating. Teachers provided the researchers with the names and contact information of children who had parental consent to participate.

Child participants were assessed at the end of the senior kindergarten year by trained research assistants. The test battery included receptive vocabulary, non-verbal reasoning, word reading, and four phonological awareness tasks (described above). Children in the intervention group attended the 'summer camp' for two weeks at a local public school. Parents of children in the intervention group were invited to participate in two evening education workshops. At the beginning of grade one, children from both groups were assessed using the same battery of measures. As part of this follow-up, parents completed three short, mail returned questionnaires: a general information survey, a summer activities

survey, and a satisfaction survey. Parents of children in the comparison group were invited to attend a parent workshop in their community after completion of the post-test assessments.

Measures

Receptive vocabulary

Peabody Picture Vocabulary III (Dunn & Dunn, 1997). The PPVT-III is a commonly used measure of receptive vocabulary. The tester presents a slide with four pictures then reads a target word. The child is asked to identify which picture best depicts the target word. The task is stopped when children make eight or more errors in a set. Form A was used for pre-tests and form B was used for post-tests. Split-half reliability across age groups 4 thru seven ranged from .93 to .95; Chronbach's alpha is reported as .92 to .98.

Phonological awareness

Rhyme Oddity (Bradley & Bryant, 1983; Stanovich et al., 1984): The tester names three pictures presented on a card, and asks the child to choose the one that does not rhyme or 'that doesn't end with the same sound'. The tester points to each picture as the word is spoken to reduce memory load. Example – hat, cat, bed. The experimenter provides feedback and guidance during three practice items. Children complete all 14 items in the rhyme oddity task.

Phoneme Oddity (Stanovich et al., 1984): In this task children identify which word, from 3 choices, differs in the initial phoneme. For each trial, the tester points to the picture while the word is being spoken. Children are asked to choose the one 'that begins with a different sound'. Example – bag, nine, butterfly. The experimenter provides feedback for three practice items. There are 14 items in this task; children complete all trials.

Syllable Deletion (Rosner & Simon, 1971): Deletion tasks require the child to say a word minus a specific sound, to form a new word. In the syllable deletion task, children are

asked to say a word without either the first or final syllable. For example, say cowboy without the 'boy' part (initial syllable) or say hotdog without the 'dog' part (final syllable). All remaining syllables formed a real word. Children completed all 10 items.

Phoneme Deletion (Rosner & Simon, 1971): In the phoneme deletion task, children are asked to say a word without the initial phoneme. For example, say bus without the 'b' sound (phoneme). For each item, the remaining part of the word formed a real word. The task was stopped when children made four consecutive errors.

Word Reading

Woodcock Reading Mastery Test – Revised (Woodcock, 1987). Children are asked to read the first 28 words from the WRMT-R. If the child indicated that he/she does not know the word, they were encouraged to 'try and figure it out' and 'make a guess'. The tester recorded the child's pronunciation of each word, including errors. Word reading was discontinued when the child made 6 consecutive errors. Internal consistency for four year olds is reported as .916.

Non-verbal reasoning

Matrix Analogies Test – Pattern Completion (Naglieri, 1985): One subtest of the MAT was administered. Children were presented with a series of pictures, each missing a square shaped, portion of the picture. Children were asked to select the square that would complete the pattern from 5 available choices (6 choices as difficulty increases). Chronbach's alpha is .88.

General information survey: This one page survey collected demographic information about the families who participated in the project (income, parental education, occupation) and was created by the researcher for the purposes of this project. The survey was distributed to parents with the summer activities survey and satisfaction survey

(intervention group only), at the start of grade one, after the completion of the post-test assessments. The demographic information was used to describe the participating families in the study. (See Appendix 1.)

Summer activities survey: This parent completed survey asked about the literacy activities that children completed over the summer months. It was created by the researcher for the purposes of this project. Open-ended questions were used to collect information about the frequency and type of parent-child and child alone literacy activities that occurred in the home after the summer intervention.

Satisfaction survey: Our community partner requested a satisfaction survey be added to the program evaluation. It was based on other satisfaction surveys used by the community partner to collect feedback about parent training workshops. The satisfaction survey was distributed only to families of children from the intervention group. The survey asked parents to complete four general, open-ended questions about their experience with the summer reading program. Comments from the satisfaction survey are reported as parent perceptions about the influence of the intervention program.

The Intervention Program

There were two components to the intervention program – a 'camp' for children and evening workshops for parents. Families in the intervention condition participated in both components of the intervention. A comparison group, that received no intervention components, also was recruited.

Summer camp program for children

The child component of the intervention was a summer 'camp' offered for two weeks over the summer break between senior kindergarten and grade one. The program was designed to be similar to a kindergarten classroom schedule with crafts, activities, gym play,

lunch breaks, outdoor play and quiet reading. The activities offered in the summer camp were selected based on research evidence and efforts were made to be consistent with the teaching curriculum of the local school boards.

Almost all activities offered were related to language, letters, or reading. Explicit, direct instruction in phonological awareness was combined with practice of letter names and sounds. Daily activities provided opportunities to practice new skills, to discuss print concepts and to develop listening and story comprehension.

The summer camp curriculum is attached as Appendix two. Each day was structured using the same basic framework. As children arrived in the morning they began an independent activity that related to the day's theme (e.g. cutting out words from grocery flyers to make a grocery list; writing/cutting out words that start with the same letter as their name). This was followed by a morning circle. After the circle, the children were divided into three small groups (maximum of 6) and rotated among three teacher led activities, at least one of which included direct, explicit instruction in phonological awareness. After the first rotation of the small group activities, there was a break for recess and snack. After two further rotations of the small group activities, children had a lunch break.

The afternoon began with quiet reading time with a book children self-selected. To encourage children to become engaged in the story print, each day staff asked children to complete a small task with the book that they selected (e.g. find at least one word that starts with the same letter as your name, find a colour word). Quiet reading was followed by an afternoon circle. The main activity in the afternoon was a large group exercise, held outside as permitted. During this time there were gross motor activities, games, and crafts, but each with a literacy focus. For example, on day six, staff organized a scavenger hunt to find objects that started with different letters of the alphabet; on day seven the afternoon activity

was a treasure hunt using word clues (what rhymes with 'cat' but starts with an 'h' sound?). At the end of each day, children had another recess break before a period of 'free-play' at different play centres. These centres were carefully planned and structured to provide rich learning opportunities. There were always five different centres (writing, board games, construction, science, and drama) that changed during the course of the two week camp.

A number of factors make the summer reading camp different from children's experiences in kindergarten. First, in a regular classroom, teachers must teach to a group of students with a wide range of literacy levels. For the summer program, we selected across schools and classrooms to bring together children who were struggling with phonological awareness skills. This reduced the variability of children's phonological awareness and reading skills, and allowed teachers to focus instruction and activities at a group of children with similar literacy levels. A more focused level of instruction meant that children were less likely to encounter tasks or activities that were well above their current skill level. In a regular classroom, a struggling reader might see peers succeeding at activities that were too difficult for them, creating frustration and self-doubt. We chose activities that were challenging, but that could be completed by children with teacher encouragement. This allowed children to be successful at phonological awareness tasks, building confidence and motivation for other activities.

Another feature of the program was the small teacher-to-child ratio. The camps were taught by a group of three teachers and a maximum of 18 children were enrolled for each session. Careful planning by the three teachers meant that children were never left waiting for the next activity; one or two teachers could lead the group while the third teacher prepared for the next activity. This also meant that children experienced more small-group

time and more one-on-one time with teachers. At this level, teacher instruction could be focused even more.

The program centred around five books that had been selected by the government of Ontario for use in all of the Ontario Early Years Centres across the province. The books ranged in the amount of text, subject matter, and format. In order of use, the books were *Mole Sisters and the Rainy Day* (Schwartz, 1999), *One Grey Mouse* (Burton, 1995), *Red is Best* (Stinson, 1982), *Big Sarah's Little Boots* (Bourgeois, 1987), and *In my Backyard* (DeVries, 1992). Each book was used for two days. On the first day of the book, children heard the story read by the teacher in the afternoon circle. Children then took the book home to read the story with their parents. On the second day of the book, teachers read the story during both morning and afternoon circle. In the afternoon circle, each child held their own copy of the book. Before the story, teachers talked about the cover, title, author, and illustrator of the book. There also was careful attention to ensure the children were following along with the text and turning the pages at the appropriate times. During this reading of the book, teachers focused on the comprehension of the story.

Focusing the summer program on five children's books adds a number of dimensions to the intervention program. First, general themes from each book were used to structure the activities for the two days when the book was used. For example, for the book about *Mole Sisters' Rainy Day*, children talked about weather and sang weather related songs during circle times. For the book, *In My Backyard*, children made rubbings from sticks, leaves, and other 'backyard' items during a craft activity. This gave continuity and flow to the child's day.

Focusing the program on a select number of books also gave children lots of experience with the book – both the key words in the book and the story line. The second day

of each book was more focused on comprehension of the story (as comprehension is a vital part of reading once phonological skills are developed). By this time, children would have heard the story at least twice, hopefully three times, if the story was read at home with children by their parents. This means they would have had more opportunities to think about the story and understand the story content. Repeated exposure with the book would also increase children's familiarity with key words in the book. By the second day, when teachers discussed the book with the group, children could feel confident about their understanding of the story and could participate in the group discussion.

Finally, unlike other summer reading programs that provide blocks of literacy instruction (e.g. Schacter & Jo, 2005), almost every single activity during the summer camp program had a literacy component. In addition to traditional literacy activities like teacher-led book reading and instruction in phonological awareness, children played letter bingo, used a recipe to make playdough, created menus for the restaurant drama centre, wrote letters to their friends, made books, and created a puppet show. The summer camp was short in duration, but children were able to have an intense, literacy-rich experience in just two weeks.

Upon completing the two week program, children received a 'literacy backpack': a book bag filled with crayons, pencils, paper, one of the storybooks used in the camp, and literacy-based activity sheets. In addition to new activity sheets, children also received blank copies of the activity sheets that were completed during the summer camp. This follows from the program's focus on providing high-success, confidence building activities; by providing children with worksheets with which they were familiar, children could complete the activities on their own over the remainder of their summer break.

Parent education workshops

The parent component of the intervention program was two workshops, held on each Wednesday evening of the two-week camp for children. The first workshop briefly discussed the important role that parents play in supporting children's academic success and included a broad overview of research evidence linking parental involvement to academic achievement. The bulk of the workshop, however, was spent discussing parent-child shared book reading. The workshop included a discussion on the role of shared book reading for children's reading development and information on how to choose books that support early reading acquisition.

As supported by research evidence (discussed above) parents learned that shared book reading is important for growth in children's vocabulary, general knowledge, and comprehension, and children's increasing understanding of print concepts and syntactic structure. The workshop presentation discussed how each of these skills is related to children's reading ability. The group also discussed the importance of creating a relaxed, supportive environment during shared book reading, and that parents need to structure the book reading experience so that children enjoy reading.

To ensure that children are enjoying books, the workshop presented tips for choosing 'good books' – books that children enjoy but are also useful for teaching phonological awareness and word reading. The workshop included information on the importance of pattern, of repetitive phrases or words, of lyrical or rhythmic flow in the text, and of content that appeals to children's interests.

At the end of the first session, the facilitator read each of the five books used for the children's camp program, demonstrating different characteristics of the books and different techniques for shared reading. The techniques demonstrated how different types of books could be used to support growth in children's vocabulary, general knowledge, and comprehension, and children's understanding of print concepts and syntactic structure.

Parents were encouraged to be 'expressive' readers so that, in addition to learning emergent literacy skills, children also would be entertained by the book reading experience.

The second workshop focused on phonological awareness specifically. This session included an explanation of phonological awareness and an explanation of its importance for reading acquisition. Parents learned that there were three types of phonological awareness (syllable, rhyme, and phoneme) that most often develop in sequence. Parents learned to recognize their own child's level of phonological awareness and were shown how to focus children's learning at their current level.

The second part of the workshop presented different types of phonological awareness skills. To demonstrate, the workshop facilitator described the phonological awareness items in the assessment battery. The test battery includes tasks where children are asked to identify, segment, and blend phonological units. Parents also learned that other tasks, not used in this assessment battery, ask children to manipulate or substitute phonological units. Parents were asked to consider these types of activities (identifying, segmenting, blending, and manipulating) when thinking of different phonological awareness activities for their own child.

At the end of this workshop, parents worked in small groups to discuss the ways that phonological activities could be incorporated into home routines. After working in small groups, parents presented different phonological awareness activities that they could perform at home. Working together with the facilitator, the group considered ways to modify children's favourite activities into 'phonological' activities, for example, while playing catch, try to say another rhyming word each time you catch the ball; see how many rhyming words the group can come up with in a row.

At the end of the second workshop, the facilitator again stressed the importance of parents taking an active role in supporting their child's learning. It was acknowledged that some parents may have had negative experiences at school, but that children deserve a 'fresh start', and that parents should not project their own negative attitudes about education onto children. The final point encouraged parents to try the phonological awareness activities and book reading activities with their own children; the activities may seem silly to adults but children often really enjoy them – or at the very least, enjoy that parents are engaged in the activities with them.

Results

Scores on the four phonological awareness tasks were highly correlated. Following Anthony and Lonigan (2004) a composite score of phonological awareness was created by summing the number of correct responses across the four phonological tasks: rhyme oddity, phoneme oddity, syllable deletion and phoneme deletion. Phonological awareness scores ranged from 0 - 37. An analysis of variance (ANOVA) indicated that the intervention and comparison groups were not different at pre-test (SK) with respect to receptive vocabulary (PPVT; F=2.369), pattern recognition (F=1.176), pre-test phonological awareness, or (F=3.612), word reading (F= .429; see Table 1.)

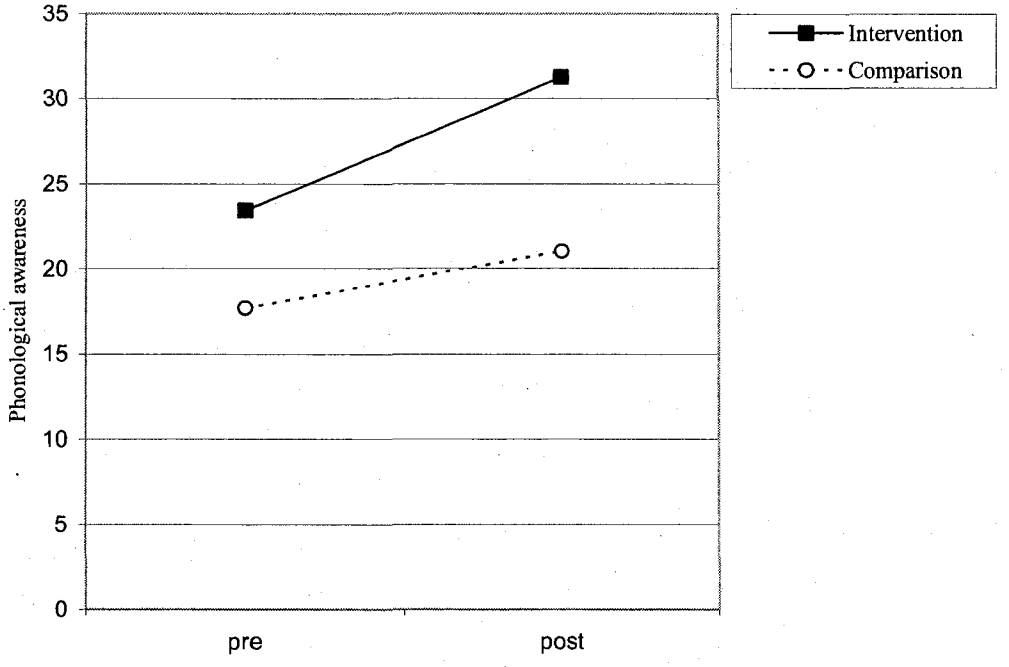
A repeated measures analysis of covariance (RMANCOVA) procedure was used to assess the influence of the intervention program on children literacy skills. Separate analyses were run for the outcome variables of phonological awareness and word reading. Pre-test chronological age and PPVT standardized scores were included as covariates. The results of the RMANCOVA analysis showed a marginally significant phonological awareness by group interaction ($F(1, 29)=3.41$, $p=.075$) suggesting that phonological awareness scores for children in the intervention group increased at a steeper rate than children in the comparison

group. Figure 2 shows the change in phonological awareness for children in both groups.

Table 1. Pre- and post-test scores by group

		Intervention n=16	Comparison n=17
receptive vocabulary (PPVT-III; std)	pre	102.19 (8.54)	97.12 (10.24)
	post	108.25 (8.88)	100.59 (11.18)
	change	6.06	3.47
pattern recognition (MAT; std)	pre	10.38 (1.93)	11.24 (2.56)
	post	11.50 (1.93)	10.82 (1.81)
	change	1.12	-0.42
phonological awareness (raw)	pre	23.44 (5.75)	17.71 (6.95)
	post	31.25 (7.51)	21.06 (9.09)
	change	7.81	3.35
word reading (raw)	pre	1.19 (1.87)	0.82 (1.29)
	post	4.44 (4.30)	2.06 (2.11)
	change	3.25	1.24

Figure 2. Change in phonological awareness for intervention and comparison groups



A similar ANCOVA was conducted to examine change in word reading; the word reading by group interaction was not significant ($F(1, 29) = 1.979$, $p = .171$). Visual analysis

shows that between pre- and post-test assessments children in the comparison group improved by an average of 1.24 whereas children in the intervention group improved by an average of 3.25 words. The small sample size and large variability in the change in children's word reading within the intervention group may have contributed to this statistically non-significant result.

Parent Surveys

Parent comments on the summer activities survey and satisfaction survey also were used to examine the influence of the intervention program. Eight parents from the intervention group and ten parents from the comparison group returned the surveys. Most parents in the comparison group (n=6) reported shared reading as children's only literacy activity over the summer. Two parents in this group also reported using flashcards, and one parent reported reviewing the alphabet and letter sounds. (Parent comments revealed that one child in the comparison group had a summer tutor to help improve literacy skills.)

Most parents of children in the intervention group (n=7) also reported shared book reading activities over the summer. Parents in this group also listed many other types of literacy activities including writing in exercise books (n=2), singing rhyming songs (n=3), making a word book (n=1), playing phonics word games (n=2), pointing out letters on road signs (n=3), and making grocery lists (n=1).

In addition to the summer activities survey, parents of children in the intervention group were asked to complete a satisfaction survey. Responses suggest that parents were generally pleased with the intervention program. Many parents commented that the most positive aspect of the program was the one-on-one time that children spent with the camp teachers (n=4). Several parents noted attitudinal changes in children following the camp including increased confidence and increased eagerness to engage in reading activities at

home (n=3).

Parents also commented that they enjoyed the evening parent workshops. Learning about how children begin to read and learning tips for shared reading activities with children were reported as positive components of the parent workshops. One parent noted that an additional parent workshop with tips and examples would be beneficial.

Discussion

Results of the pilot study suggest that the short duration intervention, comprising both child and parent components, may have the potential to improve phonological awareness skills in children experiencing early reading delays. Although the analysis of children's pre- and post-test scores were not statistically significant by conventional standards, visual inspection of the data coupled with parent feedback about the intervention, were encouraging. The small sample size and large variability in children's post-test scores within the groups may have contributed to the statistically non-significant results. The findings of the small, pilot study were promising enough to pursue an evaluation of the intervention project on a larger scale.

Study Two: Reading Intervention Program Evaluation

A larger sample size was recruited for study two to permit a more detailed evaluation of the summer reading intervention program. Children were recruited for the study in the summer of 2005 and the summer of 2006. For the analyses, data were aggregated across years. Where applicable, the terms '2005 cohort' and '2006 cohort' are used to refer to the two groups of participants. Appendix 3 provides means and standard deviations by group and cohort. Analysis indicated that children were not statistically different between cohorts on key pre-test variables (PPVT, F=.149; MAT, F=2.175; phonological awareness, F=1.849;

and word reading F= .417). The aggregated groups increased the within-group sample size, providing more statistical power for analyses.

To examine the individual impact of the child camp and parent workshop components of the intervention program, children were recruited for three conditions of the intervention program: the 'parent+child' group received both the child camp component and the parent training component of the intervention, the 'child-only' group received only the child camp component of the intervention, and the 'parent-only' group received only the parent training component of the intervention. We hypothesized that the parent+child condition would be the most effective condition for improving children's literacy skills. The child-only condition and the parent-only condition were included to gauge the influence of receiving each component of the program individually.

Also, to facilitate a more detailed evaluation of the intervention program, additional measures were added to the assessment battery. (The measures from study one with the additional measures from study two are referred to as the 'full assessment battery' in subsequent sections.) Tests of children's knowledge of letter names and sounds were added to both the pre- and post-assessment packages. Four new measures were added to the post-test assessment battery (short-term memory, working memory, processing speed, and listening comprehension). These measures have been identified in other research as influencing children's reading acquisition. They were included in this project as factors potentially influencing children's responsiveness to the intervention program. Also, the summer activities survey for parents was revised to collect more detailed information about children's literacy activities before and after participating in the intervention program. The open-ended questions were replaced with several Likert-type response questions.

A sub-set of children in the 2005 cohort also participated in a follow-up assessment at the end of grade one (approximately 10 months after participating in the intervention). The full assessment battery was used for this follow-up. We hypothesized that children whose parents received training would show more growth in reading skills than children whose parents did not receive training during the intervention.

For the 2006 phase of the project, an 'average' achieving comparison group was added. This group was important to provide information about the normal growth of children's reading skills over the summer and the level of children's reading abilities at the beginning of grade one. We asked teachers to distribute information packages to children they felt were 'normally achieving' in phonological awareness and reading at the end of senior kindergarten. Throughout, this group is labelled the 'average comparison' group.

We found it was not necessary to recruit participants specifically for a low-achieving comparison group because, each year there were children who teachers identified for participation in an intervention condition but, for any number of reasons, chose not to participate. Pre- and post-assessments were completed for children who returned consent forms to participate in the intervention but who did not to attend the summer intervention. These children were included in the study as the 'low-comparison' group.

Participants

Children from the same area of south-western Ontario were recruited through local schools. Using the same protocol as in the pilot study, teachers were asked to refer senior kindergarten children 'who were behind other classmates in phonological awareness, but were otherwise normally developing'. When recruiting the 2006 cohort, six teachers from different schools were asked also to refer children who were reading at a normal level.

The 2005 cohort included 108 children and the 2006 cohort included 76 children. Across the two cohorts, children ranged in age from 5.42 years (5 years, 5 months) to 6.75 years (6 years, 9 months). Mean age was 5.87 years (approximately 5 years, 10 months), SD = .31. Thirty-nine percent of child participants were female. (The percentage of females was slightly higher in the 2006 cohort, 42.3%, compared to the 2005 cohort where 38.2% of participants were female.)

All but two children spoke English at home. Most parents were in married or common-law relationships (n=143). Family income was normally distributed; most families reported incomes between $50 000 and $75 000 (Cdn) (n=137). Approximately 1/3 of parents (n=63) reported a college or trades diploma as their highest level of completed education; a further 1/3 of parents (n=61) reported a high school diploma as their highest level of education. Most parents worked in manufacturing, agriculture, or retail industries (n=134).

Procedure

Twenty kindergarten teachers from across thirteen schools recruited children for the project. Children who teachers identified as 'being behind other children in phonological awareness' were invited to participate in one of the intervention conditions. Teachers distributed information packages and consent letters to parents. In six classrooms, teachers also distributed information packages to 'average achieving' readers.

Children with parental consent to participate in the study were assessed at the end of the senior kindergarten year by trained research assistants. The test battery for the pre-test assessment included letter knowledge (name and sound), receptive vocabulary, non-verbal reasoning, word reading, and four phonological awareness tasks. Following the pre-tests, children recruited to participate in an intervention condition received additional information about the summer program.

Random assignment into intervention conditions was not possible for this project. The interventions were delivered in school and community locations in four different towns separated by more than one hour driving distance. It would have been unreasonable to ask parents to drive children to a program in a town one hour away simply to facilitate random assignment to conditions. Instead, intervention conditions were assigned to towns. Children participated in the intervention condition that was assigned to the town where they attended school. Intervention conditions were assigned to towns based on availability of school space (for the children's program) and coordination between sessions (in all but one instance, children's programs were provided consecutively to manage staff resources). Three of the four towns delivered two of the intervention conditions to reduce bias potentially associated with town characteristics.

The 2005 cohort was divided into three intervention groups: parent+child, child-only, and parent-only. The 2006 cohort was divided into only two intervention groups: parent+child and parent-only. We learned from the 2005 project that some of the parents in the parent+child condition will choose to not attend the parent workshops. In these cases, only children participate in the intervention, therefore they become part of the 'child-only' group. We anticipated that some of the parents in the 2006 cohort parent+child group would miss the parent workshops, thereby creating the child-only group. Re-categorizing families into intervention categories in this way maximizes the number of participants but also introduces parental motivation or interest as a potential confounding variable. The potential for this bias is explored further in the discussion section.

The summer camp for children (as described above) was provided, free of charge, for two weeks at local schools. The maximum number of students for each summer camp session was restricted to 18 children to maintain a 6:1 – child : teacher ratio. For the 2005 cohort,

four separate sessions of the child camp were offered consecutively, starting in July. Three sessions of the summer camp were offered for the 2006 cohort; two of the sessions were offered concurrently in July, with another session offered one week later. Parent training workshops were held at the local school, except in one town, where the workshops were held at a community drop-in centre that hosts other parent events.

At the beginning of grade one, trained research assistants visited with children at schools to complete the post-test assessments. In addition to tasks used in the pre-test battery, children completed tasks of short-term memory, working memory, processing speed, listening comprehension, pseudoword reading, and storybook title recognition. As in the pilot study, at the time of the post-test assessments parents were asked to complete the general information survey, summer activities survey, and program satisfaction survey. A postage paid envelope was provided for parents to return surveys by mail.

At the end of grade one, approximately ten months after participation in the summer intervention program, a subset of children from the 2005 cohort from the three intervention conditions participated in a follow-up assessment using the full assessment battery. This follow-up was included to explore the longer-term influence of participation in the intervention program.

Measures

All measures from the pilot study (receptive vocabulary, non-verbal reasoning, phonological awareness, and word reading) were maintained. Letter knowledge tasks were added to the pre- and post-test assessment battery. An additional five tasks measuring memory, listening comprehension, naming speed, and pseudoword reading were added to the post-test assessment battery.

Letter knowledge

Letter name knowledge: Children were asked to name all 26 letters of the alphabet, presented randomly in upper and lower case letters, on small cards.

Letter sound knowledge: Children were asked to 'make the sound' of all 26 letters of the alphabet, presented randomly in upper and lower case letters, on small cards.

Short- term phonological memory

Digit Span – Wechsler Intelligence Scale for Children – IV (2003): Children are asked to repeat a set of numbers presented verbally by the examiner. (Example: 3 – 8 – 6). The task is discontinued when children fail both items in a set. This task is commonly labelled as phonological memory because it measures memory of sound based information.

Working memory

Phonological working memory – Swanson Cognitive Processing Test (Swanson, 1996): This task measures memory of similar sounding words. Children are asked to remember a set of rhyming words (e.g. sun – fun). The child is asked a distracter (process) question about the words (e.g. was one of the words run or sun?) and then asked to remember the original word set in sequence. If necessary, children are provided with hints (probes), based on probing guidelines described in the test manual, to help them recall the word list (e.g. 'How about a hint, the first word is sun. Now can you tell me all of the words?) The test was discontinued when children failed two consecutive items.

Naming speed

Rapid Digit Naming – Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999): Children were presented with 72 numbers in four rows then asked to name the numbers as fast as they can without making mistakes. The task was repeated for two sets of numbers. The examiner recorded the time, in seconds, and the

number of errors. A standardized score was calculated based on the total time taken to read the numbers on both sets. Children who made more than five errors on any set were excluded. Naming of digits was chosen instead of naming of letters because many children in this sample had yet to learn all of the letter names. Chronbach's alpha is .89; test-retest reliability is reported as .91.

Listening comprehension

Listening comprehension subtest – Woodcock Language Proficiency Battery-Revised (1991): This task measured the ability of the child to comprehend a passage and provide a single word response that would complete the sentence/passage. Each sentence was presented orally by the examiner and required a one-word, spoken response. Example: A dog barks, a cat _____? Test reliability for six year old children is reported as .83.

Pseudoword reading

Word Attack – Language Proficiency Battery-Revised (1991): Children were asked to read aloud letter combinations (nonsense words) that are linguistically logical in English but that do not represent actual words. The task required children to apply phonic and structural knowledge to pronounce the unfamiliar words. Example: tiff, dright. Test reliability for six year old children is reported as .95.

Story Book Exposure

Child Story Title Recognition (adapted from Senechal & LeFevre [2003]; Frijters, Barron, & Brunello [2000]): Children were asked to identify which books, from a list of 16 children's book titles, they had read. Children were instructed that 'reading' the book might have been with a parent or sibling, with a teacher, or by themselves. The assessor read the title of each of the 16 children's books and then asked children if they had 'read' the book. Four of the 16 titles were foils. Children were told that some of the titles may not be real, so

they should only say 'yes' if they had really read the story. Scores were calculated as the number of actual book titles the child reported to have read. Scores could range from 0 – 12. Chronbach's alpha was .80.

Parent Survey

Summer Activities Survey – Revised: The survey asked about the frequency of six home literacy activities (e.g. book reading, teaching letters, decoding simple words) during the senior kindergarten year and since the intervention program. Parents were instructed to rate the frequency of the activity on a six-point Likert-type scale ranging from more than once per day to rarely/never (See Appendix 4.) Chronbach's alpha across the 18 items for frequency of home literacy activities was .92.

The Intervention Program

The summer camp program for children and the parent education workshops were the same as described in study 1.

Results

Descriptive Statistics

Children's Scores

Several steps were required to prepare the data for analyses. The letter name and letter sound knowledge scores were converted into percentages of correct responses to facilitate interpretation. Scores for receptive vocabulary (PPVT-III), non-verbal reasoning (MAT), listening comprehension, and naming speed (RAN numbers) were converted to standardized scores.

Scores for word reading (Woodcock-Johnson Word Identification) and pseudoword reading (Woodcock-Johnson Word Attack) were not converted to standardized scores. Many children received a score of zero on the word reading and pseudoword reading tasks. The

examiner's manual for these tasks suggests that a raw score of zero may reflect the participants' inability to perform the task, and that recording no score for the test may be more valid than a standardized score based on a raw score of zero (Woodcock, 1991). For a raw score of 0, standardized scores would range from 62 to 101, depending on children's age at the time of the test.

For this project, absolute growth in word reading ability represented by raw scores was more important than age-appropriate level of word reading, which would be represented by the standardized score. Seventy-three percent of children in the intervention or low comparison group condition read two or fewer words at pre-test and 90% of children could read fewer than five words; raw word identification scores ranged from 0 to 14 across the intervention groups and the low comparison group. There was, however, variability in word reading at post-test: 34% of children read two or fewer words and raw scores ranged from 0 to 33. For the purposes of this project, growth in raw word reading scores is a better measure of the influence of the intervention on word reading. To account for variability in word reading influenced by age, children's pre-test age (recorded in years to two decimal places) is included as a covariate in all analyses. A change score was calculated for word reading by subtracting the number of words read at pre-test from the number of words read at post-test.

At post-test, 61.4% of children were unable to perform the pseudoword reading task. This task required more advanced application of phonological awareness to decode non-words. The difficulty of this task for the young children in this study was anticipated but more improvement was expected between the pre- and post-test assessments. As a result of the large floor effect, scores of pseudoword reading were not used in the analyses.

Correct responses across the four phonological awareness tasks (rhyme oddity, phoneme oddity, syllable deletion, and phoneme deletion) were summed to create a

composite score (Anthony & Lonigan, 2004). Some researchers prefer to use a single measure of phonemic awareness, most often a measure of phoneme deletion or phoneme substitution, instead of a composite phonological awareness score. In this study, the phoneme deletion data showed a floor effect, in that 75% of children received a score of zero during the pre-test assessment. This is consistent with other research that suggests phoneme manipulation tasks are the most difficult for children and are best for measuring phonological awareness in children with some reading ability.

The composite phonological awareness score was normally distributed. The maximum possible score was 52; the mean score was 22.65 (SD=8.81) and children's scores at pre-test ranged from 5 to 47. A confirmatory factor analysis was conducted using structural equation modeling to confirm that the four phonological awareness tasks could be adequately represented by a single phonological awareness factor (see Appendix 5).

Finally, five children in intervention groups were removed from the analyses because they showed average to high phonological awareness and/or reading ability at pre-test. The intervention was designed to support young children with low phonological awareness at the end of senior kindergarten and so change in the reading skills of children with average initial ability is not important to the evaluation of the intervention program. Exploratory analysis of pre-test abilities was used to identify outlier cases. Outlier cases were excluded from the analyses: one child was excluded from the parent+child group, one child was excluded from the parent-only group, and three children were excluded from the child-only group.

Families were initially recruited to participate in one of three intervention conditions (parent+child, child-only, parent-only). However, not all children and parents participated in the components of the intervention to which they were enrolled. For the analyses, families were recoded to represent the components of the intervention in which they participated. For

example, if a family was initially enrolled in the parent+child condition, but the parent did not attend the workshops, the case was recoded into the child-only condition. Families that were recruited for an intervention condition but neither the child nor parent participated were recoded into the low comparison group. This process maximized the sample size for analysis but potentially introduced other effects such as parent motivation or interest. This issue is explored further in the discussion section as a limitation of the study. Table 2 shows the number of families initially recruited for each intervention condition, and the actual number of families who participated in each condition.

Table 2. Number recruited and actual participation by group

group	# recruited	# actual by participation	Experimental Condition
parent+child	73	55	parent(s) attended two workshops, child attended two-week summer camp
parent-only	36	27	parent(s) attended two workshops
child-only	44	57	child attended two-week summer camp
low comparison	17	31	no intervention
average comparison	19	19	no intervention
*removed**	*5*		*removed from analysis*
Total	194	189	

Table 3 provides pre-test scores for the five groups used in subsequent analyses: parent+child, child-only, parent-only, low comparison, and average comparison. An analysis of variance test was used to examine initial differences between groups. As expected, children from the intervention groups (parent+child, child-only, and parent-only) and the low comparison group did not differ on key variables at pre-test (PPVT, F=.270; MAT, F=1.492; phonological awareness, F=2.54; word reading, F=2.95).

The average comparison group was significantly different at pre-test from the low comparison group and the intervention groups on phonological awareness and word reading. The groups did not differ on receptive vocabulary at pre-test.

Table 3. Pre- and post-test scores by group (mean and standard deviations)

	parent+child		Parent-only		child-only		low comparison		average comparison	
	pre n=55	post n=53	pre n=27	post n=27	pre n=57	post n=55	pre n=31	post n=31	pre n=19	post n=19
% correct letter names	87.41	93.13	85.04	94.26	80.5	90.74	86.98	89.29	98.97	99.18
	18.33	14.89	23.53	14.69	25.9	14.99	11.45	20.19	2.71	3.07
% correct letter sounds	59.08	78.69	62.1	79.52	62.53	75.37	59.19	73.39	92.83	95.34
	27.6	22.61	33.72	23.12	30.28	22.77	27.35	28.87	4.58	5.04
PPVT - III *	101.62	102.33	101.3	102.32	100.31	101.06	99.87	99.29	104.63	107.24
	11.61	12.8	13.04	14.09	10.83	10.52	10.12	11.31	9.74	10.31
MAT *	11.18	11.56	10.78	11.56	10.36	11.51	11.37	11	12.6	12.61
	1.83	2.45	2.29	1.69	2.27	1.91	1.77	1.57	2.23	2.2
Rhyme oddity	8.91	9.96	8.3	10.15	7.9	10	8.1	8.68	11.05	10.83
	3.06	2.33	2.96	2.23	3.14	2.46	3.09	3.07	2.12	1.89
Phoneme oddity	7.65	9.34	7	9.48	7.69	9.59	5.63	7.1	9.68	10.94
	2.94	3.17	3.66	2.91	3.11	3.06	2.62	2.61	3.15	2.88
Syllable deletion	4.55	6.04	4.89	5.89	5.24	5.93	4.2	5.41	7.16	7.5
	2.33	2.33	2.29	1.74	2.51	1.83	1.88	2.26	2.14	1.89
Phoneme deletion	0.67	3.68	2.22	4.22	2.12	4.31	0.3	1.63	3.74	5.44
	2.19	3.9	3.62	4.39	3.71	4.04	0.99	2.76	3.94	4.34
Phonological awareness	21.81	29.02	22.41	29.74	22.95	29.78	17.66	22.48	31.63	34.72
	7.26	8.95	9.39	8.55	9.16	8.13	4.91	7.8	6.66	7.58

Word Identification	2.56	6.33	4.48	8.56	1.93	6.87	1.44	2.81	11.84	10.33
	3.16	5.75	5.74	8.22	2.96	7.34	2.14	2.46	11.7	8.49
RAN *		7.35		8.56		7.82		6.22		7.79
		2.72		3.23		2.34		2.58		1.48
Phonological memory *		6.21		6.59		5.84		6.33		7.5
		1.94		2.34		1.63		1.24		2.44
Working memory		1.12		1.52		1.28		1.17		2
		0.83		0.98		1.05		0.79		0.68
Listening comprehension *		95.48		99.27		91.57		74.77		90.56
		14.96		11.97		14.37		29.91		18.05

* Table reports standard scores.

Table 4 shows the correlation of children's pre-test scores across the 10 tasks measuring language, MAT (non-verbal reasoning), phonological awareness, and reading skills. Most variables were strongly correlated. MAT scores were not correlated with letter knowledge (sound or name), phoneme deletion, or word reading. Phoneme deletion was not correlated with PPVT, MAT, or rhyme oddity possibly due to floor effects on this task.

Table 4. Intercorrelation of primary pre-test variables

	Subscale	2	3	4	5	6	7	8	9	10
1	% correct letter names	.67 **	.20 **	.09	.28 **	.44 **	.23 **	.27 **	.43 **	.32 **
2	% correct letter sounds		.21 **	.07	.29 **	.45 **	.32 **	.35 **	.49 **	.38 **
3	PPVT standard score			.22 **	.29 **	.28 **	.22 **	.04	.28 **	.04
4	MAT standard score				.37 **	.15 *	.21 **	-.01	.24 **	.16 *
5	Rhyme oddity					.49 **	.38 **	.14	.70 **	.27 **
6	Phoneme oddity						.47 **	.34 **	.80 **	.38 **
7	Syllable deletion							.42 **	.74 **	.44 **
8	Phoneme deletion								.66 **	.49 **
9	Phonological awareness (composite)									.24 **
10	Word ID raw score									

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Trajectory of comparison groups

Data for two comparison groups were available; these groups serve as important baselines from which to explore the influence of the intervention conditions. A low comparison group (n=32) was recruited as part of the 2005 cohort. These were children that teachers identified as being behind other children in phonological awareness, but which did not participate in an intervention condition. An average comparison group (n=19) was

recruited as part of the 2006 cohort. Children in this group were identified by teachers as normally achieving in phonological awareness and reading. Figures 3 and 4 show pre- and post-test scores for the two primary dependent variables: phonological awareness and word reading.

Figure 3. Pre- and post-test phonological awareness for low and average comparison groups

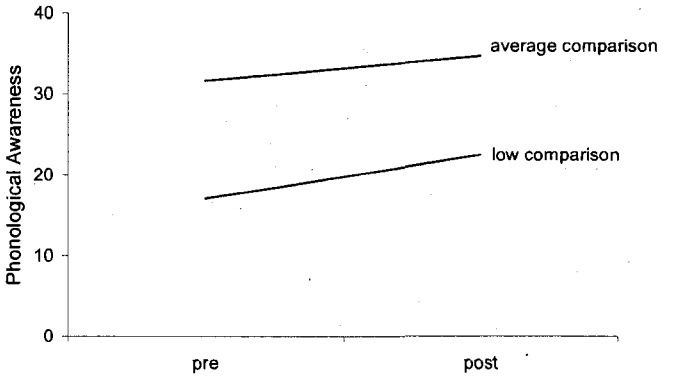
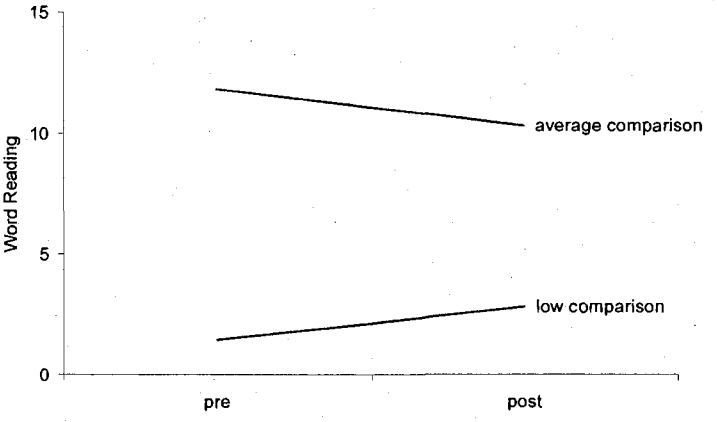


Figure 4. Pre- and post-test word reading for low and average comparison groups



The graphs shows that both the low and average comparison groups increased slightly in phonological awareness between pre- and post-assessments. Only children in the low comparison group increased in word reading between assessments. This contradicts the so-called 'summer slip' – that children decrease in education related skills like literacy and

math during the summer break from school (Entwisle & Alexander, 1994). For children in the low comparison group, the pattern may be a function of regression towards the mean.

Influence of intervention condition

Analyses for Study 2 are divided into five sections. The first section explores the influence of intervention conditions on children's phonological awareness and word reading skills using three RTI methods. The next section uses binary logistic regression to identify child characteristics that influenced children's RTI. Sections three and four use data from the parent completed surveys about the home literacy environment; section three examines the influence of the home literacy environment on children's skills and section four examines changes in the home literacy environment following the intervention. Section five revisits children's outcomes, examining the influence of intervention conditions at the one-year follow-up.

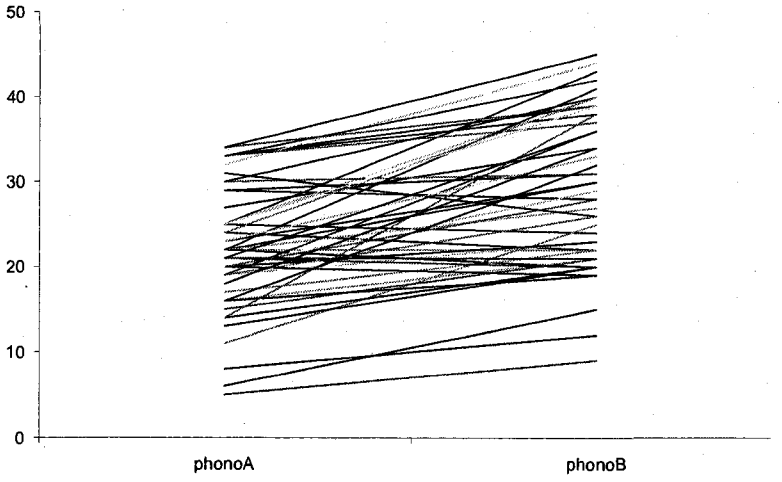
Analysis Strategy

Analyses for this project were somewhat limited by the available data. Repeated measures analysis of variance (ANOVA) tests, which are commonly used for pre/post designs were not appropriate for this project because the data did not meet the central assumptions of normality and homogeneity. The normality assumption assumes that dependent variables are normally distributed. In this case, the word reading variable showed a strong floor effect which is consistent with the primarily low achieving characteristics of the sample that was recruited for this project. Attempts to transform the data towards a normal distribution were unsuccessful. The homogeneity assumption presupposes equal variances between groups. In this project, there was an unequal number of participants in each group and the variance of the key dependent variables, phonological awareness and word reading, varied significantly between groups. Given that the data did not meet two of

the key data assumptions for parametric statistics, data estimates and significance tests using a repeated measures ANOVA procedure would be invalid.

Furthermore, based on existing responsiveness-to-intervention (RTI) literature, significant variability is expected in children's response to intervention conditions (variability in slope between pre- and post-test assessments). Repeated measures ANOVAs examine the mean change score in the repeated measure over time; however, a single mean score is unlikely to be representative of the group of children's change on dependent measures over time. Some children in an intervention group will show significant change and some children will show little change but the mean score will be unrepresentative of both groups.

Figure 5. Change in phonological awareness for children in parent+child condition



As an example, Figure 5 plots the change in phonological awareness for children in the parent+child condition. It is evident that children's responsiveness to the intervention varied significantly. A single estimate of change for these children would not be appropriate. Our primary interest in the analysis for this project is the percentage of children in each group that showed positive change following the intervention condition, and secondarily, the

characteristics of children who showed change. Other tests would be more appropriate to answer these questions.

The analyses were, therefore, guided by methods used in recent studies examining responsiveness-to-intervention (RTI). RTI can be measured by level (percentage of participants who achieve a benchmark or cut-off score on an outcome variable) or by slope (percentage of participants who show improvement on an outcome variable). Both types of analyses are used here to examine RTI for each of the intervention conditions; phonological awareness and word reading are used as dependent variables. For each analysis, children are classified as 'responders' or 'non-responders'. A priori contrasts explore differences in responsiveness first, between intervention groups and the low comparison group, and second, between the three intervention groups.

This project was primarily exploratory in nature, and for that reason, results to a significance level of $p = .10$ are reported. Several different comments are used to describe the results. The term 'visual inspection' is used to illustrate differences seen in tables and figures where statistical analyses are not used (most often due to low sample size). 'Marginally significant' is used to describe findings with a significance value between .05 and .10. 'Statistically significant' is used to describe results that meet traditional significance rules of $p < .05$.

Descriptive Analysis

The RTI analyses include only children who were initially low in the target outcome variables, phonological awareness and/or word reading. Cut-offs to determine inclusion in the analyses were somewhat arbitrary. The purpose of establishing inclusion criteria was to exclude children who were not showing initial delays in phonological awareness or word reading. The phonological awareness composite variable was created from measures used

for this study and does not have age-related norms. The cut-off for inclusion for phonological awareness was guided by the mean pre-test score of the average comparison group. The word reading measure for this study was the Woodcock-Johnson Word Identification task. Age-appropriate norms are available for this measure. A score of five is the expected word reading score for children 5 years, 5 months to 6 years of age. The score of five excludes children in the sample who were reading more than the expected number of words at pre-test. (Appendix 6 and 7 provide scatterplot graphs of pre-test phonological awareness and word reading, respectively. Data points were not clustered around the cut-offs used for this study.)

Table 5 displays the number and percentage of children who were initially low in both outcomes, initially low in one outcome, and initially low in neither outcome. All children in the sample were included to highlight the differences between groups. Only 20% of children in the average comparison group were initially low in both phonological awareness and word reading, whereas 90% of children in the low comparison group were initially low in both outcome measures.

An interesting difference arises also between the parent+child and child-only groups and the parent-only group; it appears that children in the parent-only group were either initially very low scoring (low in both outcomes) or relatively high achieving (low in neither outcome). This fits with anecdotal information received after the completion of the project from one of the participating teachers who reported that when recruiting from the 2005 cohort parent-only condition, she did not recruit very low achieving students in her classroom because she did not believe the parents of these children would attend the evening workshops. Instead, she sent the project information to children who were "almost" average achieving and whose parents would more likely attend the parent evening training sessions. The other

intervention groups, parent+child and child-only, had approximately 20% of children who were low in only one of the outcome variables.

Table 5. Children with low scores at pre-test by group

	parent+child		parent-only		child-only		low comparison		average comparison	
	N	%	N	%	N	%	N	%	N	%
low both	39	72.2	20	74.1	40	70.2	27	90.0	4	21.1
low one	10	18.5	1	3.7	12	21.1	3	10.0	5	26.3
low neither	5	9.3	6	22.2	5	8.8	0	0.0	10	52.6
total	54		27		57		30		19	

Though the RTI concept technically applies only to children who participated in one of the intervention conditions, data from children in the low comparison group are presented also. The low comparison group represents the outcomes of initially low achieving students who receive no intervention. In this way they serve to illustrate the effect of the intervention. Though children in the low comparison group received no intervention per se, for simplicity, the term RTI was used to discuss findings across all groups.

Responsiveness-to-intervention: Phonological Awareness

Benchmark

A benchmark style of analyses requires a cut-point score to determine responsiveness. However, there are no established early literacy benchmarks for phonological awareness or word reading (Torgesen, 2000). In the absence of recognized benchmarks it is up to individual researchers to set cut-points that determine 'responsiveness' (Denton et al., 2006). Linan-Thompson et al. (2006) categorized children as non-responsive to the intervention if scores on the Woodcock Language Proficiency Battery –Revised were more than one standard deviation below the mean (a standard score of 85). Alternatively, Torgesen (2001) and Mathes and Denton (2002) use the 30th percentile score as the benchmark of responsiveness. In these studies with percentile benchmarks, all children from the school

district were assessed so the sample included a wide distribution of literacy skills, making identification of a specific range of children possible.

For this study, although we did not test all senior kindergarten children in the school board, the project did include an average comparison group; a group of children whom teachers identified as normally achieving in phonological awareness and early word reading. The mean phonological awareness score for children in the average comparison group at pre-test was 31.63, almost 10 points higher than the mean phonological awareness score for children in the intervention and low comparison groups.

A score of 30 on phonological awareness was chosen as the benchmark indicating responsiveness for this study for several reasons. First, most children who had been referred by teachers as having low phonological awareness (children in the intervention and low comparison groups) had a pre-test phonological awareness score less than 30 (82.8%). Therefore, a large sample would be available to examine what percentage of children in each condition improved to a phonological awareness score equal to, or greater than, 30. Second, the mean phonological awareness score for children in the average comparison group was 31.63 (SD=6.66), just slightly above 30. It seems reasonable that RTI could be measured as the percentage of children who started with low phonological awareness that were able to improve such that their skills were comparable to pre-test phonological awareness scores of children identified as normally achieving. Similar criteria of gains relative to the class average have been used in research on Reading Recovery programs (e.g. Schwartz, 2005).

Setting a cut-point for 'responsiveness' in the absence of established benchmarks is arbitrary; however, it is important that the cut-point be considered with respect to the distribution of scores and the degree of change that is reasonable given the sample population. Denton et al. (2006) cautioned that setting a benchmark too high can be unrealistic if pre-test

scores are very low; that is, 'responsiveness' becomes more indicative of pre-test score than change following the intervention. If the cut-point for responsiveness in phonological awareness was set at 40, then 88.6% of initially low achieving children and 66.7% of initially average achieving children would not have met the benchmark at post-test.

For analyses examining RTI for phonological awareness, only children with pre-test phonological awareness scores less than 30 were included. For analyses examining RTI with word reading, only children reading fewer than five words at pre-test are included. After applying these inclusion rules, only 8 children from the average comparison group were eligible for analyses related to phonological awareness and only 5 children from the average comparison group were eligible for analyses related to wording reading. Due to the low samples eligible for analyses from this group, children in the average comparison group were not included in RTI analyses. The final sample for analyses of RTI measured by phonological awareness was 140.

The first step to examining RTI with phonological awareness as a dependent variable was to select children who had pre-test phonological awareness scores less than 30. This step reduced the sample for analysis to 140; 33 children were eliminated from analyses for the intervention groups, and 2 children were eliminated from the low comparison group (see Table 6). Children eliminated from analyses were equally distributed across the three intervention conditions. This step ensured that the analysis of responsiveness, or improved performance, was based on a group of children with initial low phonological awareness.

The second step was to identify children who achieved the post-intervention cut-off score of 30. Children who had post-test phonological awareness scores equal to or greater than 30 were coded as '1'. This group was labelled responsive. Children with post-test phonological awareness scores less than 30 were coded as '0' and were labelled non-

responsive. Table 7 shows the number and percentage of children in each category by condition.

Table 6. Pre-test phonological awareness scores above and below score of 30

	parent+child		parent-only		child-only		low comparison	
	N	%	N	%	N	%	N	%
< 30	42	76.4	21	77.8	43	75.4	29	93.5
> 30	13	23.6	6	22.2	14	24.6	2	6.5
total	55		27		57		31	

Table 7. Responsive and non-responsive children in phonological awareness by group using benchmark method

	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	26	61.9	16	76.2	24	55.8	66	62.26	24	82.8
responsive	16	38.1	5	23.8	19	44.2	40	37.74	5	17.2
total	42		21		43		106		29	

A higher percentage of children who participated in an intervention group were responsive than children in the low comparison group. Within intervention conditions, visual analysis shows that children who participated in the child camp component (parent+child and child-only) were slightly more responsive than children in the parent-only condition.

The chi-square statistic, measuring significant variation in the pattern of results across the whole data set, is available for a cross-tabulation table such as that in Table 7. This statistic does not however, explore differences between groups within the data set, as a contrast would in an analysis of variance test. Therefore, a test of two proportions (Gebotys, 2007) was used to explore significant differences between groups. All tests explored the null hypothesis that there was no difference between groups. The equation results in a z-score

related to the magnitude of difference in the percentage of children coded 'responsive' across the two test groups. Eight such 'contrasts' were conducted for each RTI analysis (six total). A positive z-score indicates that the group listed first included more children who were responsive than the group listed second. A negative z-score indicates that the group listed second included a higher percentage of children who were responsive than the group listed first. Traditionally, a Bonferroni correction would be employed to account for the number of tests used in the analysis and limit the potential for Type 1 errors. However, due to the exploratory nature of this study, no correction for number of tests was employed.

Table 8. Significant differences between groups in responsiveness as measured by benchmark method for phonological awareness

Comparison	z-score	p value
parent+child vs child-only	-1.13	0.25
parent+child vs parent-only	0.46	0.65
child-only vs parent-only	1.58	0.11
parent+child vs low comparison	1.90	0.06
parent-only vs low comparison	0.58	0.57
child-only vs low comparison	2.38	0.02
interventions vs low comparison	2.08	0.04

When responsiveness was measured using a benchmark score of 30 on phonological awareness, the child-only group had significantly more children who were responsive to the intervention than the low comparison group (p=.02). There was a significant difference in the percentage of responsive children in intervention groups as compared to the low comparison group (p=.04). Based on the other contrasts, it appears this significant finding is being driven by a higher percentage of responsive children in intervention conditions with a child camp component (parent+child and child-only) than children in the low comparison. Analysis between the parent+child and low comparison group was marginally significant (p=.06).

Slope

Regardless of the cut-point used, the benchmark strategy for determining RTI is still dependent on pre-test scores; children with pre-test scores closer to the benchmark are more likely to achieve the cut-point and be categorized as responsive. Evaluating RTI using a measure of slope permits children to be classified as 'responders' even though they may not have achieved a set benchmark. For example in the benchmark method analysis, if the cut-point for 'responsiveness' is set at a score of 30, a child who begins at a score of 5 and makes consistent progress such that he/she obtains a score of 29 following intervention would be classified as non-responsive whereas a second child, who begins at a score of 25 and progresses to a score of 31 would be classified as responsive. Though child A has clearly shown more improvement in reading skills, he/she would not be considered responsive to the intervention.

A slope approach to measuring RTI considers the degree of change in an outcome variable rather than setting a specific cut-point score. Vellutino et al. (1996) rank-ordered children's slopes on the Woodcock Reading Mastery Test–Revised and designated children with slopes in the lower half as non-responsive. Use of the slope method as the exclusive RTI measure is rare. In most instances, slope is used along with the benchmark method in the dual discrepancy approach.

For this study, slope in phonological awareness was calculated by subtracting pre-test phonological awareness from post-test phonological awareness and dividing by 4.5 – the number of months between pre-test and post-test assessments. The slope variable, therefore, represents change in phonological awareness per month. A slope of 1 indicates that the child increased one point in phonological awareness each month between pre- and post-test assessments. Only children with pre-test phonological awareness scores less than 30 were

included in the analysis. Calculating slope as the increase per month 'standardizes' the unit of change and permits future comparisons with other studies where the time between assessment periods may be different than the current study.

Table 9 reports mean and standard deviation scores for slope in phonological awareness by group. The overall mean slope across groups was 1.54 (min = -1.78, max = 5.33) meaning that most children increased in phonological awareness at a positive rate between assessments. Visual inspection shows that children in the intervention groups had a higher mean slope than children in the comparison groups (low comparison and average comparison groups). It is important to notice the relatively large standard deviations for slope across all groups; this suggests that the rate of change in phonological awareness, or responsiveness, was significantly varied within groups.

Table 9. Rate of change (slope) in phonological awareness by group

	Mean	SD
parent+child	1.63	1.52
parent-only	1.89	1.41
child-only	1.65	1.26
low comparison	1.10	1.37
average comparison	1.14	1.15
Total	1.54	1.39

Using a similar process to that described above, children were classified as responders or non-responders based on their slope, or rate of change, in phonological awareness. Children with slope scores less than 1.5 were coded as '0' and labelled non-responders. Children with slope scores greater than or equal to 1.5 were coded as '1' and were labelled responders. Similar to a process employed by Vellutino et al (1996), the slope score of 1.5 was chosen to separate non-responder and responder groups because it represents

the mean slope across all children included in the analysis. Table 10 reports the number and percentage of responders by group.

Table 10. Responsive and non-responsive children by group using slope

	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	21	50	6	28.6	17	39.5	44	41.51	19	55.2
responsive	21	50	15	71.4	26	60.5	62	58.49	13	44.8
total	42		21		43		106		29	

Using the slope method of analysis, more children were classified as responsive. This indicates that though children may not have reached the benchmark of 30 on post-test phonological awareness, many children made steady increases in phonological awareness between pre- and post-test assessments. In particular, few children in the parent-only group reached the benchmark at post-test (23.8%), but more than 70% of children in this group showed steady improvement.

Between group comparisons of the percentage of responsive children are reported in Table 11. There were no statistically significant contrasts between groups. Only one marginally significant between-group difference was found; the parent-only group had a larger percentage of responsive children than the low comparison group ($p=.06$). The majority of children in the parent-only and child-only groups were responsive when categorized using the slope method and 50% of children in the parent+child group were categorized as responsive. It is possible that a higher slope score cut-off that reduced the overall number of responsive children would show more between-group differences.

Table 11. Significant differences between groups in responsiveness as measured by slope method for phonological awareness

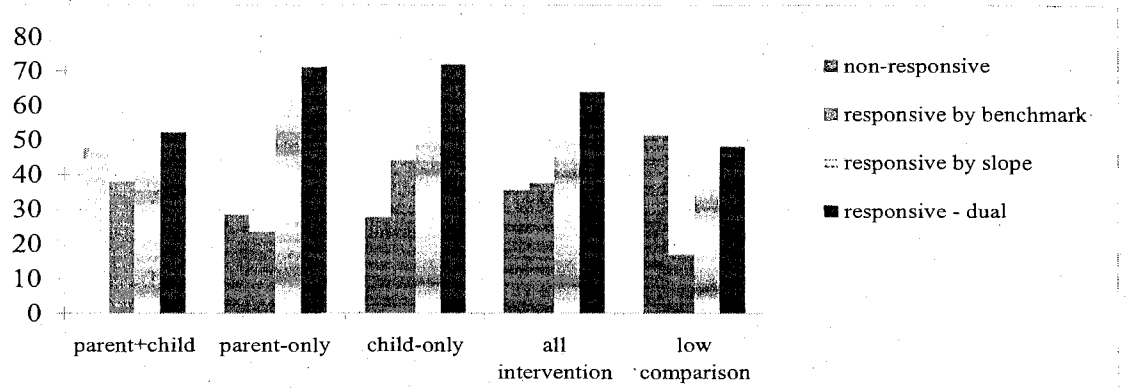
Comparison	z-score	p value
parent+child vs child-only	-0.79	0.45
parent+child vs parent-only	-1.62	0.10
child-only vs parent-only	0.85	0.40
parent+child vs low comparison	0.43	0.67
parent-only vs low comparison	1.87	0.06
child-only vs low comparison	1.31	0.19
interventions vs low comparison	1.31	0.19

Dual discrepancy

Several authors now support a dual-discrepancy approach to RTI analysis; children who reach the benchmark or show significant improvement (slope) are considered responsive. The dual discrepancy approach was applied in the current study with children who showed low initial phonological awareness (pre-test phonological awareness less than 30). Figure 6 shows the number and percent of children within each group who were categorized non-responsive by both methods (benchmark and slope), categorized responsive by one method, and categorized responsive by both methods.

The pattern of results is interesting and highlights the fact that the RTI analysis methods measure responsiveness in very different ways. Most children in the parent-only group categorized as responsive met the criteria under the slope approach; this suggests that though children in this group made large improvements in phonological awareness, they had yet to reach the level of same-grade peers. A larger percentage of children in the parent+child and child-only groups were categorized as responsive through both methods. One of the important contributions of this study is to explore the utility of different RTI analysis methods. Recommendations for future RTI studies will be described upon the close of this project.

Figure 6. Percent responsive in phonological awareness by method



For analysis of the dual discrepancy method, children who were coded responsive using either the benchmark or slope method were categorized as responsive. Results are reported in Table 12. Table 13 reports z-scores for the difference in percentage of responsive children between groups. Only one significant between group difference was found using the dual discrepancy approach; the child-only group had significantly more children categorized as responsive than children in the low comparison group (p=.04). The marginally significant difference between the parent-only group and the low comparison group (p=.10) is heavily influenced by the large percentage of children classified as responsive in the parent-only group via the slope method.

Table 12. Responsiveness by dual discrepancy approach for phonological awareness

	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	20	47.6	6	28.6	12	27.9	38	35.85	15	51.7
responsive	22	52.4	15	71.4	31	72.1	68	64.15	14	48.3
total	42		21		43		106		29	

Table 13. Significant differences between groups in responsiveness using the dual discrepancy approach for phonological awareness

Comparison	z-score	p value
parent+child vs child-only	-1.52	0.13
parent+child vs parent-only	-1.44	0.15
child-only vs parent-only	0.06	0.95
parent+child vs low comparison	0.34	0.74
parent-only vs low comparison	1.63	0.10
child-only vs low comparison	2.05	0.04
interventions vs low comparison	1.55	0.12

Responsiveness-to-intervention: Word reading

Analyses of RTI by benchmark, slope, and dual discrepancy were repeated using word reading as the outcome variable.

Benchmark

The benchmark for word reading responsiveness was set at a raw score of five on the Woodcock-Johnson Word Identification Task. Of children recruited for intervention groups and the low comparison group, 82.5% read fewer than five words at pre-test, while only three children in the average comparison group (26.3%) read fewer than five words at pre-test. Only children who read fewer than five words at pre-test were included in the analysis (see Table 14). A higher percentage of children in the parent-only group could read five or more words than children in the parent+child and child-only intervention groups; this fits with anecdotal information received by a participating teacher as described above. Only 12.5% of children in the low comparison group (n=4) could read five or more words. Children in the average comparison group were not included in the analyses because only a small number of children (n=5) were reading five or fewer words at post-test.

Post-test word reading scores were recoded where '0' represented children reading fewer than five words, labelled non-responders, and '1' represented children reading five or more words, labelled responders. Table 15 shows responders and non-responders by group as

measured using the benchmark approach to word reading. A greater percentage of children in the intervention conditions were categorized as responsive than in the low comparison group. Within interventions, the largest percentage of responsive children was in the parent-only condition.

Table 14. Pre-test word reading scores above and below score of five

	parent+child		parent-only		child-only		low comparison	
	N	%	N	%	N	%	N	%
less than 5 words	45	81.8	20	74.1	48	84.2	28	87
5 or more words	10	18.2	7	25.9	9	15.8	4	12.5
total	55		27		57		32	

Table 15. Responsive and non-responsive children in word reading by group using benchmark method.

	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	26	61.9	12	60	28	66.7	66	63.46	23	82.1
responsive	16	38.1	8	40	14	33.3	38	36.54	5	17.9
total	42		20		42		104		28	

Results of analyses of between group differences using the test of two proportions are reported in Table 16. There were no statistically significant contrasts. Several marginally significant differences were found: parent+child vs low comparison (p=.07), parent-only vs low comparison (p=.09), and intervention conditions vs low comparison (p=.06). It is important to remember, however, that the benchmark method is strongly influenced by pre-test scores. For example, children in the parent-only group had a mean pre-test score of 4.48 on word reading, whereas children in the low comparison group had a pre-test word reading score of 1.44. Children in the parent-only group required only marginal improvement in word reading to achieve the benchmark score of five.

Table 16. Significant differences between groups in responsiveness using the benchmark method for word reading.

Comparison	z-score	p value
parent+child vs child-only	0.37	0.71
parent+child vs parent-only	-0.14	0.89
child-only vs parent-only	-0.52	0.60
parent+child vs low comparison	1.81	0.07
parent-only vs low comparison	1.70	0.09
child-only vs low comparison	1.42	0.16
interventions vs low comparison	1.87	0.06

Slope

Slope in word reading was calculated by subtracting pre-test word reading scores from post-test word reading scores and dividing by 4.5, the time in months between pre- and post-test assessments. The slope variable, therefore, represents the change in the number of words read by month between pre- and post-test assessments. Only children with pre-test word reading scores less than five were included in the analysis. The mean slope for children initially low in word reading (pre-test word reading < 5) was 0.67 (SD=.93, min= -.67, max=4.44). Table 17 reports descriptive statistics for slope in word reading by group.

Table 17. Rate of change (slope) in word reading by group

	Mean	SD
parent+child	.74	1.06
parent-only	.63	1.01
child-only	.83	.99
low comparison	.38	.55
average comparison	.58	.40
Total	.67	.93

Children were categorized as responders if slope scores in word reading were greater than or equal to 1. Children were categorized as non-responders if slope scores in word reading were less than 1. Responsiveness for children in intervention conditions was similar,

ranging from 25.0% to 31.0%, while only 10.7% of children in the low comparison group had slope scores greater than 1 (see Table 18).

Table 18. Responsive and non-responsive children in word reading by group using slope method

	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	30	71.4	15	75	29	69	74	71.15	25	89.3
responsive	12	28.6	5	25	13	31	30	28.85	3	10.7
total	42		20		42		104		28	

Table 19. Significant differences between groups in responsiveness using the slope method for word reading.

Comparison	z-score	p value
parent+child vs child-only	-0.19	0.85
parent+child vs parent-only	0.30	0.76
child-only vs parent-only	0.49	0.62
parent+child vs low comparison	1.79	0.07
parent-only vs low comparison	1.31	0.19
child-only vs low comparison	1.98	0.05
interventions vs low comparison	1.97	0.05

Table 19 reports z-scores examining between group differences in responsiveness under the slope approach. The child-only group had a greater percentage of responsive children than the low comparison group (p=.05). Taking all intervention conditions together, children who participated in an intervention condition were more likely to be categorized as responsive than children in the low comparison group (p=.05). A marginally significant difference was found between children in the parent+child comparison and the low comparison group (z=1.79, p=.07);

Dual discrepancy

As with the analysis of phonological awareness, a dual discrepancy approach was also used to explore RTI as measured by word reading. Children were coded as responsive under the dual discrepancy approach if they were scored as responsive using either the benchmark or slope method. Table 20 shows the number and percent of children who were responsive using the dual discrepancy approach. Analysis of non-responsive and responsive groups is shown in Table 21. There were no statistically significant contrasts between groups. Two marginally significant differences were found. Children in the parent+child group and children in the parent-only group were more responsive in the word reading domain than children in the low comparison group (p=.07 and p=.09). Across all intervention groups, more children in intervention groups were responsive compared to the low comparison group (p=.06).

Table 20. Responsiveness by dual discrepancy approach for word reading

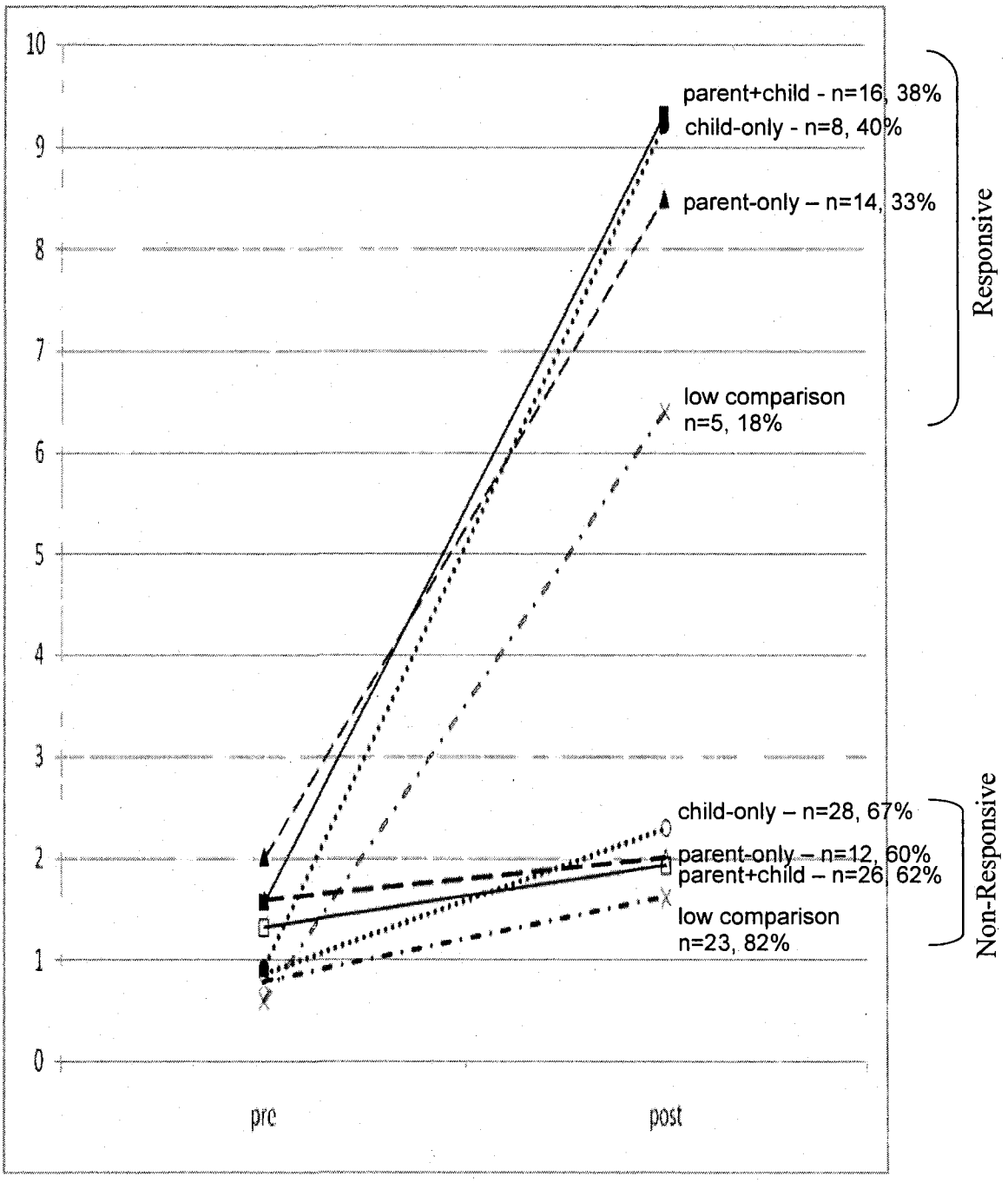
	parent+child		parent-only		child-only		all interventions		low comparison	
	N	%	N	%	N	%	N	%	N	%
non-responsive	26	61.9	12	60	28	66.7	66	63.46	23	82.1
responsive	16	38.1	8	40	14	33.3	38	36.54	5	17.9
total	42		20		42		104		28	

Table 21. Significant differences between groups in responsiveness using the dual discrepancy approach for word reading

Comparison	z-score	p value
parent+child vs child-only	0.37	0.71
parent+child vs parent-only	-0.14	0.89
child-only vs parent-only	-0.52	0.60
parent+child vs low comparison	1.81	0.07
parent-only vs low comparison	1.70	0.09
child-only vs low comparison	1.42	0.16
interventions vs low comparison	1.87	0.06

Pre- and post-word reading scores for responsive and non-responsive children across groups are graphed in Figure 7 to permit further exploration of the findings. It is evident from the graph that children who were categorized as responsive had similar initial word reading scores to children who were coded as non-responsive. Interestingly, the small percentage of children from the low comparison group coded as responsive have a similar slope to responsive children in the intervention groups.

Figure 7. Change in word reading for responsive and non-responsive children by group



Factors mediating response-to-intervention

The above analyses categorized children as responsive or non-responsive to intervention as measured by both phonological awareness and word reading. Further analyses were conducted to examine factors potentially mediating RTI. Binary logistic regression was used to determine how well the classifications predicted actual performance and which variables were most highly related to group membership. For each of the dependent variables, seven post-test measures were included as independent variables: age, knowledge of letter sounds, PPVT-III (std), RAN (std), phonological short-term memory, working memory, and listening comprehension. Group, a categorical variable representing the five study conditions, was included as an independent variable as well. (Categorical variables are included in the analyses as dummy variables representing each of the study conditions.) Six binary logistic models were created in total to explore variables related to responsiveness by benchmark, slope, and dual discrepancy RTI methods for both phonological awareness and word reading. The Wald cut-off score, which determines variables included in the model, was extended to a significance level of $p<.10$ to ensure that all influential variables were included in the final model.

Table 22 reports the discriminant power of the overall model (percent of cases correctly categorized using the derived model), plus predictor variables with their significance and odds multiplier for the phonological awareness and word reading models. Overall, models were more accurate at predicting responsiveness when phonological awareness responsiveness was the dependent variable. RAN was a significant predictor of responsiveness across all models except RTI of word reading as measured by slope.

For models exploring responsiveness in phonological awareness as the outcome variable, RAN was the central predictor of all three models. Working memory was also a significant variable for predicting responsiveness as measured by the benchmark approach.

Table 22. Significant predictors of responsive and non-responsive children

Significant Predictors	% correct	Wald Statistic	Odds Multiplier	P
Phonological Awareness				
RTI by benchmark (phono >30)	44.3			<.001
RAN		6.673	1.274	.010
Phonological working memory		6.402	1.381	.011
RTI by slope (slope >1.5)	57.7			.001
RAN		9.564	1.332	.002
RTI by dual discrepancy	63.9			.002
RAN		8.153	1.306	.004
Word Reading				
RTI by benchmark (word >5)	43.0			<.001
listening comprehension		5.067	1.041	.024
RAN		3.721	1.192	.054
% letter sounds		3.068	1.016	.080
RTI by slope (slope >1)	39.0			.003
listening comprehension		4.738	1.039	.030
% letter sounds		3.943	1.019	.047
RTI by dual discrepancy	43.0			<.001
listening comprehension		5.067	1.041	.024
RAN		3.721	1.192	.054
% letter sounds		3.068	1.016	.080

Several variables were found related to responsiveness as measured by the outcome variable word reading. Listening comprehension and knowledge of letter sounds were significant predictors of responsiveness across all methods. RAN was an important predictor for the benchmark and dual discrepancy models but not the slope approach model. Overall Wald scores for models for the word reading outcome measure were lower than Wald scores

for models examining responsiveness in the phonological awareness measures. This suggests that the word reading predictors are not as strong as the influence of RAN on responsiveness in phonological awareness at this age.

Influence of home environment

Indicators of children's home literacy environment were taken from surveys completed by parents following children's post-test assessments (retrospective data). The literacy activities survey (see Appendix 4) asked questions about the frequency of six home literacy activities as they occurred before the child started school, during the child's kindergarten year, and since the intervention program. Item 2, the frequency of shared reading with a sibling, was not used in the analyses as this item was not applicable to all respondents; not all participants had a sibling.

The remaining five items were grouped to represent three types of home literacy activities. Scores for item one, the frequency of parent-child shared reading, are included in the analysis as the variable 'shared reading'. Items three and four, direct teaching of letter names and sounds, were grouped to form the variable 'teaching letters'. Items five and six which include the frequency of direct teaching of words and word reading were grouped to form the variable 'teaching words'. Scores ranged from 1 (never) to 6 (more than once per day) on a 6 point Likert-type scale. Median scores were calculated to represent the frequency of each activity before the intervention (before school and during kindergarten) and since the intervention (or over the summer for the comparison groups).

A measure of book exposure was included in the post-test assessment battery as a further indicator of literacy experiences in the home environment.[2] Scores represent the

[2] For the 2005 cohort the book exposure task was included in the grade one follow-up; the third assessment for children in that cohort. An independent t-test shows no significant difference of book exposure scores between the 2005 cohort (where book exposure was measured at the end of grade one) and the 2006 cohort

number of actual book titles that children reported reading. The maximum possible score on the book exposure task was twelve.

Table 23 reports median scores for the four home literacy environment measures by group and time – shared reading, teaching letters, teaching words, and book exposure. Median values are reported as the measure of central tendency because the survey responses were ordinal in nature and the distance between reporting categories was not equidistant. Unfortunately, the overall response rate for the parent completed surveys was quite low at 35%. Parents in the low comparison group were least likely to return the parent completed surveys. Children in the low comparison group and the average comparison group were excluded from analyses because of the low sample size (n=8 in each group). The response rate is, however, fairly equal across the intervention groups which permits further analyses; response rate by group is provided in Table 23.

Visual inspection shows that the frequency of home literacy activities was similar for the time periods before school entry and during kindergarten. Before school entry, it appears that parents reported more shared reading and activities related to teaching letters than activities related to teaching words. Following the intervention, parents in all intervention conditions reported high frequency of home literacy activities.

Table 24 reports the inter-correlation between the frequency of home literacy during kindergarten and children's pre-test scores as measured at the end of senior kindergarten. Parent reported shared reading was correlated with scores on the child completed book exposure task. Children's PPVT scores were related to teaching letters and teaching words at home and book exposure. Interestingly, phonological awareness was not related to reported frequency of home literacy activities during kindergarten.

(where book exposure was measured at the beginning of grade one), t (113) = .442, p=656. Mean book exposure for the 2005 cohort was 5.54 and mean book exposure for the 2006 cohort was 5.30.

Table 23. Median frequency of home literacy activities by group

	parent+child (n=23, 41.8%)	parent-only (n=13, 48.1%)	child-only (n=19, 32.8%)	low comparison (n=8, 25.8%)	average comparison (n=8, 50.0%)
Before school entry:					
shared reading	5	4	4	-	-
teaching letters	3.5	3.5	3.5	-	-
teaching words	3	2	2.5	-	-
During kindergarten:					
shared reading	5	5	4	-	-
teaching letters	4	4.5	4.5	-	-
teaching words	4	4	4	-	-
Since intervention:					
shared reading	5	5	4	-	-
teaching letters	5	5	5	-	-
teaching words	5	5	5	-	-

Change in home literacy activities

Analyses of home literacy activities took three directions. First, frequency of home literacy activities were collapsed into three groups (low frequency, medium frequency, and high frequency) to explore patterns in home activities across groups. Second, "change scores" (increased frequency, no change, decreased frequency) were calculated to explore changes in home literacy activities between pre- and post-assessments. Increased frequency of home literacy activities among intervention groups with the parent workshop component could be used as evidence of an effect of the intervention condition. Finally, frequency of home activities were calculated for children categorized as responsive and non-responsive as presented above to explore differences related to children's responsiveness in phonological awareness and word reading.

The frequency of home literacy activities by intervention group are reported in Table 24 and Table 25. Scores were coded into three categories: low frequency (rarely or less than

once per week), medium frequency (two to three times per week), or high frequency (once per week or more). Tables report the percentage of families by condition in each frequency category. Frequencies are reported for home literacy activities before children began kindergarten (labelled before), while children were in senior kindergarten (labelled SK), and since the summer intervention program (labelled summer). Table 24 reports the frequency of activities related to teaching or practicing letter names and sounds. Table 25 reports the frequency of activities related to teaching or practicing word reading.

Visual analysis shows that more parents in the parent-only group reported high frequency of activities related to teaching or practicing letter names and sounds before school entry than children in the parent+child and child-only groups. Similarly, more parents in the parent-only group reported high frequency of letter name and sound activities since the intervention program than parents in the other intervention groups. This pattern is shown also for home activities related to teaching or practicing word reading.

Across intervention groups an interesting pattern emerges. For home activities related to teaching or practicing letter names and sounds (Table 24) the majority of parents, regardless of group, reported medium frequency of activities before kindergarten and during SK. However, parents in all three groups reported a high frequency of home activities related to letter names and sounds after the intervention. For home activities related to teaching or practicing word reading (Table 25) the majority of parents, regardless of group, reported low frequency of activities before kindergarten and medium frequency of activities during SK. Parents in all three groups reported a high frequency of word reading home activities after the intervention. It appears that regardless of intervention condition, parents in all groups increased the frequency of literacy activities in the home while participating in the study.

Table 24. Frequency of home activities related to teaching or practicing letter names and sounds by time period

	parent+child (n=23)			parent-only (n=13)			child-only (n=19)			
	BEFORE	SK	SUMMER	BEFORE	SK	SUMMER	BEFORE	SK	SUMMER	
low	30.43	4.35	4.35	15.38	0.00	0.00	15.79	5.26	10.53	low
med	60.87	56.52	39.13	46.15	53.85	30.77	68.42	47.37	36.84	med
high	8.70	39.13	56.52	38.46	46.15	69.23	15.79	47.37	52.63	high

Table 25. Frequency of home literacy activities related to teaching or practicing word reading by time period

	parent+child (n=23)			parent-only (n=13)			child-only (n=19)			
	BEFORE	SK	SUMMER	BEFORE	SK	SUMMER	BEFORE	SK	SUMMER	
low	47.83	8.70	4.35	58.33	7.69	0.00	52.63	5.26	10.53	low
med	43.48	60.87	43.48	16.67	53.85	30.77	36.84	63.16	36.84	med
high	8.70	30.43	52.17	25.00	38.46	69.23	10.53	31.58	52.63	high

The next step in the analysis of home literacy activities was to explore changes in the frequency of home literacy activities by intervention condition. Families were coded as showing increased frequency of home literacy activities (positive change score), unchanged frequency of home literacy activities, or decreased frequency of home literacy activities (negative change score) based on responses on the six-point Likert-type scale[3]. Table 26 reports the change in home literacy activities related to teaching or practicing letter names/sounds and activities related to teaching or practicing word reading. For each, change is reported between the frequency of activities as reported before kindergarten to during senior kindergarten and between the frequency of activities as reported during senior kindergarten to since the summer program. Increased frequency of activities since the summer program could be used as evidence of the influence of the parent education workshops.

When children were in senior kindergarten, half of families in the parent+child group increased the frequency of activities related to letter names and sounds; about 30% of families in the other intervention groups increased the frequency of letter name/sound activities during this period. Approximately half of parents in all groups increased the frequency of activities related to teaching or practicing word reading skills during this period.

Thirty-one percent of families in the parent-only condition and 22% of families in the parent+child condition increased the frequency of activities related to teaching or practicing letter names and sounds from senior kindergarten to after the summer program. This is compared to 10% of families in the child-only condition who reported increased activities related to letter names/sounds in this period. More parents in the parent-only condition

[3] Families who answered with a score of six, activities occurred more than once per day, for frequency of activities before kindergarten or during SK were not included in this analysis, as increased frequency was not measurable for these families.

reported increased frequency of activities related to teaching or practicing word reading since the summer program (46%) than parents in the parent+child (26%) and child-only groups (26%). Interestingly, several families in the child-only group reported decreased frequency of activities since the summer program; 10% reported decreased activities related to letter names/sounds and 15% reported decreased activities related to word reading.

Table 26. Change in home literacy activities by group (%)

Home literacy activities related to teaching/practicing letter names/sounds

Change in frequency - BEFORE SK and DURING SK

	parent+child	parent	Child	total
decrease	4.35	7.69	0.00	3.64
unchanged	43.48	61.54	63.16	54.55
increase	52.17	30.77	36.84	41.82

Change in frequency - DURING SK and SINCE SK (SUMMER)

	parent+child	parent	Child	total
decrease	4.35	7.69	10.53	7.27
unchanged	73.91	61.54	78.95	72.73
increase	21.74	30.77	10.53	20.00

Home literacy activities related to teaching/practicing word reading

Change in frequency - BEFORE SK and DURING SK

	parent+child	parent	child	total
decrease	0.00	7.69	0.00	1.82
unchanged	52.17	30.77	42.11	43.64
increase	47.83	61.54	57.89	54.55

Change in frequency - DURING SK and SINCE SK (SUMMER)

	parent+child	parent	child	total
decrease	0.00	7.69	15.79	7.27
unchanged	73.91	46.15	57.89	61.82
increase	26.09	46.15	26.32	30.91

Influence of intervention condition: Grade one follow-up

A similar process to that described above was used to examine the influence of intervention condition in a subset of the 2005 cohort who participated in follow-up assessments at the end of grade one. Forty-seven children, representing all thirteen

participating schools, completed follow-up assessments using the full assessment battery in May of the grade one year. Due to a small sample size in the low comparison group (n=3), scores are reported for only children in the intervention groups. Follow-up data were not available for children in the average comparison group because this group was not included until 2006. Table 27 shows pre-, post- and follow-up test scores for children from the 2005 cohort who participated in the follow-up assessments.

A visual inspection shows that children in the parent-only group who participated in the follow-up assessment had higher PPVT and word identification scores at pre-test, and higher phonological awareness and listening comprehension scores at post-test. These are important differences as PPVT, word identification, and listening comprehension are potentially related to growth in phonological awareness and word reading.

Using the same procedure as described above, children were categorized as non-responsive or responsive based on post-test scores at the beginning of grade one and again based on follow-up test scores at the end of grade one. Only children who had initially low scores at pre-test were included in the analyses. As above, low scores were operationalized as scores of less than 30 on phonological awareness and less than 5 on word identification. Only nine children from the parent-only group participated in the follow-up assessment at the end of grade one. Though the sample size is small, this group was included in analyses for this section because it represents an important part of the evaluation of the intervention components. However, results for this group must be interpreted with caution.

Table 27. Pre-, post- and follow-up scores for 2005 follow-up cohort

	parent+child (n=13)			parent-only (n=9)			child-only (n=22)		
	pre	post	follow-up	pre	post	follow-up	pre	post	follow-up
% correct letter names	95.26	93.49	-	90.59	98.42	-	86.35	96.21	-
	9.19	19.31		16.23	3.13		23.01	8.02	
% correct letter sounds	69.21	79.82	93.51	66.66	85.58	94.03	68.52	80.18	86.02
	15.38	19.71	9.47	34.61	16.53	6.95	26.31	20.18	19.33
PPVT - III *	99.77	104.92	100.38	108.78	105.38	102.44	102.77	104.32	101.81
	8.65	13.56	13.23	10.73	12.48	7.67	7.83	10.85	10.39
MAT *	11.85	11.85	12.00	10.89	11.22	13.11	9.73	11.53	12.11
	1.77	3.95	1.41	2.71	1.64	2.03	2.60	2.04	1.68
Phonological awareness	23.62	28.31	38.08	25.78	35.67	45.67	25.00	31.89	41.91
	6.02	8.38	7.22	10.59	7.45	1.80	9.24	9.10	4.92
Word Identification	2.00	6.85	26.54	6.89	13.67	33.89	1.18	9.15	28.15
	1.78	4.14	8.69	8.34	8.82	11.97	1.62	8.27	13.10
listening comprehension *	-	95.31	97.69	-	100.78	103.22	-	96.60	99.61
		15.50	11.50		7.48	12.04		10.43	11.45

phonological memory *	-	7.15	6.69	-	7.11	6.78	-	5.75	6.35
		2.88	2.21		1.90	1.09		1.52	1.54
working memory	-	1.15	0.54	-	1.56	0.67	-	1.35	0.57
		0.80	0.66		0.73	0.50		1.09	0.62
RAN *	-	7.46	8.62	-	9.00	9.44	-	8.50	8.93
		3.20	2.69		3.04	1.94		2.56	2.33

* Table reports standard scores

As described above, children were categorized as responsive in the phonological awareness domain if post-test scores were greater than 30 or they had a slope score of greater than 1.5 (an increase of 1.5 phonological awareness points per month between the intervention and post-test assessments). Children were categorized as responsive in the word reading domain if post-test scores were greater than 5 or they had a slope score of greater than 1.0 (a minimum increase of 1 on the word identification task per month between the intervention and post-test assessments).

After the follow-up assessment at the end of grade one, children were again categorized as responsive or non-responsive. Children were categorized as responsive in the phonological awareness domain if follow-up scores were greater than 40 or they had a slope score of greater than 1.5 (an increase of 1.5 phonological awareness points per month between the post-test and follow-up assessments). Children were categorized as responsive in the word reading domain if post-test scores were greater than 15 or they had a slope score of greater than 2.0 (a minimum increase of 2 on the word identification task per month between the intervention and post-test assessments).[4]

Children's scores were further coded into four categories that described the pattern of responsiveness from post-test through follow-up assessment. Children coded as 'maintainers' were categorized as responsive following the intervention (post-test) and responsive as measured at follow-up. Children labelled 'positive switchers' were initially non-responsive following the intervention (post-test), but scored in the responsive range at follow-up; whereas 'negative switchers' were initially responsive (post-test) but later scored unresponsive at follow-up. Non-responsive coded children were categorized as non-

[4] After the post-test assessment, children were categorized as responsive if slope scores between pre- and post-test was greater than 1.0. Throughout the school year, with ongoing formal instruction in reading, most children showed consistent gains in word reading. A slope score of 2.0 was selected to determine responsiveness after the follow-up assessment to differentiate between children that showed strong versus modest gains in word reading during grade one.

responsive after the intervention and remained in the non-responsive range at follow-up. Results of this coding procedure are summarized in Table 28. In both the phonological awareness and word reading domains, more children were categorized as maintainers under the benchmark method, than using the slope method. This may suggest that the benchmark used for this analysis was too low or that the criteria used to determine responsiveness using the slope method was too high.

Table 29 reports the percent of children by responsiveness category and group for the four outcome variables: responsiveness in the domains of phonological awareness and wording reading by both benchmark and slope. Overall, children in the parent-only group had more positive outcomes, with more children being categorized as maintainers or positive switchers, than the parent+child and child-only groups. This is especially evident under the benchmark method where all of the children in the parent-only group achieved the benchmark in the follow-up assessment. Children in the parent+child group appear to have slightly more positive outcomes than children in the child-only group; more children were in the maintainer or positive switcher categories and fewer children in the negative switcher and non-responsive categories.

Table 28. Responsive and non-responsive categories after pre-, post- and follow-up assessments

Category Name	Status at post-test	Status at follow-up	% Cases by Outcome Variable and RTI Method			
			Phonological awareness		Word Reading	
			benchmark	slope	benchmark	slope
Maintainer	responsive	responsive	28.1 %	21.9 %	54.5 %	27.3 %
Positive Switcher	non-responsive	responsive	25.0 %	25.0 %	24.2 %	27.3 %
Negative Switcher	responsive	non-responsive	12.5 %	34.4 %	9.1 %	21.2 %
Non-responsive	non-responsive	non-responsive	34.4 %	18.8 %	12.1 %	24.2 %

Table 29. Percent of children by responsiveness category by group

Phonological awareness: benchmark (phonological awareness > 40)

	parent+child	parent-only	child-only	total
maintainer	16.67	66.67	21.43	28.13
positive switcher	25.00	33.33	21.43	25.00
negative switcher	16.67	0.00	14.29	12.50
non-responsive	41.67	0.00	42.86	34.38

Phonological awareness: slope (slope > 1.5)

	parent+child	parent-only	child-only	total
maintainer	8.33	50.00	21.43	21.88
positive switcher	33.33	0.00	28.57	25.00
negative switcher	33.33	50.00	28.57	34.38
non-responsive	25.00	0.00	21.43	28.75

Word reading: benchmark (word identification > 15)

	parent+child	parent-only	child-only	total
maintainer	63.64	80.00	41.18	54.55
positive switcher	27.27	20.00	23.53	24.24
negative switcher	0.00	0.00	17.65	9.09
non-responsive	9.09	0.00	17.65	12.12

Word reading: slope (slope > 2)

	parent+child	parent-only	child-only	total
maintainer	18.18	20.00	35.29	27.27
positive switcher	45.45	40.00	11.76	27.27
negative switcher	27.27	20.00	17.65	21.21
non-responsive	9.09	20.00	35.29	24.24

In the previous section, binary logistic regression was used to explore factors related to responsiveness. Due to the small sample size in the follow-up component of the study, logistic regression analysis was not possible. Instead, Table 30 reports the correlation of variables to responsiveness category for each of the four outcome variables. Responsiveness categories were coded so that higher scores were related to more positive outcomes; 4=maintainer, 3=positive switcher, 2=negative switcher, 1=non-responsive. Correlations

were calculated using the Spearman method because the dependent variables, responsiveness category, were ordinal in nature. The Spearman method rank orders interval data, transforming the variable into an ordinal scale for analysis. This process creates only a slight reduction in data precision; for example, the magnitude of differences between numbers 17 and 21 is lost if the values are consecutively ranked. Only variables with significant or marginally significant correlations are shown. The full table of correlations is provided as Appendix 8.

Table 30. Correlation of assessment variables to follow-up responsiveness category

	Phonological Awareness		Word Reading	
	Benchmark	Slope	Benchmark	Slope
Pre-test measures:				
PPVT (std)	0.21	0.48 **	0.25	0.12
% letter sounds	0.36 *	-0.01	0.30 ^{t}	0.28
Word Identification	0.36 *	0.30 ^{t}	0.35 *	0.07
Post-test measures:				
PPVT (std)	0.26	0.31 ^{t}	0.28	0.29
% letter sounds	0.49 **	0.13	0.25	0.20
Phonological awareness	0.51 **	-0.22	0.03	0.30 ^{t}
Word Identification	0.53 **	0.26	0.74 **	0.45 **
Listening comprehension (std)	0.36 *	0.27	0.42 **	0.27
Follow-up measures:				
PPVT (std)	0.20	0.29 ^{t}	0.25	0.09
% letter sounds	0.25	-0.23	0.42 **	0.58 **
Phonological awareness	0.83 **	0.52 **	0.42 *	0.31 ^{t}
Word Identification	0.48 **	0.07	0.71 **	0.82 **
Listening comprehension (std)	0.13	0.35 *	0.23	0.13
Working memory	0.11	0.11	0.39 *	0.28
RAN (std)	0.33 ^{t}	0.14	-0.06	-0.04

** Correlation is significant at p<.01
* Correlation is significant at p<.05
^{t} Correlation is marginally significant at p <.10

The PPVT, knowledge of letter sounds, and word identification variables were the only pre-test measures correlated with responsiveness category after the follow-up

assessment. Post-test and follow-up scores of these variables were also correlated to responsiveness category. Similar to the earlier binary logistic analysis, listening comprehension, measured at post-test and follow-up was related to responsiveness category, although the association changed across assessment periods. This is an interesting, though somewhat unexpected, relationship and may indicate some function of general cognition or comprehension that is related to literacy skills. Unlike earlier analysis that showed a strong association between RAN and response-to-intervention, RAN scores at follow-up were only marginally associated to one of the outcome variables: follow-up responsiveness in phonological awareness under the benchmark method.

Discussion

This section reported many scores, percentages, and analyses so a summary of results is helpful before a discussion of findings. Following the order of results reported above, this section is organized into three parts: influence of intervention condition at post-test, influence of home literacy activities, and influence of intervention condition at grade one follow-up.

Influence of intervention condition

RTI studies typically analyze data by categorizing children into 'responsive' and 'non-responsive' groups based on some criteria. Given the high-risk of lower literacy outcomes for children in these studies, it is expected that only a percentage of children will be categorized as 'responsive'; other children are expected to require on-going support to achieve desired literacy outcomes. The purpose of RTI evaluations is to determine if a greater percentage of children are responsive under different intervention conditions. Without established criteria to determine responsiveness (Torgesen, 1999), researchers are left to set their own criteria. Though always arbitrary in nature, criteria are fair guidelines to determine differences in responsiveness as long as the same criteria are applied to all groups. For this

study, we also used a low comparison group to explore potential differences between intervention conditions and no intervention. Due to the relatively small sample size within groups, marginally significant results are reported as well.

Following the RTI literature, two sets of criteria were used to determine responsiveness: benchmark and slope. Children were categorized as responsive in the phonological awareness domain if they achieved a score of 30 on the composite phonological awareness measure or a slope of 1.5 (between pre- and post-assessments). Children were categorized as responsive in the word reading domain if they achieved a score of 5 on the Woodcock-Johnson Word Identification task or a slope of 1 (between pre- and post-assessments). The benchmarks were arbitrary in nature but influenced by the study sample. In the absence of an age-related norm, the phonological awareness benchmark was based on the mean pre-test phonological awareness score for the average comparison group. The word reading benchmark was based on the age-expected word reading score on the word reading task (Woodcock-Johnson Word Identification).

Using the benchmark score of 30 for phonological awareness, greater percentages of children in the parent+child group and child-only group were responsive than in the low comparison group. Using slope as the criteria for phonological awareness, more children in the parent-only group were responsive than the low comparison group. While more children in the parent+child and child-only groups achieved the benchmark score of 30, a greater percentage of children in the parent-only group showed measureable growth in phonological awareness.

It is important to note that children in the parent-only group had slightly higher word reading scores at pre-test. Though the difference was not statistically significant, visual inspection shows children in this group read almost two words more, on average, than

children in other intervention groups at pre-test. As well, the standard deviation of word reading scores was larger for this group indicating that some children were reading many more words than the group average. It is possible that higher word reading ability of children in the parent-only group was responsible for larger increases in phonological awareness. This would be consistent with the hypothesis that the relationship between phonological awareness and word reading is bi-directional (McBride-Chang, 1995; Perfetti, 1985; Stanovich, 1986; Wagner et al., 1997) which suggests that greater word reading ability may help children 'pick-up' or notice the phonological structure of words more easily.

For the outcome variable word reading, marginally more children in the parent+child and parent-only groups were categorized as responsive using the benchmark method. Under the slope method, a greater percentage of children in the parent+child and child-only group were coded responsive. As described above, children in the parent-only group had marginally higher word reading scores at pre-test. The mean pre-test word reading score for children in the parent-only group was 4.48, compared to 2.56 for children in the parent+child group and 1.93 for children in the child-only group. On average, children in the parent-only group needed to increase less than one word read between pre- and post-test assessments to achieve the benchmark and be categorized as responsive.

Across outcomes, it appears that children in the parent+child group showed the most gains between pre- and post-test assessments. Compared to the low comparison group, more children in the parent+child group were coded responsive for phonological awareness (benchmark method) and word reading (benchmark and slope methods). Children in the child-only group showed gains as well. Compared to the low comparison group, more children in the child-only group were coded responsive for phonological awareness (benchmark method) and word reading (slope method). Significant gains were found for the

parent-only group in phonological awareness (slope method) and word reading (benchmark method), but these findings may be partly explained by the higher average pre-test word reading score for this group. Overall, findings for the parent+child group are the most positive.

We hypothesized that other child characteristics were related to children's responsiveness to the intervention. Analyses showed that RAN was consistently related to responsiveness-to-intervention across all outcomes. Listening comprehension and knowledge of letter sounds was related to responsiveness in the word reading domain across all methods.

RAN was the characteristic related most strongly to responsiveness to intervention. It is commonly interpreted as reflecting the speed with which item names can be retrieved and articulated (Share, 1995; Wagner et al., 1997). In the current study, higher RAN scores were related to more positive outcomes (responsiveness) in both phonological awareness and word reading at post-test. This finding is consistent with the 'double deficit' theory that argues poor readers often experience difficulties in both phonological awareness (phonological processing) and RAN (orthographic processing). It is also consistent with the idea that phonological processing includes three related subprocesses – phonological awareness, phonological recoding in lexical access, and phonological recoding in working memory (Wagner & Torgesen, 1987).

The finding that knowledge of letter sounds was related to responsiveness in word reading is consistent with previous literature as well. Several other studies have found that letter knowledge predicts word reading (see Scarborough [2001] for a meta-analysis).

The third significant finding, that listening comprehension was related to responsiveness in word reading was less expected. Studies often report links between listening comprehension and reading comprehension, but few studies have found a direct

relationship between listening comprehension and word reading. The listening comprehension task used for this study asked children to listen to a sentence or short passage, then provide a single word response that would complete the sentence/passage. Many of the test items were phrased as riddles (A bird flies, a fish ____[swims]). Due to the cognitive component of this task scores may be evidence of a more global cognitive or language delay. Scores could be interpreted as representing general knowledge and/or cognitive ability. Given that children recruited for this study represent the lowest performing children at the end of senior kindergarten, it is reasonable that a small group of participating children have general cognitive delays, often referred to as 'garden variety poor readers' in other reading research. This group of children would likely require on-going support in reading over time.

Influence of home literacy environment

The type and frequency of home literacy activities was measured using a parent-completed survey following children's post-test assessments (retrospective data). The response rate for the parent survey was low, at 35 %; however, response rate was similar across groups permitting further analyses. The frequency of home literacy activities was similar across intervention groups before school entry and during kindergarten. Shared book reading was the most frequent home literacy activity reported by families. This is consistent with current literature that suggests shared reading is strongly related to receptive vocabulary (Fletcher & Reese, 2005; Senechal & LeFevre, 2001, 2002; Whitehurst & Lonigan, 1998) and that shared reading acts indirectly on word reading through its influence on language development.

Analysis of the influence of home literacy activities took two directions. First, the frequency and change in frequency of home literacy activities between groups was considered. Second, analyses examined the relationship between the frequency of home

literacy activities and children's responsiveness to intervention, independent of intervention condition.

Visual inspection showed that more parents in the parent-only group reported increased frequency of home literacy activities following the intervention. More parents in the parent+child group reported increased frequency of letter knowledge related activities than parents in the child-only group. A similar percentage of parents in the parent+child and child-only group reported increases in the frequency of word reading related activities.

The parent+child and parent-only intervention conditions included two parent workshops. The workshops stressed the importance of shared book reading and explained the importance of phonological awareness and letter sound teaching activities to growth in word reading. A simple analysis would expect the frequency of home literacy activities to increase in the parent+child and parent-only groups because these activities were highlighted and stressed during the workshops. More detailed exploration, however, reveals a potential confound in this simple analysis. As part of the camp component of the intervention, parents were encouraged by teachers to engage in shared book reading and poem/rhyme reading activities at home with their children. This means that the importance of home literacy activities was encouraged and highlighted for parents in the child-only group, even though they did not attend the parent workshops.

The frequency of home literacy activities following the intervention may not be a strong measure of change resulting from the parent workshops as parents in all three groups were encouraged to engage in home literacy activities with their children over the summer period. A stronger measure of the influence of the parent workshops would be the quality of parents' home literacy activities. The parent workshops included discussions about choosing appropriate books for children, strategies to engage children in storybook reading and

strategies to teach phonological awareness and word reading skills through storybooks, and tips to teach phonological awareness skills at home. The quality of home literacy activities is difficult to assess using a survey method because it is unlikely that parents could objectively self-report on the quality of these activities. Some data about the quality of home literacy activities was collected through the home visit portion of the project, reported as study three.

Influence of intervention: Grade one follow-up

Building on the analyses that explored the influence of intervention conditions on post-test scores, children were further coded based on assessment at the end of grade one (follow-up). As with the previous analyses, both benchmark and slope criteria were used to determine responsiveness. Children were categorized as responsive in the phonological awareness domain if they achieved a score of 40 on the composite phonological awareness measure at the follow-up assessment or a slope of 1.5 (between post- and follow-up assessments). Children were categorized as responsive in the word reading domain if they achieved a score of 15 on the Woodcock-Johnson Word Identification task or a slope of 2 (between - and follow-up assessments).

Based on responsiveness at the post-test and follow-up assessments, children were sorted into four responsiveness categories: a) 'maintainers' - responsive following the intervention (post-test) and responsive as measured at follow-up, b) 'positive switchers' - initially non-responsive following the intervention (post-test) but in the responsive range at follow-up, c) 'negative switchers' - initially responsive (post-test) but later scored unresponsive at follow-up, d) 'non-responsive' - categorized as non-responsive after the intervention and remained in the non-responsive range at follow-up.

Visual inspection showed that children in the parent-only condition had the most positive outcomes at the end of grade one. All children in the parent-only group achieved the

benchmarks in phonological awareness and word reading at the follow-up assessment, and at least half of the group showed positive outcomes when measuring responsiveness using the slope method. Further exploration, however, shows that the subsample of children from the parent-only group had significantly higher scores in word reading, and to a lesser extent phonological awareness, at pre- and post-test assessments. Children in the parent-only group did not have the same mean pre- and post-test scores as children in the parent+child and child-only intervention conditions and so direct comparisons cannot be made across groups.

There was no difference in the responsiveness of children in the parent+child and child-only groups in the phonological awareness domain. For both groups, approximately 25% of children remained non-responsive under the slope method and 42% of children did not achieve the benchmark for responsiveness at the follow-up assessment.

Children in the parent+child group showed more positive outcomes than children in the child-only group in the word reading domain; more children were categorized as maintainers and positive switchers in the parent+child group and fewer children were categorized as negative switchers and non-responsive.

Children in both the parent+child and child-only condition participated in the two week summer camp program. However, parents of children in the parent+child group also participated in two evening workshops for parents. The workshops included information on home literacy activities that would improve children's reading skills such as strategies to teach phonological word reading skills through storybooks and strategies to teach segmentation and blending phonological awareness skills that would lead to word reading. One hypothesis is that training received during the evening workshops for parents was related to the parent+child group's success in the word reading domain at follow-up.

The sample size of the follow-up assessment limited opportunities for analysis of the influence of child characteristics on responsiveness at the follow-up assessment. Correlations were calculated to explore the relationship between child characteristics and responsiveness categories in phonological awareness (benchmark and slope) and word reading (benchmark and slope). Receptive vocabulary (PPVT), knowledge of letter sounds, listening comprehension, working memory, and RAN were all correlated with responsiveness category at the follow-up assessment.

Receptive vocabulary and knowledge of letter sounds are emergent literacy skills in the continuum of skills that includes phonological awareness and word reading. Research suggests that receptive vocabulary acts indirectly on word reading through phonological awareness and so the finding that vocabulary is related to both early phonological awareness and word reading is consistent with previous literature. A larger vocabulary might drive the development of phonological awareness by causing children to have more differentiated phonological representations (Metsala & Walley, 1998). The important role of letter sound knowledge is consistent with previous literature that shows letter knowledge predicts phonological awareness (Ehri, 2005).

Listening comprehension was a significant predictor of responsiveness in word reading at the post-test assessments. At the follow-up assessments, listening comprehension was related to both phonological awareness and word reading. The relationship between listening comprehension and the dependent variables was less expected than other relationships found in the data. Listening comprehension may influence children's ability to benefit from formal instruction in literacy. The structure of the listening comprehension task may have drawn on general knowledge and reasoning skills. Thus an additional hypothesis is that low listening comprehension is indicative of broader language or cognitive delays. For

this project, teachers referred children who had the poorest literacy skills in their classroom and so it is reasonable that a subset of the sample show overall cognitive delay or a specific language impairment that would also present as delays in emergent literacy skills and other skills like listening comprehension.

RAN and working memory were weakly correlated with responsiveness category at the follow-up assessments. The weak correlation of RAN is surprising given the strong relationship between RAN and outcome variables found using binary logistic regression with the larger sample at post-test. The research literature also supports a strong correlation between RAN and phonological awareness (Vukovic & Siegel, 2006). It is possible that the correlation method obscured the relationship between RAN and the outcome variables.

Research studies support the relationship between working memory and word reading (De Jong, 1998; Passolunghi & Siegel, 2001; Swanson, 2003; Swanson, Howard, & Saez, 2006).

Working memory involves both storage and processing of information. Some researchers suggest that the working memory model of storage and processing better describes early word decoding (Oakhill & Kyle, 2000) and thus would be a good predictor of reading ability. Scores on working memory may be more strongly related to future word reading ability.

Finally, the correlation of follow-up assessment variables revealed a strong relationship between phonological awareness and word reading. Phonological awareness and word reading measures at pre-test, post-test, and follow-up were related to responsiveness category of both phonological awareness and word reading at follow-up. This is consistent with current views of the bi-directional relationship between phonological awareness and word reading (Hogan, Catts, & Little, 2005; McBride-Chang, 1995; Perfetti, 1985; Stanovich, 1986).

Study 3: Case study of 2006 cohort families

Pre- and post-intervention home visits were conducted with a small number of families from the 2006 cohort. This 'case study' approach was used to explore the qualitative impact of the reading intervention program. As well, the method allowed us to gather information about the frequency and quality of parent literacy activities in the home before the intervention and about the changes to home literacy activities after the intervention. The case study method is more appropriate to examine issues of 'quality' because parents may not be able to accurately self-report this kind of data.

Participants

Six families from the 2006 cohort participated in the case studies. Two families participated in the parent-only condition, one family was from the low-achieving comparison group, and one family was from the average-achieving comparison group. Two families were scheduled to participate in the parent+child condition, however, parents in one family did not attend the parent workshops so they were re-categorized into the child-only group. Though all of the families had other children in the household, the case studies focused on the children who were in senior kindergarten at the time of the first visit. Two of the target children were boys; the other four children were girls. Five of the families were headed by a married-couple. The other family was a divorced couple; both the mother and father attended the parent workshops (parent+child condition), however only the mother was interviewed as part of this study.

Procedure

In addition to parents' consent to participate in the intervention program, a second section of the consent form for the 2006 cohort asked parents to consent to a pre- and post-home visit. Parents could consent to participate in the intervention but choose not to

participate in the home visit portion of the study without penalty. Ten families were randomly selected from consenting families to participate in the pre- and post-intervention home visits. Six families, representing each of the different groups in the study, participated in the post-intervention home visit. Only the six families who participated in both the pre- and post-home visits are included in the analyses.

The pre-intervention home visit occurred at the end of children's senior kindergarten year. The researcher visited the home, at a time arranged by the parent, when both the child and the parent who most often engaged in shared book reading, were available. During the home visit, parents were videotaped while they engaged with the child in a joint-storybook reading task and a letter sound teaching task (sounding out a list of rhyming words). After the videotaped activities the researcher interviewed the parent about the home literacy environment. Items were drawn from the Learning Stimulation subscale of the Home Observation for Measurement of the Environment tool – Early Childhood version (HOME-EC; Caldwell & Bradley, 1984) and from the Home Literacy Environment Survey used in a study by Leseman and DeJong (1998). (See Appendix 9 for the home visit interview protocol.) The home visit took approximately 45 – 60 minutes to complete for each family.

After children's post-test assessments were completed, the researcher conducted the post-intervention visit with six, of the initial ten, families. The post-intervention home visit was less formally structured. The researcher asked questions related to changes in parents' home literacy activities or practices, changes in children's reading and phonological awareness skills over the summer, and general impressions of the intervention program (for families in the intervention conditions). Transcripts of pre- and post-intervention visits were created from video recordings; Interviewer field notes were used to augment the transcripts.

A description of each of the six case study families follows. All of the participating parents were mothers. Children's first names are used in each case. Throughout, 'mom' is used to refer to the child's mother. Quotations were drawn from transcripts of video-taped activities during the home visit. Additional information reported is taken from interviewer field notes.

Description of cases

Case 1: Brian – Age 5 years, 5 months; Average comparison group

Brian lives with his parents and older sister in a semi-detached house situated in an older subdivision. When I arrived, mom answered the door then asked Brian to show me into the living room. It was easy to see that Brian and his mom have a loving, playful relationship – they quickly settled down next to each other on the couch for the book reading task. Brian was familiar with the 'In My Backyard' story that I had brought, so he asked if he could read his new Shaggy and Scooby book instead.

It was clear from the beginning that Brian was expected to do the reading; he held the book and turned the pages, while mom looked over his shoulder. Brian read most of the words easily. When he came to a word he didn't know, mom would start sounding it out very slowly, until Brian recognized and read the word. When he read a whole sentence or sounded out a difficult word, mom would praise him with 'good boy'. Beyond the occasional help in decoding words, mom made very few comments during the book reading except near the end when she said 'only a few more pages, almost done'. At the end of the book, mom said 'good boy' and gave him a high-five.

Though Brian could read most of the words, it wasn't clear whether he understood the story. It seemed like all of his attention was directed at reading the words and so he couldn't attend to the story comprehension. He also struggled with correct intonation in sentences (i.e.

when it was a question). Other comments by mom suggest that storybook reading is just a task that Brian is expected to complete, for example he was told that he had to read this book before he could watch his movie and mom said they worked on reading every night whether Brian wanted to or not.

In the word reading task, Mom provided lots of help. For each word, mom asked him to make the sound of the initial letter. Then Brian would read the word.

Mom – 'Pronounce your 'h'.'
Brian – 'h-h-h'
Mom – 'Good.'
Brian – 'hat'

This pattern continued for the words hat, mat, bat, and cat. On the second page, mom made the sound of the initial letter then Brian would say the word.

Mom – 'f-f-f'
Brian – 'fat'
Mom – 's-s-s'
Brian – 'sat'
Mom – 'p-p'
Brian – 'pat'
Mom – 'v-v-v'
Brian – 'vat'

It was unclear why Mom would want to help Brian read the simple '–at' family words when he was expected to read the Shaggy and Scooby book with very little help.

Brian remained beside his mom on the couch while we talked about literacy experiences in the home. They receive a daily newspaper at the house, but no adult reading materials were visible in the family room (i.e. books, newspapers, magazines, etc.). She estimated that they have over 200 children's books; some were visible in the family room but I was told most of the books were kept upstairs in the kids' rooms. Mom has read to Brian nightly since he was a toddler. About six months ago, Brian started doing most of the 'reading' during these shared book experiences. Before school started, Mom was teaching

Brian about numbers, letters, and letter sounds. Since Brian started JK, they have been doing letter and word games, and flashcards. Mom talked about how Brian receives a weekly word list from his teacher. They use the computer to make flashcards of the words on the list. Mom said she likes using flashcards because it helps Brian memorize the word and 'memorizing is a big part of reading.' When Brian struggles with a word, mom said she helps him 'break the word down into segments'.

The family is very active and they do many activities together. They often go to the park or skating at the arena, and once a month they go to the movies together. Brian plays on a hockey team and the family often goes to watch his games. In the home, mom reports that the tv is 'always' on except when the kids are doing homework. Brian also likes to play video games.

At the follow-up visit, Brian said he was enjoying grade one. Mom said his teacher had commented positively about his eagerness to participate in class, but she said he was having a hard time going to school everyday after attending a full-day, every other day kindergarten.

Over the summer they had cut back on Brian's reading practice. Once a week, they would do a review using phonics books and during shared book reading, mom would read the text and Brian would follow along. Mom said that that kids 'need a break' from the school work sometimes and that the summer is supposed to be fun.

Mom said she likes to keep the kids busy so they don't get into trouble. She commented that Brian is a bit lazy and a 'bit of a trouble maker because he's a boy.' She is strict with Brian about his homework and his behaviour because she doesn't want her son to be a 'bad apple'.

Case 2: Alexis – Age 5 years, 5 months; Low comparison group

Alexis lives with her parents and younger brother in a newer house in a neighbourhood on the outskirts of Stratford. Alexis' father works at a nearby factory and mom works part-time in the town. Alexis and her parents were invited to participate in the parent+child condition of the intervention but they declined the invitation because the second week of the child camp coincided with the annual factory shut down and her father's first week of summer holidays. Her parents wanted Alexis to be home when her father was on his summer holidays.

At the first visit, Alexis' father was at work and her younger brother was playing at a neighbours' house. Alexis answered the door; seeming very happy and excited to have a visitor. She watched intently as I set up the video camera and then took a spot on the couch beside her mother for the storybook reading activity.

Alexis was attentive while her mom read the storybook; her eyes were glancing over the pictures on each page. Mom was expressive during her book reading, however, her expressions were over-exaggerated and had the effect of appearing fake. Her mom asked occasional questions about the story content and about the storyline inferences but Alexis almost always answered with 'I don't know'; after a brief pause mom would answer the question.

Mom – "What do you think it's about?"
Alexis – "I don't know"
Mom – "A boy and his dog?"

Mom – "Why do you think mom said to get rid of him?"
Alexis – "I don't know"
Mom – "Maybe it's because she doesn't like frogs."

Mom occasionally asked Alexis to read a word from the story, but Alexis either said 'I don't know' or just looked up at her mom with a questioning expression. Halfway through the book, mom seemed to get frustrated with Alexis. Alexis too was becoming frustrated; she

glanced at the video camera and made a move like she was going to get up from the couch but mom grabbed her arm and said she had to finish the book before she could leave the couch. Mom sped through the last few pages of the book and though this part of the story featured a series of rhyming words, the fact that the words rhymed wasn't mentioned. After finishing the story, mom was going to flip through the book to do some word decoding but Alexis said she didn't want to. At this point, Alexis again started to get up from the couch; mom looked at me and said "she has a short attention span".

For the word reading task, Alexis and her mom moved to the dining table because that is where she usually does home work. Alexis read the word 'cat' immediately but struggled with the next five words. There was very little praise on occasions when Alexis did read a word correctly. When providing decoding support, mom first asked Alexis to identify the initial sound and then the final sound, followed by the vowel sound. Mom didn't tell Alexis that all of the words on the list rhymed or point out that all of the 'at' word endings would sound the same. Alexis noticed that they were all rhyming words on word five.

Mom – 'what sound is this one?' (pointing at the letter m)
Alexis – 'I don't know, I only know cat.'
Mom – 'Ok, now look at the word beneath it. What sound is that?' (pointing at the letter m)
Alexis – 'I don't know.'
Mom – 'You have to concentrate.'
[Alexis' affect changes from cheery and playful to somber; she sits back in her chair and crosses her arms.]
Mom – 'You can do this.'
[Mom pulls Alexis' chair closer to the dining table.]
Mom – 'What sound is this?' (pointing at the letter m)
Alexis – 'mmmm'
Mom – 'mmmm'
Alexis – 'my?'
Mom – 'Nope. What's the last letter?' (pointing to the 't')
Alexis – 't'
Mom – 'Right, so… mmmm…. t,t,t'
Alexis – 'mmmm…. t,t,t… mitt?'
Mom – 'What's the middle sound?'
Alexis – 'mitten?'
Mom – 'No, what's the middle sound? (pause) a, a, a (pause) so, mmm…a,a,a….t,t,t'

Alexis – 'mat?'
Mom – 'Ok, what's this sound?' (pointing to initial letter in next word)

After Alexis and her mom completed the two tasks, I sat with mom at the dining table to talk. Alexis stayed nearby and occasionally spoke to her mom, but her mom rarely acknowledged Alexis' contribution to the conversation; she would just stop talking while Alexis spoke and then continue speaking to me once Alexis was finished. Alexis' parents do not receive a newspaper but they do receive one magazine. Alexis' mom said that they owned many children's books but none were visible in the family room area. Mom reads a book to Alexis every night at bedtime (Alexis' dad is rarely home at night so mom does most of the book reading with kids) but rarely engages with her children in shared reading other times during the day. Alexis is supposed to work on a sound book from school in the evenings but mom said Alexis doesn't like the book and that she has a hard time getting her to work on it.

Alexis enjoys crafts and puzzles, and particularly enjoys copying written text. She also owns a 'leap pad' and a Barbie computer upon which she can play games with letters, numbers, and colours. The family used to take regular trips to the library but this happens less often now that Alexis is in school. Mom mentioned that alone time with Alexis, for playing games and reading books, is more difficult now that Alexis' younger brother is more active.

When I returned for the follow-up visit in September, Alexis' brother and father were home but they went downstairs while I was visiting. Over the summer the family had gone fishing, visited Storybook Gardens, and had hiked through a cave. Alexis was eager to tell me all about her summer activities. In Alexis' family, the summer is about having fun and enjoying the summer weather, so mom doesn't 'make' the kids do phonics or other 'school stuff' over the summer break. Mom did start a review of letter sounds with Alexis while they were at the cottage, but they lost the book after the first couple of days so the practice stopped.

In grade one Alexis was placed in the school-based reading intervention program. Alexis, with six other students from her class, is taken out of regular classes (missing either French or Math) one hour each day from September to January. Alexis' mom was concerned about how children were chosen for the intervention, suggesting that children weren't tested and that the parents don't think they picked the 'lowest kids'. Alexis' mom said the reading intervention teacher is against sounding out words, and that she encourages them to look at the picture to help them figure out the word. For the reading intervention, Alexis is expected to read one book at home every night, in addition to the book that she is expected to read for her regular grade one class.

Alexis' mom was concerned that the school wasn't helping Alexis learn. She said that Alexis, and many other kids in her class, didn't like the senior kindergarten teacher. She didn't feel like Alexis progressed in her reading in kindergarten and that Alexis was afraid of what school would be like in grade one. In addition, she was concerned that taking Alexis out of math class for the reading intervention would cause Alexis to fall behind in math class. Alexis' mom was planning on talking with the school principal to learn more about the school reading intervention and why Alexis had been chosen to participate in the program.

Case 3: Nathan – Age 5 years, 6 months; Parent-only

Nathan lives in the country on a farm with his parents and three sisters. When I arrived for the home visit, dad was outside with the two younger girls. He was getting ready to take them over to the barn for the afternoon. The older sister was at school. Both mom and Nathan seemed shy so we spent some time talking about a recent local event before they began the book reading activity.

During the shared reading, Nathan sat very close to his mom, with his head leaning against her shoulder. Mom read most of the story text, using lots of expression. She talked in

a quiet voice, almost a whisper in parts, but loud enough for Nathan to hear, creating a very intimate experience between the two of them. Mom made an attempt to get Nathan involved in the book reading at the beginning of the story.

Mom – 'what's this word?'
Nathan – (shakes his head)
Mom – 'do you want to sound it out?'
Nathan – (shakes his head)
Mom – 'what's this letter?'
Nathan – 'I'
Mom – 'yes, that's the word 'I''

From then on, mom asked Nathan to read the word 'I' whenever it appeared in the text. At first, she would need to prompt him to say the word, 'what's this', but later she would just pause and point to the word as a cue. This activity required Nathan to follow along with the text so he knew when to read the 'I' word. Both mom and Nathan asked questions of each other during the story.

Nathan – 'how come "get rid of him"?'
Mom – 'because he's messy'

Mom – 'what do you think is going to happen?'
Nathan – 'I don't know.'
Mom – 'I bet you grampa gets scared. Let's see.' (as she turns the page)

Mom also made comments describing the pictures – 'he's jumping on the computer'. When she made descriptive comments, she paused before turning the page to give Nathan time to examine the picture.

During the word reading task, mom helped Nathan sound out each letter in the word and then encouraged him to blend the sounds together.

Mom – 'do you know what this is?'
Nathan – '|c| - |a| - |t|' (as mom points to different letters)
Mom – 'now put them all together'
Nathan – 'cat'
Mom – 'good one, now what about this one?'
Nathan – (looks at mom questioningly)

Mom – 'what letter is that?' (pointing at 'h')
Nathan – 'h'
Mom – 'do you know what sound 'h' makes?'
Nathan – '|h|'
Mom – 'good, now stretch it out'
Nathan – '|h| - |a| - |t|' (pause, Nathan whispers a word but not discernible)
Mom – 'no, remember this is |h|'
Nathan – (looks at mom questioningly)
Mom – 'what was this word?' (pointing at cat)
Nathan – 'cat'
Mom – 'good, and this one?' (pointing at hat)
Nathan – 'hat'
Mom – 'good'

Though mom never explicitly says that the words all rhyme or that they would sound the same at the end, she often pointed to the same '–at' ending of the words and directed Nathan to refer to the previous word in the list to show that they were the same. Once Nathan decoded all of the words on page one, mom asked him to read them all again. The same process was used for the second page of words.

During the interview portion of the home visit, I learned that the family does not watch television. They use the tv only to watch a Disney movie on Friday or Saturday night, and occasionally to watch children's movies when it is raining outside. Inside, the children spend time doing crafts like painting, drawing, and gluing. Nathan likes to 'write' on paper; mom notes that at first it was a lot of scribbles but he is starting to write letters now. The family spends most of their time outside. In the summer they often go on trips to local attractions (e.g. Storybook Gardens, African Lion Safari, and Toronto Zoo), day trips to the nearby beach, or vacations to a lakeside cottage.

The family receives a local newspaper and adult magazines. Several children's books and adult books were visible in the family room. Mom reads books with the children almost every day. The girls have started to look at books independently, but Nathan still only reads when he is with a parent. Mom said that Nathan was slow to get interested in books and

letters. He also went through a two year period, from 1 ½ to almost 4 years of age, when he rarely spoke. Mom said she was concerned about this but didn't seek professional help because she thought he would grow out of it.

When I returned for the follow-up visit in the fall, I found Nathan and two of his younger sisters doing exercises in workbooks at the kitchen table. One girl (3 years old) was doing a worksheet where she was tracing a dotted line to learn how to print letters. Nathan's other sister (4 ½ years old) was doing a worksheet where she matched a picture to the pictures initial letter (i.e. picture of house, so draw line to letter 'h'). Nathan was doing a worksheet where he circled all of the pictures on the page that started with a target letter (i.e. circle all pictures that start with the letter 's').

Mom says that since participating in the summer parent workshops, the kids do more literacy activities at home. Nathan's grade one teacher gives him five books each Monday. Mom reads one of the books with the kids each night then they return them to the school the following week. The grade one teacher also gives out 'word boxes' that contain eight, three letter words that Nathan and his mom practice sounding out. In addition, each night after dinner, the kids can colour or write in the workbooks that mom found at the local bookstore. At the mention of the workbooks, the oldest girl got up from the table and opened a drawer in the desk to show me all of the workbooks from which they can choose.

Nathan has become more interested in reading and writing. When I was visiting, he showed me a notebook in which he had written his name and many other words. This notebook was full and he was waiting for his mom to get him another one. Mom says that Nathan is a 'stubborn guy sometimes' and that sometimes he just won't do an activity. Now when this happens, she will shorten the homework or go on to a new activity so that he doesn't become frustrated. His grade one teacher has told mom that homework should be no

longer than 10 – 15 minutes; if Nathan doesn't get all of the work done in that time then they should come back to it the next day. Mom has had some feedback from the teacher by way of notes in the spelling book but she would like more feedback about Nathan's progress. She is eager to learn how to do more work with the kids at home and had signed up for several parent workshops at the nearby Ontario Early Years Centre to get more tips on how to help her kids with their learning.

Case 4: Emily – Age 5 years, 9 months; Parent-only

Emily lives in a small town outside of Stratford with her parents and older brother. Both mom and dad were home when I arrived for the home visit. Mom participated with Emily in both the shared book reading and word reading tasks, but dad stood watching nearby.

For the shared book reading task, mom and Emily sat together on the couch. Looking at the cover of the book, mom said 'what do you think it's about', but didn't wait for a response from Emily. Throughout the book, mom quickly read the text while Emily followed along. She was paying close attention to the story and examining the picture on each page. Mom didn't ask any questions about the story or the words on the page while reading but did make occasional comments about the storyline – 'it's kind of like papa Jim, falling asleep' and 'he has a lot of stuff'. At one point she also commented about the rhyme between two words 'they rhyme huh?', to which Emily replied 'ya, dog and frog'.

At the beginning of the word reading task, mom pointed out that all of the words ended with '–at' and she said 'I think they all rhyme'. Emily read 'cat' and 'hat' easily but seemed to struggle with the other words. During this task, mom used two techniques to help Emily: she helped Emily identify the initial sound and reminded her that the words all ended in the 'at' sound.

Mom – 'what's that one?' (pointing to the next word)
Emily – 'dog?' (looking at mom questioningly)
Mom – 'look at the letters'
Emily – 'bat?'
Mom – 'yes, and this one starts with?'
Emily – 'mmmm'
Mom – 'and?' (pointing to 'at' part of word)
Emily – 'mat?'

Mom – 'what's that sound, 'f'?' (pointing to letter 'f')
Emily – 'ffff'
Mom – 'ok, so adding –at'
Emily – 'fat'
Mom – 'and the next one'
Emily – 'sssss'
Mom – 'if that's an 'ssss' sound then what's the word? If it rhymes with fat but it starts with 'sss'?'
Emily – 'sat'

After the two reading tasks, dad joined mom and Emily on the couch to talk about the literacy activities in the home. They reported that there are approximately 75 children's books in the home, mostly hand-me-down books from Emily's older brother. The family receives a weekly newspaper and several adult magazines but these were not visible during the visit.

Though they would like to do more literacy activities with Emily, or learning activities in general, Emily's parents find it very difficult to fit those activities into their daily routine. They report that they don't read books with Emily on a regular basis and rarely have time to sit with Emily as she completes her homework.

Emily's parents were aware that she was showing signs of a reading delay. Her brother had been previously diagnosed with a learning disability and so they had been monitoring Emily's progress at school closely. Earlier in the senior kindergarten year, Emily's teacher had told her parents that she was falling behind and could use some extra help at home. Without the time to work with Emily themselves, her parents hired a tutor to

work with Emily twice per week. The tutor will continue working with Emily once per week over the summer.

At the post-intervention visit, I found the family still settling into their new home. Emily's parents had both attended the two parent workshops about shared book reading and phonological awareness activities to support Emily's reading development. They reported that they enjoyed the workshop sessions, particularly examples about how to bring literacy instruction into daily activities. Though the frequency of literacy activities in the home has increased since the workshops, they were still struggling to fit literacy activities into the family's daily routine.

Case 5: Becky – Age 6 years, 9 months; Parent+Child

Becky is a very shy girl who lives with her mother and older sister in an older, established subdivision in Stratford. Becky's parents are divorced and her dad lives in a small town nearby. She and her sister spend every other weekend plus one day a week with their dad. Becky is one year older than the other children in the study because her mom started her in junior kindergarten one year after she was eligible to attend.

Becky and her mother sat on the couch, side-by-side, for the storybook reading activity. At the beginning, Becky was reading most of the words. For difficult words, mom would simply read the word when Becky couldn't read it. For words that Becky might be able to decode or figure out herself, mom provided several different types of cues.

Mom – 'this is a big word but it is actually two words put together. See 'back' and 'yard'. (pointing to each part of the word). So the word is 'backyard'.
Becky – 'backyard'

Mom – 'this word is something that you might find in daddy's backyard. I see it in the picture.
It's green.'
Becky – 'frog'

Mom – 'let's look at the picture. What do you see here?'

Becky – 'a dad'
Mom – 'Let's see what happens to him.' (turning the page)

This style of reading was likely normal for Becky and her mom, because when Becky didn't know the word, she glanced at her mom for a cue. On words where mom helped Becky sound out and decode the word, mom would repeat the word then read the full sentence to reinforce and help with comprehension. If Becky struggled with several words at the start of a sentence, mom would take over and read the full sentence. About halfway through the book, Becky started to become frustrated. Mom said 'how about I read this page and then you read the next one.' Looking at me, mom said 'this book is longer than the stories we usually read.' Becky read one more sentence from this point, then mom finished reading the rest of the pages.

At the start of the word reading task, mom noted 'these are all rhyming words'. Becky read the first word without any problems, but was reluctant to continue. First, she buried her head in mom's lap then she sat up and started rocking back and forth. Becky was clearly guessing at the remaining words, and mom was frustrated by the end of the task. Despite this, she kept working with Becky through the word list, continuing to reinforce that the words rhymed.

Mom – 'ok, the ones on this page are all rhyming words too. I'll help you. The first one is fat.'
Becky – (laughs)
Mom – 'the second one rhymes with 'fat' but it starts with the snake sound.'
Becky – 'slither' (then laughs)
Mom – 'no they rhyme. Ok, I'll do them. 'Fat' and then 'sat'. Those rhyme right? Fat – sat.'
Becky – 'No!'
Mom – 'yes they do. Fat – sat.' (pause) 'Now this one rhymes too but it starts with |p|.'
Becky – 'pin!'
Mom – 'How about 'pat'.'
Becky – 'pat'
Mom – 'Now we have fat, sat, pat… What about this one with the 'v'?'
Becky – 'vine?'
Mom – 'But these ones rhyme because they have the same ending sound right? So it must be fat,

sat, pat, and (pause) vat.'

Though Becky was laughing and participating with mom during the two reading activities, she quickly became shy and quiet once I sat down for the interview. Mom said they read one or two books together every night and that Becky now expects reading before bed. She has 75 – 100 books, mostly hand-me-downs from her older sister. Occasionally they get new books to read from the library. Becky will 'play' with books on her own, mostly in the car, but mom said 'she's not really reading them'. Mom receives a local newspaper and several adult magazines, but these were not visible in the family room.

At home Becky enjoys computer games and crafts; drawing pictures and especially 'cutting and pasting'. She takes dance lessons (jazz and tap), plays baseball, and takes swimming lessons. As a preschooler, she participated in a 'Kindermusic' program.

Becky has a severe articulation disorder and has been seeing a speech therapist for more than two years. Mom chose to send Becky to a licensed child care centre instead of junior kindergarten in part because of her speech problems but also because of her maturity. She felt that Becky would benefit from the peer interaction at the child care centre and from the extra time to improve her speech before starting school. When she started school, Becky began in an SK classroom. At the end of the year, mom asked that Becky be kept back for a second year of SK because she felt it was important that Becky develop basic skills and improve her speech in SK before being promoted to grade one. The school refused but mom was encouraged by her siblings (one a school principal, and two others teachers) to stay firm on Becky repeating SK, and the school finally agreed. Mom feels it was a good decision for Becky to repeat SK and thinks she is now more ready for grade one.

In addition to the homework she gets from her kindergarten teacher, the speech therapist assigns a number of activities each week to practice pronouncing sounds. Mom

thinks that some of this practice has helped Becky learn the letter names and sounds. Mom also noted that Becky must be in the right 'frame of mind' to do homework and reading at home. Becky sometimes has trouble concentrating and can be very stubborn when she doesn't want to do something. She can be difficult to work with because sometimes an activity is interesting to her and then the next time she'll refuse to do it.

Over the summer, Becky and her parents participated in the summer intervention. Becky attended the two week summer camp and both of her parents attended the evening workshops. Mom reported a significant change in Becky's skills over the program and saw a dramatic increase in her confidence. Mom said she enjoyed the tips about storybook reading that she learned in the workshops, but reported that phonological awareness activities have been more difficult to implement at home. Over the summer, they continued to do shared storybook reading every night and Becky continued to see her speech therapist.

Becky also went camping over the summer with her dad and older sister. In addition, they took several day trips including African Lion Safari, Marineland, and the beach.

Mom reported that Becky was enjoying grade one. At the end of SK, her teacher gave her the 'courage award' for not being intimidated by her speech impediment. Her classmates in grade one seem to be welcoming and the teacher hasn't made any comments about teasing from the other students. They have recently found out that there is no physical problem with Becky's throat or mouth so there is an opportunity for her to acquire perfect pronunciation. Her speech is improving but she still struggles with 'throaty sounds' like 'g' and 'k'.

Mom says Becky seems confident with her achievement at school but she becomes discouraged if she does poorly on an assignment or spelling test. Becky seems to be having trouble particularly with spelling and the teacher has sent a note home asking them to do extra work with Becky at home. Each week they get a word list that Becky writes out in a

notebook. Once a week they do a dictation 'test' at home and then Becky does extra practice on the words she gets wrong. They also do a word of the day; each day Becky writes out the new word five times then writes a sentence using the word. Becky's stubbornness can be a problem sometimes, and there are days when she will 'absolutely refuse' to do her spelling work, but mom says they'll just 'stick with it'.

Case 6: Mary – Age 5 years, 9 months; Parent+Child

Mary is the youngest of four children. She has an older sister in grade three and two teenage brothers. She moved from Cambridge with her parents one year ago. The family lives in a newer house in a quiet subdivision of a small town outside of Stratford. When I arrived for the home visit, Mary and mom were both waiting in the family room.

For the storybook reading activity, mom and Mary sat together on the couch; Mary was holding the book and mom had her arm around her. From the inside page, mom read the title, illustrator, and acknowledgements. When the story started mom would read a phrase then Mary would repeat mimicking mom's expressions. Mary would turn the page once she was finished looking at the picture. Mom occasionally made comments about the story or pictures ('the dog has a pet cat') but she didn't ask Mary any questions.

At the beginning of the word reading task, mom noted that all of the words rhymed and she pointed to the '–at' ending of each word. Throughout the activity, like in the shared reading task, mom would often read the word and Mary would repeat. At the end of the task, mom read through all of the words quickly.

Mary – 'hat'
Mom – 'yes'
Mary – 'mug?'
Mom – 'mat'
Mary – 'mat'
Mom – '|v| - |v|'
Mary – '|v|'
Mom – 'vat'

Mary – 'vat'
Mom – 'and the 's'?'
Mary – 'sac?'
Mom – 'at' (pointing to the –at ending)
Mary – 'at'
Mom – 'sat'
Mary – 'sat'

During the interview, I learned that mom had worked at the Ontario Early Years Centre in Cambridge before the family moved. Mary often went to the Early Years Centre when she was younger. Mom believes that Mary has regressed in the last year and that perhaps she is having some trouble with the move. Mom also has concerns about Mary's new school, questioning the ratio of JK's in the JK/SK split class and has concerns about the lack of involvement of local parents in the school.

The family does not receive a newspaper or magazines, and there were no adult books visible in the room. They have approximately 125 children's books, mostly in Mary's bedroom, and mom reads with Mary 'a couple minutes most days' during the school year. Mary regularly looks at the books independently.

At home, Mary enjoys crafts like painting, colouring, and paper maché. Mom reported that the family spends a lot of time watching tv and playing video games, but noted that Mary also enjoys board games and playing outside. She did not report that the tv time or video games were educational in nature. In the past, Mary has taken violin lessons, guitar lessons, and swimming lessons. In the summer this year, she will be playing on a soccer team. Each summer the family also vacations for two weeks at a family cottage in northern Quebec.

After the summer, at the follow-up visit, the family was still adjusting to the move from Cambridge. In their new house, they are closer to dad's work but mom is missing her friends and neighbours in the old neighbourhood. Dad enjoys the rural life and thinks it is

good for the kids; the family enjoys the parks and quaint downtown of the new community, but admits they are feeling more isolated now that they live outside of a city.

Over the summer, the family spent two weeks at the cottage in Quebec. Over the two weeks, Mary and her dad read a long children's book with several chapters, but she didn't do much reading the rest of the summer. Mary played soccer, the children did lots of crafts, and the family spent a lot of time outside. Mary said she is planning to resume her music lessons next month.

Mary participated in the child component of the intervention (two week camp for kids) but her parents were unable to attend the evening parent workshops. For the first workshop, mom had to work at her part-time retail job and dad decided not to go after a full day of work; for the second workshop both parents attended their older daughter's baseball game instead of going to the parent workshop. Mary said the camp was fun and that she made new friends. She liked the books that we gave out and had already filled up the notebook that she got at the end of the camp. Mom said she thought that Mary had fun at the children's camp but that she herself didn't know much about the activities that happened during the camp day.

Mary is enjoying her new grade one teacher. She has several friends in her class and doesn't find the work 'too hard'. The teacher gives out homework some nights but not as much as the senior kindergarten teacher. Mary was eager to show me some printing that she had been working on the previous week and she recited a poem that she had learned the first week of class. Mom and dad have had good feedback from the teacher about Mary's progress so far in grade one. The teacher says she has a good attitude and her reading is getting better.

Children's Scores

Pre- and post-test scores for children in the case studies are provided in Table 31. Mary, who was identified to participate in the parent+child condition, later re-categorized as

child-only condition, had a pre-test phonological score of 33, greater than the mean score of the average comparison group and the cut-off score used for analysis of RTI. Mary's word reading scores are low (pre-test word reading = 1, post-test word reading = 2) but she showed above average scores in letter knowledge (name and sound), PPVT, and phonological awareness. She should not have been referred by her senior kindergarten teacher for the intervention program.

Table 31. Pre- and post-test scores of children in case studies

	letter name		letter sound		PPVT (std)		phonological awareness		word reading	
	pre	post	pre	post	pre	post	pre	post	pre	post
Brian (average comparison)	96.2	92.3	84.6	92.3	106	104	15	30	1	5
Alexis (low comparison)	92.3	92.3	76.9	96.2	111	97	26	26	3	2
Nathan (parent-only)	84.6	84.6	61.5	84.6	102	99	16	22	1	1
Emily (parent-only)	73.1	100	76.9	84.6	88	85	16	16	2	1
Becky (parent+ child)	84.6	92.3	76.9	88.5	90	84	20	23	2	4
Mary (child-only)	100	100	61.5	100	113	119	33	42	1	2

Several children show a decline in standard PPVT scores between pre- and post-assessments. This indicates that receptive vocabulary did not increase at a rate expected over the summer period. Standardized scores are calculated by examining children's raw score on the test with age-expected scores. As children age, the same raw score will provide declining standard scores over time.

According to the methods used to determine response-to-intervention in study two, only Brian would be categorized as responsive. Brian participated in the study as part of the average comparison group because his teacher identified him as average achieving in emergent literacy skills. Despite the teacher's observations, Brian's pre-test phonological awareness and word reading scores were low. However, he achieved the benchmark scores in both phonological awareness and word reading at the post-test. Mary, participating in the child-only group, would not have been included in the analysis of phonological awareness RTI because her pre-test score was greater than 30. None of the other children had post-test scores that achieved the benchmark scores (phonological awareness score of 30, word reading score of 5) or showed significant growth in the two outcome variables (slope).

Cross-case comparisons

High quality parent-child shared reading activities are characterized by active dialogue about the pictures, characters, and storyline of the book and the links between the story and the child's experience (Reese & Cox, 1999; Reese, Cox, Harte, & McAnally, 2003; Whitehurst et al., 1998). For literacy instruction, shared book reading is also an opportunity to highlight word structure and to practice decoding of simple words. Across cases, there were large differences in the amount and type of dialogue between parents and children during the shared reading activity.

Brian and Becky both took primary roles during the book reading activity. Brian chose to read a much more difficult 'Scooby-Doo' book rather than the storybook that was intended for the activity. His mother's only comments were word corrections or help sounding out a word that Brian couldn't read. Becky read most of the storybook text in the shared reading activity with her mother. When Becky did not know a word her mom would provide word hints. Two types of word hints were used, a) picture clues – 'I see it in the

picture. It is green.' or b) word structure clues – 'This is a big word but it is actually two words put together. See 'back' and 'yard'. Neither parent asked questions about the book's pictures, characters, or storyline. There were no comments or questions during the shared reading activity between Mary and her mother either; Mary's mom read each sentence then Mary would simply repeat it. There was limited extra-text talk in these parent-child dyads.

To varying degrees, Emily, Alexis, and Nathan's mothers included more traditional book reading comments and questions. Emily's mom made only three comments about the book; one to point out a rhyming pair, and two comments about the story. Emily was not expected to reply to these comments. Alexis' mother asked several questions during the book reading. Alexis either responded with 'I don't know' or simply said nothing and her mother continued reading. In some cases, Alexis' mom scarcely paused long enough for Alexis to provide a response before continuing reading. Nathan's mom made the most extra-text talk and was able to use comments and questions most effectively. Nathan was engaged in the story throughout the reading and even asked some questions himself ('how come "get rid of him"?').

During the word reading activity, Mary, Becky, and Nathan's mother began by pointing out that all of the words rhymed (or 'ended with the same sound'). Emily's mom instructed her to add the 'at' sound to the end of all the words, but did not explicitly note that the words would therefore rhyme. After completing half of the task, Alexis noticed that all of the words rhymed, but this comment was not acknowledged by her mother. The strategy employed by Brian, Becky, Emily, Mary, and Nathan's mother was to identify and sound out the initial letter then blend (also add or stretch) the 'at' ending sound. Alexis' mom instructed her to sound out the initial consonant, then the final consonant, and then the middle vowel sound to identify the word. It may be difficult for Alexis to hold the initial and final

consonant sounds in memory to add the vowel sound. This would require increased load on working memory and is different strategy than the method normally taught in school.

The analysis also considered parents' general attitude toward home literacy activities and involvement in children's learning at home. Becky's mother was actively involved in her child's learning and had been providing speech and language instruction and support at home since Becky was a toddler. Her mother is a devoted and patient supporter of Becky's learning.

Alexis, Brian, and Mary's parents could be categorized as being involved in their child's learning but they are using inappropriate teaching strategies. Brian's mother focuses reading instruction on flashcards and required reading of books that may be too difficult for Brian to enjoy. During the book reading task, Brian read most of the words correctly but showed little comprehension and lacked appropriate sentence phrasing and intonation. Reading was described by his mom as 'work' that had to be done before he could do 'fun' things.

Mary's mom is content for Mary to repeat sentences and words. During book reading activities, she does not ask Mary to read words nor does she ask questions or make comments about the story characters or storyline. If asked a question about a letter sound, word, or storyline, Mary can say 'I don't know' or simply wait for her mother to provide the answer. Mary's mom is providing too much help on literacy activities and Mary isn't being given opportunities to develop word reading skills.

Alexis' mom is not positively supporting her learning at home. Though they reported participating in nightly shared book reading, the book reading demonstrated for this study did not include the type of questions or comments that are characteristic of high quality shared book reading. Similarly the strategy used to help Alexis read the rhyming words was different from conventional strategies and may have made the word reading task more

difficult. Perhaps most troubling was the negative comments made by Alexis' mother about her learning. Alexis' mom said she was 'difficult', 'has a short attention span' and 'isn't doing well at school'. Though the camp program of the intervention was free and Alexis' teacher said she could benefit from participating, Alexis' mom chose not to have Alexis participate. Alexis was selected to participate in a reading support program at her school in grade one but her mom is opposed to her participation because she did not believe that Alexis was the among the poorer readers in her class. Alexis did not participate in the school support program because her mother would not give consent.

At the first meeting, both Nathan and Emily's mothers were eager to learn strategies to help support their child's learning, however, only Nathan's mom made any real changes to the home literacy environment after the intervention. Emily's parents are eager to help support Emily but they are unable to make time for regular literacy activities in the home. They provide a tutor for Emily to help compensate for the lack of home literacy activities.

Nathan's mom was eager to learn more about early literacy, especially with three other young children at home. During the pre-intervention visit she showed positive shared book reading strategies but knew little about the importance of letter knowledge or phonological awareness. Following the intervention, she had incorporated phonological awareness activities and games into the family's after-dinner routine and selected workbooks that focus on key skills.

Influence of intervention

Four of the six case study families participated in intervention conditions. Nathan and Emily's parents participated in the parent-only group, Becky participated in the parent+child group, and Mary participated in the child-only group (though initially recruited for parent+child). Mary's mother showed the least amount of change following the intervention.

She anticipated continuing the type and frequency of literacy activities used before the intervention. Though invited to attend the parent workshops to learn how to improve home literacy activities, neither of Mary's parents chose to participate.

Becky participated in the parent+child intervention condition. Both of her parents, though divorced and living in separate towns attended both of the parent workshops. Becky has a severe articulation disorder and her parents have been strongly involved in her learning since she was a toddler. With the homework completed through speech language services and the homework completed for school, Becky was already participating in many literacy activities in the home each week. Though the frequency of activities is unlikely to change, Becky's mother noted that she is more aware of the role of phonological awareness in learning to read words and some of the home activities have been changed to reflect this new understanding.

Emily and Nathan's parents both participated in the parent-only group. Emily's parents report being more aware of the importance of home literacy activities and more confident engaging in literacy activities with Emily, but report they still struggle to provide regular literacy support. They are unlikely to increase the frequency of home literacy activities with Emily. Conversely, Nathan's mother has made dramatic changes in the type and frequency of literacy activities in their home. Nathan's mom reported greater confidence in choosing storybooks to help her child's reading. As a family, they also spend time each evening after dinner playing literacy related games, completing literacy activities, or writing in notebooks to practice and improve emergent literacy skills.

Discussion

The cases illustrate the significant differences in home literacy activities in the children participating in the reading intervention project. Differences were found both in

terms of the frequency and quality of home literacy activities. The quality of home literacy activities is a complex concept. For this project quality was interpreted as the frequency and appropriateness of extra-text talk during shared book reading and appropriate guidance and support during the formal word reading activity. Though most parents reported reading with children on a daily basis, there were large differences in the strategies used during shared reading activities. Some parents made positive, instructive comments targeted at children's skill level while other parents made little to no extra-text comments during the story. These are important differences in the quality of shared book reading experienced by children that would not be captured using a literacy survey that asked solely about the frequency of shared reading.

The most positive home literacy environments were displayed by the parents of Becky and, following the intervention, Nathan. These parents are actively involved in their child's learning, have taken steps to learn how to effectively support their children, and are making time for literacy activities in the family's daily routine.

Brian and Mary may appear to have positive outcomes but their learning is not being optimally supported. Brian has learned to read words through flashcards and memorization. Though he could read the greater part of a 3rd grade 'Scooby-Doo' book, he showed low phonological awareness scores at pre-test and barely achieved the benchmark score of 30 by the post-test. Brian will likely struggle in school as text comprehension becomes more important and as he is presented with more and more new words. Brian is currently relying on memorization techniques to learn new words, but this strategy will be ineffective as the number of new words continues to increase. Memorizing words gives the appearance of effective reading skills in the short-term but the skill of decoding is essential to reading novel words and reading success in the long-term (Adams, 1990; Ehri, 2005).Without phonological

awareness and basic decoding skills to read new words, Brian's word reading fluency will slow and text comprehension will suffer.

Mary had the highest scores of children in Study 3 but she is not being challenged during literacy activities at home. Despite good emergent literacy skills, Mary is a passive participant in early literacy activities at home. Mary may improve at reading if she received more explicit instruction in word reading tailored to her current skill level.

Alexis and Emily may continue to experience delays in reading if they do not receive targeted reading support. Emily's parents are aware that they are not able to allocate enough time to literacy activities at home with Emily so they have hired a tutor to provide literacy instruction. It would be important to ensure the tutor is using similar techniques to those Emily practices at school to maintain consistency. Though they have taken steps to bring in a tutor to support Emily's learning, it is still important that they carve out regular time to work with Emily themselves; even a 10 minute, high-quality, shared reading activity at bedtime would be beneficial.

Alexis' parents are not providing a positive learning environment at home. Though being identified by both her SK and Grade one teacher as requiring additional help in early reading her mother is restricting participation in programs that could support her learning. If Alexis is not going to participate in community or school programs to support her learning, it will be important for Alexis' parents to provide high-quality learning activities. Currently, Alexis' mom is promoting techniques inconsistent with Alexis' school experience or current reading theory. She may benefit from parenting resources and courses that are available in the community to learn about effective strategies and activities to support children's reading. Alexis enjoys a wide range of activities such as crafts and drama. Alexis' mom could build on these activities to establish basic emergent literacy skills such as letter knowledge and

vocabulary. Because she is struggling at school and receiving less than optimal support at home, Alexis is developing negative attitudes about school and learning which may translate into increased problems in educational achievement. Alexis' mom needs to take a leadership role to make significant changes at home and change the trajectory of Alexis' learning.

The cases included in study three served to illustrate the large variation in children's literacy experiences in the home. Study three also highlighted the importance of a quality survey tool for capturing the characteristics of participating families and home literacy activities. Consider for example that Emily had a regular literacy tutor; though she was in the parent-only condition of the research study she did receive regular child-centred literacy instruction in the summer. Nathan experienced significant language delays as a preschooler which could influence emergent literacy skills like vocabulary (PPVT) and letter knowledge. Becky was kept out of junior kindergarten and repeated senior kindergarten, not only because of her academic skills but also so she could develop stronger social skills and increased maturity to help her deal with her articulation disorder. On the demographic survey, Becky's parents are listed as divorced and though living in separate towns, both attended the parent workshops. Becky is receiving literacy support in both of her home locations. Mary's parents, though married and available, did not attend the workshops. These are significant confounding variables that would not be captured on a simple survey (including the survey included for this study) but could potentially influence quantitative analyses of the data. These qualitative results also highlight the complexity of issues around home literacy that are not likely to be captured by a simple survey format.

General Discussion

The purpose of this project was to evaluate the influence of a summer intervention for children showing early signs of reading delay. The project evaluated two intervention

components: a two week camp for children and two training workshops for parents. Data were collected for five groups of participants. In all but one group, children were identified by teachers as having difficulty in phonological awareness and word reading skills at the end of senior kindergarten. The five groups were labelled 'parent+child' – families who participated in both the child camp and the parent workshops, 'parent-only' – families who participated in only the parent workshops, 'child-only' – families who participated in only the child camp, 'low comparison' – families who did not participate in an intervention condition, and 'average comparison' – families of children identified as showing average achievement in phonological awareness and word reading and who did not participate in an intervention condition.

The intervention program was based on current understanding of early reading development. Word reading ability was conceptualized as part of the continuum of emergent literacy skills that also includes vocabulary, letter knowledge, and phonological awareness. The intervention program sought to improve children's word reading ability by promoting emergent literacy skills. Advances in the study of emergent literacy skills have identified the strong predictive link between phonological awareness and later reading ability. The relationship between phonological awareness and word reading is likely bi-directional in nature such that initial word reading ability strengthens phonological awareness and vice versa.

Intervention programs to support early reading development must be implemented while children are young to achieve the best outcomes. The importance of early intervention is amplified by theories such as the Matthew Effect which suggests that children with stronger early literacy skills may increase in reading ability at a greater rate than children with lower initial abilities. Interventions targeted at young children have an opportunity to

influence emergent literacy skills while the differences between the highest and lowest achieving children are still quite small. Previous studies have shown that early reading interventions can positively impact children's early reading ability. Intervention programs for children must provide explicit instruction in phonological awareness. Some studies have shown positive results with summer programs and shorter duration programs. Many of these studies, however, showed that short-term gains were lost over time. Children's programs may improve children's immediate skill level but additional parental support is potentially required for long term positive outcomes.

The initial hypothesis was that children participating in the camp conditions of the intervention (parent+child and child-only) would show larger immediate gains in phonological awareness and word reading outcome measures, than children in the parent-only group and the low comparison group and that children in the parent conditions of the intervention (parent+child and parent-only) would be more likely to maintain gains at the follow-up assessment at the end of grade one. If both of these hypotheses were correct, children in the parent+child group would show the most positive gains overall, benefiting from both the child camp and the parent workshop components of the intervention.

In the initial pilot study, reported as study one, children in the parent+child group had a trend toward higher phonological awareness scores after the intervention program. This initial finding was encouraging enough to support a more extensive evaluation of the summer intervention. A larger sample was recruited in the summer of 2005 and 2006 to permit analyses of children's responsiveness-to-intervention (RTI) and factors related to RTI.

RTI studies typically analyze data by categorizing children into 'responsive' and 'non-responsive' groups based on some criteria. Given the high-risk of lower literacy outcomes for children in these studies, it is expected that only a percentage of children will

be categorized as 'responsive'; other children are expected to require on-going support to achieve desired literacy outcomes. The purpose of RTI evaluations in a research program is to determine if a greater percentage of children are responsive under different intervention conditions. Without established criteria to determine responsiveness, researchers are left to set their own criteria. Though often arbitrary in nature, consistently applied criteria are fair guidelines to determine differences in responsiveness between intervention conditions because the same criteria are applied to all groups. For this study, we also used a low comparison group to explore potential differences between intervention conditions and no intervention.

For the phonological awareness outcome variable, a greater percentage of children in the parent+child group and child-only group achieved the benchmark for responsiveness than the low comparison group; a greater percentage of children in the parent-only group met the slope criterion for responsiveness. The significant finding for the parent-only group under the slope criterion could be related to the higher initial word reading ability of children in this group; given the theorized bi-directional nature of the phonological awareness – word reading relationship.

In word reading, more children in the parent+child and parent-only groups were categorized as responsive using the benchmark method. However, children in the parent-only group had higher word reading scores at pre-test meaning children in the parent-only group needed to show only marginal gains between pre- and post-test assessments to achieve the benchmark and be categorized as responsive. Under the slope method, a greater percentage of children in the parent+child and child-only group were coded responsive.

At the follow-up assessment at the end of grade one, a subset of children was further categorized into groups labelled maintainer, positive switcher, negative switcher, and non-

responsive, based on the pattern of change across post- and follow-up assessments. The maintainer and positive switcher categories were understood as positive outcomes – children who were responsive across both assessments (maintainers) or children who achieved responsiveness criteria by the end of grade one (positive switchers). Negative switcher and non-responsive categories were considered negative outcomes. These groups included children who showed initial gains but were non-responsive at the follow-up (negative switcher) and children who were non-responsive at both the post- and follow-up assessments (non-responsive). Non-responsive children may have true reading disabilities or general cognitive delays that may require on-going support to achieve desired literacy outcomes.

In general, children in the parent-only group showed the most positive outcomes at the follow-up assessment; however, further exploration showed that the sub-sample of children from the parent-only group participating in the follow-up assessment had significantly higher scores in word reading at pre- and post-test assessments than children in the other intervention groups. Children in the parent-only group did not have the same mean pre- and post-test scores as children in the parent+child and child-only intervention conditions. This limits the ability to compare outcomes between the parent-only group and the other intervention conditions at the time of the follow-up assessment.

There were no differences in outcomes of children in the parent+child and child-only outcome group in phonological awareness at the follow-up assessment. However, children in the parent+child group had more positive outcomes than children in the child-only group in the word reading domain. More children in the parent+child group were categorized as maintainers and positive switchers and fewer children were categorized as negative switchers and non-responsive, than the child-only group.

Across the assessment periods it appears that children in the parent+child and parent-only groups had the most positive outcomes. Children in the child-only group showed strong initial gains in phonological awareness (benchmark) and word reading (slope), but had less positive outcomes at the follow-up assessment. Children in the parent+child group showed strong initial gains with high responsiveness in phonological awareness (benchmark) and word reading (benchmark and slope) outcomes. Children in this group also showed strong positive outcomes at the follow-up assessment with more children coded into maintainer and positive switcher categories in the word reading domain.

Children in the parent-only group had strong initial gains in phonological awareness (slope) and word reading (benchmark) but these findings are coloured by a marginally higher initial word reading score. Higher initial word reading ability could influence the rate of growth of phonological awareness. Evidence suggests that phonological awareness and word reading are bi-directionally related such that ability to read words helps children recognize and understand the phonological components (Hogan, Catts, & Little, 2005; McBride-Chang, 1995; Stanovich, 1986). Initial differences between the parent-only group and the other intervention groups limit the ability to compare outcomes across conditions.

Analyses of children's scores at pre-, post-, and follow-up assessments appear to support the hypothesis that children in the parent+child group showed the most positive outcomes following the intervention. Children in the parent+child and child-only groups who participated in the camp component of the intervention, showed positive gains at the post-test assessment but children in the parent+child group were more likely to maintain gains through the follow-up assessment at the end of grade one.

The findings based on children's scores suggest that some of the gains made by children after participating in the summer camp intervention may be lost without parent

training. Responses from the parent survey showed that most parents were engaging in shared reading activities with their children at home and some were engaged in more formal literacy activities like direct teaching of letters and word reading both prior to the research project and between the pre- and post-assessments. The frequency of reported home literacy activities was related to children's outcomes regardless of intervention condition. Analyses of parent survey responses showed the frequency of word reading activities at home was significantly related to children's outcomes. Children who experienced more reading-related activities at home showed more growth in both phonological awareness and word reading (responsive using slope method, indicating more growth between pre- and post-test assessments). Regardless of intervention condition, children who experienced more reading-related activities at home showed more improvement in early literacy skills over the study period.

Parents in two intervention groups participated in parent training sessions about shared reading and phonological awareness. Visual inspection of the parent survey data showed that parents in the parent-only group increased the frequency of both letter teaching and word reading activities more than parents in the other intervention groups. Parents in the parent+child group increased the frequency of letter teaching activities more than parents in the child-only group. Parents in all groups increased in the frequency of home literacy activities during the study period.

The frequency of home literacy activities is perhaps not as important as the quality of the home literacy activities. A more positive outcome from the parent training sessions would be that parents engaged in more purposeful, high quality literacy activities. The training sessions sought to improve the quality of home literacy activities by explaining to parents how parent-child literacy activities help develop early reading skills and by teaching parents

how to identify their child's current skill level and target literacy instruction appropriately. Instead of allocating more time to home literacy activities, parents may have simply 're-allocated' their time on higher quality home literacy activities.

Change in the quality of home literacy activities is difficult to assess using a survey; however, the family case studies described in Study 3 help to illuminate changes in the home following the parent training. Nathan and his mother were already engaging in shared reading activities but Nathan's mother knew very little about the role of language or phonological awareness for supporting reading development. Following the parent workshops, Nathan's mother provided interesting and stimulating phonological awareness activities for Nathan and his two younger sisters each evening around the kitchen table. Emily and her parents engaged in limited shared reading activities at home. When books were read with Emily, her mother simply read the book from cover-to-cover without prompting, or discussion. Following the parent training, Emily's parents still had difficulty finding time for home literacy activities but the activities they did engage in were of higher quality. Shared book reading time now included discussions about the storyline and content of the book and Emily's mother pointed out rhyming words and other word structures in the text.

The case studies also illuminated other important differences across children and families that were not captured in the parent survey. For example, Nathan rarely spoke for a two year period before he was four, which may be related to subtle delays in early langauge. These language delays could result in delays in the development of letter knowledge and phonological awareness. Brian's mother was focusing literacy instruction on sight reading with a large amount of home literacy time on reading word lists. Brian showed above average word reading skills during the home visit but his assessments showed low phonological awareness skills. This would be consistent with sight word reading. This strategy may work

in the short term while the numbers of words in children's texts are relatively limited, but Brian may experience problems in word reading in the future if he does not develop phonological awareness and decoding skills. Emily's parents had difficulty making time for home literacy activities but had hired a tutor to support Emily's reading skills. On the parent survey, the frequency of home activities would have been very low, but Emily was receiving additional literacy instruction outside of the home and school. These are all important characteristics and experiences of the research participants that would not have been captured on the parent survey. They point to the possibility of confounding variables in the data that blur the ability to statistically detect the influence of the intervention condition on children's literacy skills.

Alexis' parents declined to participate in the intervention and chose not to send Alexis to the child camp because they wanted her to be at home during their vacation. Alexis' mother insisted that Alexis was not one of the 'lowest kids' even though two different teachers had referred Alexis for supplemental literacy support. Several other parents consented to their children participating in the child camp but their child did not attend the camp itself. Anecdotal information suggests one child said he wanted to stay home and play with his brothers and the parent agreed, and another parent decided it was too difficult to drive their child to the camp each day. This suggests that some parents may not take advantage of resources or opportunities available to support their child.

Findings from this study provide additional support for the important role of parents on children's early literacy development. Children's pre-test knowledge of letter sounds was correlated with the frequency of shared reading activities and the frequency of letter teaching activities at home. The frequency of home activities related to teaching word reading skills was related to growth in both phonological awareness and word reading, regardless of

intervention condition. Some parents attended parent training workshops, capitalizing on an opportunity to learn how to support their child's reading at home; other parents who were invited to attend the workshops did not. Still other parents did not take advantage of the opportunity for children to attend a free program to improve literacy skills. A small percentage of exceptional children may be able to develop reading skills without the support of parents, but home literacy activities appear to be important for children to develop early reading skills.

In addition to parental support of literacy activities at home, child characteristics appear to have influenced change in phonological awareness and word reading scores between assessment periods. Analyses were conducted after the post-test assessments and after the follow-up assessments to explore the role of children's characteristics on children's RTI. RAN was strongly related to responsiveness in both phonological awareness and word reading at post-test. Children with higher RAN scores were more likely to be coded as responsive. This is consistent with the literature that RAN and phonological awareness are strongly correlated (Vukovic & Siegel, 2006) and the 'double-deficit' hypothesis that argues poor readers often experience difficulties in both phonological awareness (phonological processing) and RAN (orthographic processing; Miller et al., 2006; Wolf & Bowers,1999). Alternatively, RAN might be the strongest predictor due to its relationship with phonological awareness under the general skill of phonological processing (Wagner & Torgesen, 1987). Despite the strong link between RAN and child outcomes at post-test, RAN was only marginally related to responsiveness in phonological awareness at the follow-up assessment.

Knowledge of letter sounds and listening comprehension were significant predictors of responsiveness at the post-test and follow-up assessments. The important role of letter sound knowledge is consistent with previous literature that shows letter knowledge predicts

phonological awareness (Ehri, 2005) and that letter sound knowledge is related to decoding ability and word reading (Scarborough, 2001).

Listening comprehension was related to responsiveness in word reading (post-test and follow-up) and phonological awareness (follow-up). The influence of listening comprehension on word reading was less expected than other relationships found in the data. Further exploration reveals that the listening comprehension task used for this study may also indirectly measure general knowledge and/or cognitive ability to complete the riddle-like sentences. In this way, low scores on the listening comprehension task may also indicate more global cognitive delay that also presents as delays in emergent literacy skills. Given that children recruited for this study represent the lowest performing children at the end of senior kindergarten, it is reasonable that a small group of participating children have general cognitive delays, often referred to as' garden variety poor readers' in other reading research. This group of children would likely require on-going support in reading over time. Additional work exploring the cognitive demands of the listening comprehension task would be beneficial to help interpret the significant finding in this study.

Limitations

As with all research projects, especially of this size and scope, there are several limitations and several 'lessons learned' for future work of this nature. First, random assignment is always the gold standard for experimental studies. However, this is challenging in applied research. The findings of this study would be strengthened if children had been randomly assigned to research conditions. Attempts were made to limit systematic bias by assigning children from across classrooms and across schools for study groups. This procedure still leaves potential biases related to self-selection and geography. Teachers were instructed to refer children who were behind other children in emergent literacy skills. The

researchers had no knowledge of child or family characteristics when determining how intervention conditions were assigned to different project sites.

Other design/procedure limitations are the process of teacher referral, consistency of the parent trainer across conditions, and timing of the intervention. Anecdotal information from one teacher involved in the study suggests teachers did not always refer children who showed the poorest emergent literacy skills, as they had been instructed. In discussing teacher referrals for the parent-only condition, a teacher confided she did not refer children with the lowest phonological awareness in her classroom because she did not feel the parents of those children would attend the parent workshops. Instead, she referred children who 'could use some help' and where she had greater confidence that parents would participate in the evening sessions. Visual inspection of the data shows that children in the parent-only group had marginally higher word reading skills than children in the other intervention conditions. A more objective referral process might reduce the potential for teacher biases to influence the study sample.

As the research took place over a period of three years, different people were enlisted to facilitate the parent workshops. The author co-facilitated one session in the pilot study (2004) and all parent sessions in 2006; the author's advisor facilitated one session in the pilot study; the community's 'Early Literacy Specialist' facilitated sessions for three of the parent groups in 2005; and the community's 'Early Years Coordinator' co-facilitated one session in the pilot study and sessions for one parent group in 2005. Information from the satisfaction surveys completed by parents at post-test suggests parents were less satisfied with sessions facilitated by the Early Literacy Specialist in 2005 than other facilitators. It is possible that parents were less receptive to the information presented and that there were different

outcomes (e.g. change in parent activities at home) between parents who enjoyed the parent workshops and those who did not.

A third limitation is the timing of the intervention during the summer months. Organizational issues, principally maintaining consistency in child camp staff, necessitated that some child camp programs were offered shortly after children's senior kindergarten year (early July) and some child camp programs were offered closer the end of the summer, near the start of grade one (mid-August). There are not sufficient data to test if the timing of the intervention was related to change as measured in children's post-test scores. It is possible that children who participated in earlier camps experienced increases in phonological awareness and/or word reading that were subsequently lost or diminished before the post-test assessments in grade one.

The second category of limitations relates to the data collected during the project. Analysis of the influence of the parent workshops and change in home literacy activities would have been stronger (and increased power to detect differences) with an increased response rate of parent completed surveys. In particular, children in the low comparison group that did not receive an intervention component were least likely to return the parent survey. Additional follow-up with parents or incentives to complete the survey may improve the response rate in future studies. A revised procedure that limited the reliance of data self-reported by parents would also strengthen the study by improving the validity of the data.

Additional data could be collected to increase the scope of the analysis. First, qualitative data from parent surveys completed at post-test suggest that one of the main effects of the child camp component was changes in children's attitudes about school and reading. Parents reported children were looking forward to school for the first time or were excited for the start of grade one. One parent said her son was more confident starting grade

one because he felt like he could participate in circle-based activities 'without looking stupid'. Future studies that include a 'fun, educational component' for children such as the child camp, should include a measure that captures potential socio-emotional changes in children's attitudes towards reading and/or school.

Additional data about the type and quality of home literacy activities and about potential confounding variables would improve the scope of the analysis as well. Qualitative data from study three (case study) captured information about the quality of home activities for six families. However the home visit model is time consuming and would be difficult to implement on a large scale. Future research could explore self-report methods to capture information about the quality of home activities.

The case studies also illuminated other characteristics about the family or children's experiences over the summer that are potential confounding variables for this study's analysis. For example, Emily had a regular tutor to improve literacy skills and so the frequency of literacy activities reported by her parents on the survey would not be an accurate reflection of Emily's exposure to literacy over the summer. Future studies could benefit from information collected in the qualitative case studies; additional questions could be added to parent surveys to capture information about potential confounding variables.

The third category of study limitations relates to the analysis of data. Small sample sizes, especially for the comparison groups and grade one follow-up cohort, limited the analysis methods that were possible and decreased the statistical power of analysis methods to detect differences between groups and changes over time. Work of this kind, with assessments of students across multiple time points, is expensive and time-consuming. Given the pilot nature of this project, the smaller sample sizes were justified. Further studies should increase the sample size, particularly within groups, to facilitate more statistical power to

detect significant differences between groups. A larger sample would also permit use of more advanced statistical methods such as hierarchical linear modelling (HLM). HLM methods are more advanced for longitudinal analyses because they can account for missing data (maximizing available sample size), they can account for unequal group sizes (that limit the power in standard regression methods) and they partition error in the model at the level of the child and the group (providing important information about the source of the variance).

HLM works by creating two regression models. In longitudinal data, the first regression is at the level of the child; HLM identifies the slope and intercept across time for each child. In the second step, child level slope and intercept values serve as dependent variables to fit a regression with independent variables and covariates. HLM would be a strong statistical method for testing RTI models because it can account for children with different initial intercepts and slopes within- and between-groups that is expected in RTI data while simultaneously testing the influence of mediating variables.

The fourth category of limitations relates to the implementation of intervention conditions. The decision to maximize the available sample size by re-assigning families to the intervention condition in which they participated may have introduced other biases, such as parent motivation or parent interest. Most changes in intervention condition were related to parents not-participating in the parent workshops: families assigned to the parent+child condition who did not participate in the parent workshops were re-assigned to the child-only group and families in the parent-only group who did not participate in the parent workshops were re-assigned to the low comparison group. Parents who chose not participate in the parent workshops may have less time to engage in literacy activities with children at home, may be less motivated to support children's learning at home, or may be less interested in learning new skills to improve their ability to support children's literacy at home. Future

studies may need to exclude families from analyses that do not participate in the assigned research condition to begin to disentangle these potential influences.

Finally, the implementation of the low comparison group could have been improved to reduce the so-called 'Hawthorne effect'. Similar to the 'placebo effect', the Hawthorne effect suggests that participants may behave differently because they are aware that they are part of an intervention. In this project, it is possible that changes in children's reading skills and changes in the frequency of parent literacy activities are due to participation in an intervention study – not the intervention components specifically. Troya (1999) recommends that comparison groups receive an alternate intervention of similar duration to minimize the Hawthorne effect.

Use of RTI

Based on experiences with this project, both the benchmark and slope methods have a purpose. The benchmark method may be particularly useful for identifying children that could benefit from intervention. For example, following a teacher referral, only children with scores falling below an established score or norm would participate in the intervention. Further, using an age-appropriate norm or benchmark as the post-test 'cut-off' would report the percent of children that showed positive change following the intervention such that they now show age expected scores.

As a second use, the benchmark method is also appropriate for identifying children with reading disabilities. Under the new RTI approach to identifying reading disabilities, children are only identified as having a reading disability if they fail to make adequate progress after receiving several stages of reading support of increasing intensity (i.e. intensive classroom instruction, small group instruction, one-on-one instruction). The benchmark method, especially using standard scores from reputable instruments, is simple

and would be practical for non-researcher practitioners such as teachers and administrators to generate consistent, reliable criteria for monitoring children's development in reading.

The slope method appears to be the more useful method for research and evaluation studies exploring the influence of intervention programs. The slope method relates to the degree of change between assessment points, regardless of initial or final level, which is a stronger measure of the effect of intervention. The slope method allows researchers to quantify the degree of change following intervention which is more helpful for researchers seeking to validate intervention programs suitable for more wide-spread use in school and community settings.

Following this study, slope would be the recommended method for use in future RTI research studies with the caveat that additional work must be done to determine the appropriate 'degree of slope' that indicates responsiveness. The benchmark and dual discrepancy approach are not ideal methods for research purposes; the benchmark method is heavily influenced by initial ability and the dual discrepancy method confounds the role of initial level and growth which limits the ability of statistical analysis to accurately estimate the impact of an intervention. Regardless of the direction taken in future studies, additional work must be done to establish consistent analysis methods and best practices (slope vs benchmark and criteria of responsiveness) to permit more rigorous study of RTI and facilitate comparison across studies.

Summary

This project builds upon previous evidence that children's 'emergent reading skills' are a strong predictor of later reading ability, that assessment methods can identify young children with difficulties in emergent literacy skills, particularly phonological awareness, and that early intervention programs that provide explicit instruction in phonological awareness

positively support the development of word reading ability. The purpose of the study was to improve reading 'futures' of young children by providing intensive, early intervention to children showing early signs of difficulty in the emergent literacy skills that lead to successful word reading.

The study was designed to assess the influence of two intervention components, both alone and in combination, on children's phonological awareness and word reading skills. Building on previous literature, the intervention for children (child camp) provided explicit instruction in phonological awareness, with additional opportunities to build letter knowledge and vocabulary. Activities were provided in the context of a fun, print rich environment that utilized individual and group activities, in the classroom and outside. The parent workshops were intended to influence children's literacy outcomes by improving the quality of support parents could provide through home-based literacy activities. Parents learned about the role of shared book reading and phonological awareness in children's reading development, and discussed practical strategies to improve the quality of home literacy activities of children with different learning styles, at different skill levels, and with different interests.

The influence of the intervention conditions was assessed through changes in children's scores in phonological awareness and word reading. Three methods were used to explore children's response to the intervention: benchmark, slope, and dual discrepancy. Analyses explored the percent of children who were responsive to the intervention for each outcome, using each method. Both components of the intervention showed some influence on children's outcomes.

We hypothesized that children participating in the camp conditions of the intervention (parent+child and child-only) would show larger immediate gains in phonological awareness and word reading outcome measures, than children in the parent-

only group and the low comparison group. Secondly, we hypothesized that children in the parent conditions of the intervention (parent+child and parent-only) would be more likely to maintain gains at the follow-up assessment at the end of grade one. Finally, we hypothesized that children participating in both components of the intervention would show the strongest overall gains because they would benefit from the child-based literacy instruction at the camp and the improved quality of parent support from the parent workshops. To some degree, the findings support these hypotheses.

Children in the parent+child group showed positive change after the child camp and many children had positive outcomes at the follow-up assessment at the end of grade one. Children in the parent-only group also appeared to have positive results following the intervention; however, higher initial scores of this group in the follow-up study and concerns about the recruiting process used to identify families for this group limits the ability to compare outcomes of this group with the other intervention groups.

Contributions

Overall, three key findings emerge from this project. First, children's skills can be influenced by short-duration, high-intensity programs. The child camp component of the intervention was a carefully designed two-week program for children that focused on letter knowledge, phonological awareness, and word reading instruction through fun, interactive, in many cases non-traditional, learning activities. This program demonstrated positive short-term gains in children's phonological awareness and word reading skills. In addition, anecdotal reports suggest the programs 'fun' focus also positively influenced children's attitudes towards school and learning in general. Short-duration, high-intensity programs are less expensive to operate than long-term, school-based intervention and are a practical alternative to traditional reading intervention programs. They also allow students additional

exposure to instruction in areas of weakness without missing instructional time in other school subjects.

The second key finding is the importance of parent support for children's on-going reading success. A combination of evidence from the parent survey and case study analysis suggests that both the frequency and quality of literacy activities at home is important. Children in the parent+child condition, where parents participated in the parent workshops showed more positive one-year follow-up scores than children in the child-only condition, where parents did not receive the parent workshops. This suggests that parent support is required to maintain children's gains from the child camp. The children in the parent+child condition were also more likely to be coded as responsive regardless of the RTI definition used.

Finally, this study also tested three different methods for analyzing RTI: benchmark, slope, and dual discrepancy. Each approach has its strengths and limitations. Based on experiences through this project, the benchmark approach is recommended for non-research practitioners such as teachers or school administrators to provide consistent, reliable information about children's skills relative to age-appropriate norms. The slope method is recommended for researchers evaluating interventions because this approach better quantifies the degree of change in children's scores apart from the influence of initial ability. This project contributes to growth in the RTI field by objectively considering the statistical methods currently used by researchers and initiating a discussion about appropriate methods for future studies. Ideally, researchers would work together to establish consistent methods that would permit comparison across studies in the future.

The role of community collaboration for supporting early literacy

This project could not have been completed without the generous support of several community partners. The local school boards (public and Catholic) contributed space in their schools to host the summer program and provided the salary for one teacher in each program. The local Ontario Early Years Centre (OEYC) was the other key stakeholder in the area. Early Years Centres provide free programs to children from birth to six years and their parents/caregivers across the province. The local OEYC provided program materials (craft supplies, books, toys, etc) and provided the salary for one teacher in each program. Our role as researchers was to conduct the pre- and post-testing assessments of child participants and to provide the salary for the third program staff. In collaboration with our other partners, we developed a program curriculum that was based on current research, that was compatible with the school board's literacy objectives, and that would be enjoyable for young children.

Working together, the project partners were able to pool resources to provide a program for children and parents that would not have been possible independently. Through collaborative planning, the program was able to meet the individual mandates and needs of each partner. This model fits into the broader policy strategy for collaboration and integration currently implemented by governments and large organizations around the world. By OEYCs and school boards working together, the program benefited from the expertise and teaching methods of both early childhood educators and trained teachers. With the inclusion of our research framework into the project, community partners received a detailed evaluation of the intervention components so they could make evidence-based decisions about how to support children's reading development in the future. In a time of reduced funding and higher service expectations, community collaborations may be the best way to support children and families. Integrating the intervention components into the RTI model

Under the model of response-to-intervention, students are monitored by classroom teachers; those students who do not show the expected level of response to regular classroom instruction are referred to a more intensive program (Fuchs et al., 2003). By monitoring children in this second phase of programming, students who do not respond to this extra level of programming are further referred for additional support; either a more intensive intervention support, special education classes, or a more detailed educational evaluation (Fuchs et al., 2003). Response-to-intervention (RTI) models differ in the number of steps or tiers of support offered before children qualify for special services (Fuchs, 2003) and in the type of remedial support that is provided to students (Fuchs, 2003; Fuchs, Fuchs, & Compton, 2004).

The intervention components included in the present study fit well into the RTI model. The parent training workshops provide general instruction about early reading development suitable for parents and caregivers of all young children. In Ontario, parental education is a central component of the mandate for Ontario Early Years Centres (OEYCs). OEYC staff could be trained to deliver parent workshops about early reading development. In this way, community partners with the goal of improving outcomes for young children can support school boards by helping parents provide high quality literacy activities at home.

Under the RTI model, only children who do not respond to a series of interventions of increasing intensity are understood to be reading disabled. Many children evidence early delays in reading because they did not have early opportunities to develop emergent reading skills, either at home or in other care settings. In some cases, these children are referred to school-based reading support programs that remove them from other subject areas to receive additional instruction in reading. The child camp provides an important function by helping those children to 'catch-up' in emergent reading skills by providing intensive instruction in

the summer months between formal education schooling. For some children, as shown through the follow-up assessment, the child camp helped them achieve initial gains that were maintained through the end of the grade one school year.

The intervention components could be combined to create two different models of RTI. Under the first model, parent workshops would be available to all parents and caregivers of children six years and younger. Workshops would be offered intermittently throughout the year to provide support to parents of all young children. The child camp would serve as tier two of the RTI intervention model. (Most researchers consider classroom instruction to be tier one [see Fuchs et al., 2003]; however, some classify classroom instruction as tier one only if the instruction has been enhanced through some form of professional development.) The child camp is a community-based learning program that provides children with explicit instruction in key emergent literacy skills like letter knowledge and phonological awareness. It would be an effective 'tier two' intervention because it provides children who show early signs of difficulties with an opportunity to practice and strengthen key skills necessary for word reading. Ideally, the child camp would be offered in combination with additional parent education.

In the second RTI model, parent education would serve as the first two of the intervention. JK teachers could refer parents of children showing early difficulties with emergent literacy skills or children who appear to have little support completing homework activities. A series of parent workshops (perhaps more than the two sessions described in the current project) would be provided to parents during the JK school year. The child camp would serve as tier three of the RTI model, offered between the SK and grade one school years. The child camp could be offered in combination with more intensive parent support, perhaps home visits that model high-quality literacy activities with children.

Both models would serve to support children who simply need time to 'catch-up' in reading. These successive levels of community-based interventions reduce the number of children requiring school-based interventions. This means that funding for school support programs can be targeted for children with true reading disabilities perhaps resulting in higher quality supports or more individualized instruction.

This study sought to evaluate the influence of a short, summer intervention program for children and families. A community partnership composed of researchers, school boards, and a community service provider, was created to pool individual resources and build on expertise to offer the program free of cost to children identified by teachers as showing early signs of reading difficulties. Both the summer camp component of the intervention and the parent workshop component of the intervention had a positive influence on participating families. Alone, or in combination, the summer camp and parent workshops could be used as effective 'tiers' in the layers of support provided to children who need extra help learning to read. Community involvement in supporting early literacy could reduce the number of children identified for school-based reading support programs, allowing special needs funding to be concentrated on children with true reading disabilities.

Appendix 1. General Information Survey

General Information Survey

These questions are to help us understand the families who participated in this project. Please indicate your response in the line provided. If you prefer not to answer a specific question - just leave it blank.

1. Are you the child's... O mother O father O other _____

2. What language do YOU speak most often at home? O English O French O other _____

3. What language does your child (in Gr 1) speak most often at home?

O English O French O other _____

4. What is your child's date of birth? _____
dd mm yy

5. What is your current partnership (relationship) status?

O single O common-law O married O divorced/ separated O widowed

6. What was your total household income in 2005? (yearly, before taxes)

O less than $25 000 O $25000 - $50 000 O $50 001 - $75 000 O $75 001 - $100 000 O more than $100 000

7. What is your highest completed level of education?

O did not complete high school
O completed high school
O completed college or trade diploma
O completed university degree
O completed university graduate degre

8. What is your partner's highest completed level of education?

O do not currently have a partner/spouse
O did not complete high school
O completed high school
O completed college or trade diploma
O completed university degree
O completed university graduate degre

9. What is your job title? (please explain if necessary) _____

_____

10. What is your partner's job title? (please explain if necessary) _____

_____

11. Do you rent or own your home? O own O rent

Appendix 2. Summer camp curriculum

Drop Off	8:30-8:45	**DAY ONE**
Independent Activity	8:30-9:00	Child activity Decorating Treasure Boxes- use old shoeboxes and recyclable materials – this will be mailbox for the remainder of the camp Make name tags for cubby, find name tags to wear today
Circle	9:00-9:45	Morning circle Good morning Poem - name song(social skills) Role Call Circle Song, 3 familiar songs
Activity	9:50-10:25	Morning activity – Group -letter poster (outside if good weather and can use paints; otherwise inside with just crayons) staff have outline of alphabet on large craft paper banner, students colour/decorate; use as decoration for room
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:50	Morning activity – Small Group Rotation 1 ½ group – make own alphabet poster on smaller paper, make sure previous alphabet poster is within sight so kids can use it as a guide; ensure all letters printed out before decorating ½ group – Sit in circle and review Jolly Phonics sounds
Activity	11:55-12:30	Morning activity – Small Group Rotation 2 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Have kids look for each letter of the alphabet in a book
Circle	1:15-1:45	Circle Question of the Day Mole Sisters and the Rainy Day– ie. RAINY – like BINGO song, Itsy Bitsy Spider, etc
Activity	1:45-2:30	Group activity Listening games (outside or gym) (queen's voice, submarine game variation with onset letters) Take pictures for tomorrow's ID house (head shots); photos need to be printed and brought back for tomorrow morning activity
Recess	2:30-3:00	
Play Centres	3:00-4:00	Give extra long recess then go in and demonstrate each play centre and explain rotation at play centres for rest of week (35-40 minutes) – must do every type of centre at least once (drama, science, writing, construction, puzzles/games); have 3 free spaces if want to do some activities more than once (make poster so they can see progress through week)
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY TWO**
Independent Activity	8:30-9:00	Child activity ID house (see template) children should decorate and tape picture on back so face shows through window; write name under window
Circle	9:00-9:45	Morning circle Circle morning poem Animal Songs
Activity	9:50-10:25	Morning activity – Small Group Rotation 1 (group by skill as best as possible given only day 2) 1/3 – letter bingo 1/3 – rhyme matching 1/3 – label name, address, telephone number of ID house (make sure have a cheat sheet with all this info for teacher; kids will probably need help; don't write it for them on ID house but can write on scrap paper and have them copy)
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:50	Morning activity – Small Group Rotation 2 rotate groups
Activity	11:55-12:30	Morning activity – Small Group Rotation 3 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Kids should pick a book with an animal in it; find name of animal in the book; know which letter in starts with
Circle	1:15-1:45	Circle Question of the Day Mole Sisters and the Rainy Day – comprehension q's "who was in the story" Weather discussion, weather songs
Activity	1:45-2:30	Group activity Submarine Variation Game Red Light Green Light Other gross motor?
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. costumes 2. board games, puzzles 3. sensory/science – water table "sink or float" 4. construction – lego 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY THREE**
Independent Activity	8:30-9:00	Child activity My name begins with… have child find letter that starts their name (have lrg letters pre-cut), decorate with macaroni, beads, tissue paper etc
Circle	9:00-9:45	Morning circle Hooray for me poem Personal Songs – i.e. body awareness and feelings songs
Activity	9:50-10:25	Morning activity – Small Group Rotation 1 (group by skill as best as possible given only day 2) 1/3 – letter bingo 1/3 – craft – onset books (small pre-made books that kids complete) 1/3 – onset substitution (have objects with simple names on hand and have fun substituting initial letter to make nonsense words)
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:50	Morning activity – Small Group Rotation 2 rotate groups
Activity	11:55-12:30	Morning activity – Small Group Rotation 3 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Find different words in book that starts with same letter as name
Circle	1:15-1:45	Circle Question of the Day
Activity	1:45-2:30	Group activity Gross Motor Activities with Numbers (maybe divide into 2 groups for ease) Teacher starts, do 1 cartewheel, do 2 sommersaults, take 3 baby steps backward, do 4 jumping jacks, clap your hands 5 times (only go up to 5). Count how many steps from playground to fence (etc), how many sit ups can people do, how many seconds can you stand on 1 foot (other activities with numbers)
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. costumes 2. board games, puzzles 3. sensory/science – water table "sink or float" 4. construction – lego 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY FOUR**
Independent Activity	8:30-9:00	Child activity Count Me poster – small items to be glued on corresponding number
Circle	9:00-9:45	Morning circle Introduce riddle – rhyming songs Poem, Hurray for Me
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 (group by skill as best as possible given only day 2) 1/3 – letter sound bingo 1/3 – craft – tracing outline of bodies, label with name and age, measure and label height 1/3 – make word family books
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Pick a book with a person in it, and be ready to talk about what happens to that person in the story
Circle	1:15-1:45	Circle Question of the Day One Grey Mouse, comprehension questions, day 3 songs
Activity	1:45-2:30	Group activity Sing head and shoulders knees and toes Discuss parts of body Label head, arm, leg, hand, foot (emphasize phonetics when spelling out, get at least first and final letter from students) (label outside of body outline) Decorate bodies with clothes and draw in fact
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. costumes 2. board games, puzzles 3. sensory/science – water table "sink or float" 4. construction – lego 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY FIVE**
Independent Activity	8:30-9:00	Child activity - Food Lists – Get grocery flyers, have kids cut out pictures from flyer to make list of items they would like to buy. Have each child spell out (at least) one item and print on page
Circle	9:00-9:45	Morning circle Introduce restaurants and menus (menus have words, what do they say, etc); discuss favourite foods Word Game – 'My name is Debbie. It starts with a d. I like donuts.'
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 1/3 – make menu cards 1/3 – read word family books in small group 1/3 – syllable segmenting
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Pick a book. Be ready to discuss where the story takes place.
Circle	1:15-1:45	Circle Question of the Day Red is Best book: Rhyme read, bed, ted Red song, favourite colour graph Colour mixing: red & blue = purple, red & yellow = orange
Activity Recess	1:45-2:30 2:30-3:00	Group activity Play a game of kick ball, or soccer, or dodgeball, or freeze tag (its Friday, let them relax)
Play Centres	3:00-4:00	1. costumes 2. board games, puzzles 3. sensory/science – water table "sink or float" 4. construction – lego 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY SIX**
Independent Activity	8:30-9:00	Child activity Red Book – copy word red on cover, glue or draw an item that could be red and finish the sentence (see template)
Circle	9:00-9:45	Morning circle Introduce onset riddles Each 'red book' read aloud rhyming colour game compound words Hot Dog poem
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 1/3 – onset bingo 1/3 – craft – playdough recipe 1/3 – syllable segmenting
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Find a colour word in a book
Circle	1:15-1:45	Circle Question of the Day Red is best – comprehension q's Red song Move & twist ball game using red balls
Activity	1:45-2:30	Group activity Scavenger Hunt (Find something that starts with a 't', find something that rhymes with 'pass', etc) If extra time, play I spy where kids have to make up own riddle (I spy something that starts with an 's')
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. drama – restaurant scene 2. board games, puzzles 3. sensory/science – playdough, goop, flubber 4. construction – blocks 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY SEVEN**
Independent Activity	8:30-9:00	Child activity Magazine letter cut out – do whole name (first and last), then can do other words (need old magazines)
Circle	9:00-9:45	Morning circle Compound word chart Hot Dog poem – introduce writing a poem "Today I had fun. We played in the ____. I sat on the mat and ____ _____ _____. Copy sentences and draw pictures Play with rhyme riddles: part of the body that rhymes with bed
Activity	9:45-10:30	Morning activity – Group Staff puppet show – I want your moo (PCFK has puppets) Discuss how parts of puppet show (play) similar to story (has to be characters, in a setting, and something happens; 5 Ws) Show how puppets were made, let kids get started making puppets if time
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity –Group Making sock puppets
Activity	11:50-12:30	Morning activity – Small Group Activity Divide into groups of 3 or 4 and have kids work on a puppet show (not everyone can use the puppet theatre, so show them how can use a desk/table as stage)
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Who is in the book? Where does the story take place? What happens?
Circle	1:15-1:45	Circle Question of the Day Big Sarah's Little Boots: favourite shoes, what we wear for different weather, what happens when we grow out of shoes, what colour are your shoes
Activity	1:45-2:30	Group activity Treasure Hunt (use map to find clues, solve the clues to discover the final answer) Bring final answer to specific destination to unlock treasure chest – cooler with freezies
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. drama – restaurant scene 2. board games, puzzles 3. sensory/science – playdough, goop, flubber 4. construction – blocks 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY EIGHT**
Independent Activity	8:30-9:00	Child activity Boot patterning – encourage children to see same & different; Can go on to creating own patterns (have examples ready) if finished with boots
Circle	9:00-9:45	Morning circle Whisky Frisky poem Compound words: tape up and ask group to sound out together Colourful shoe song – rhymes with bean, etc Review rainbow song and Bingo song
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 1/3 – Drawing story pictures (review parts of story/play – characters, setting, something happens – explain can tell a story with just one picture) 1/3 – sound bingo 1/3 – circle activity, child name onset substitution (have a soft ball or bean bag; hold bean bag and say, 'I'm going to pass to my friend Myler' (instead of Tyler), person who catches has to say similar phrase and pass, etc)
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 Rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 Rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Who is in the book? Where does the story take place? What happens? (make sure you ask different people)
Circle	1:15-1:45	Circle Question of the Day Big Sarah's Little Boots – comprehension: pointer finger sorry, talk about cover, author, illustrator, beginning middle end; what happened in the story; how did Sarah feel at the end
Activity	1:45-2:30	Group activity ½ group parachute activities ½ group each child describes their picture (from morning) (teacher prompt with 5 W questions)
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. drama – restaurant scene 2. board games, puzzles 3. sensory/science – playdough, goop, flubber 4. construction – blocks 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY NINE**
Independent Activity	8:30-9:00	Child activity Creating party hat and sash (small paper roll like from calculator) for next day party (have die press letters cut so kids can spell out name on sash)
Circle	9:00-9:45	Morning circle (I have am & pm circles flipped b/c I put making instrument in pm; is this ok?) In My Backyard – OG family words, frog songs, sorting boys/dogs (cards in lit kit), rhyming songs
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 1/3 – spelling word families (give each child several pieces of paper, start with –og words b/c discussed in circle; have them try to spell on own but allow copy from teacher if necessary, making sure to point out similar ending with each word) 1/3 – letter sound bingo 1/3 – allow extra time to finish hats & sashes, allow kids to make paper chains and other decorations if finished
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 Rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 Rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	Find pairs of rhyming words in a book
Circle	1:15-1:45	Circle Question of the Day Discuss beat and rhythm Syllables (beat and rhythm) ABC with instrument
Activity	1:45-2:30	Group activity Making musical instruments
Recess	2:30-3:00	
Play Centres	3:00-4:00	1. drama – restaurant scene 2. board games, puzzles 3. sensory/science – playdough, goop, flubber 4. construction – blocks 5. writing centre
Pick-Up	3:30-4:00	

Drop Off	8:30-8:45	**DAY TEN**
Independent Activity	8:30-9:00	Child activity Rubbings (leafs, sticks, coins, etc) of things found in a backyard Draw picture of their backyard
Circle	9:00-9:45	Morning circle Practice graduation ceremony (waiting until turn to walk out & shaking hands)
Activity	9:45-10:30	Morning activity – Small Group Rotation 1 1/3 – making cupcakes 1/3 – letter sound bingo with BIG prizes (erasers, fancy pencils, toy cars, etc) 1/3 – thank you cards to parents (make sure kids at least copy out thank you on the front and write name on inside; more writing beyond that is optional)
Snack	10:30-10:45	
Recess	10:45-11:10	
Activity	11:15-11:45	Morning activity – Small Group Rotation 2 Rotate groups
Activity	11:50-12:30	Morning activity – Small Group Rotation 3 Rotate groups
Lunch	12:30-1:00	Lunch
Quiet Reading	1:00-1:15	How is the character in the book feeling? Why?
Circle	1:15-1:45	Circle Question of the Day In My Backyard comprehension 'rhyming' Favourite songs
Activity	1:45-3:00	Group activity Face painting Decorate Cupcakes Parade around outside of school grounds (wearing hats, sashes, and playing musical instruments)
Party	3:00-3:30	Graduation Party Eat Cupcakes, have apple slices, other fruit available also
Graduation Ceremony	3:30-4:00	Graduation Ceremony Say something to parents, then call kids across to get literacy bag of books, notebooks, etc. Encourage parents to stay and finish up food, tour the classroom, ask questions etc. Make sure kids take home all crafts, including ID house, and treasure box

Appendix 3. Summer Activities Survey-Revised

Literacy Activities Survey

Below is a list of literacy activities that might be done by children with a parent or an older sibling. Please mark how often your child did these activities before he/she started school, during senior kindergarten, and since participating in the reading program.

1. How often did the following activities occur BEFORE YOUR CHILD STARTED SCHOOL?	never	1-2 times / mth	once a week	2 - 3 times / wk	once a day	more once / day
a) your child and a parent read a book together						
b) your child and an older sibling read a book together						
c) your child was taught or practiced identifying letters and numbers						
d) your child was taught or practiced letter sounds						
e) your child was taught or practiced blending letter sounds to read words						
f) your child was taught or practiced reading words						

On the back, please provide an example of a literacy activity that your child did at home before starting school.

2. How often did the following activities occur WHILE YOUR CHILD WAS IN SENIOR KINDERGARTEN?	never	1-2 times / mth	once a week	2 - 3 times / wk	once a day	more once / day
a) your child and a parent read a book together						
b) your child and an older sibling read a book together						
c) your child was taught or practiced identifying letters and numbers						
d) your child was taught or practiced letter sounds						
e) your child was taught or practiced blending letter sounds to read words						

f) your child was taught or practiced reading words . □ . □ . □ . □ . □ . □

On the back, please provide an example of a literacy activity that your child did at home during kindergarten.

3. How often did the following activities occur OVER THE SUMMER BEFORE GRADE ONE?	never	1-2 times / mth	once a week	2 - 3 times / wk	once a day	more once / day
a) your child and a parent read a book together						
b) your child and an older sibling read a book together						
c) your child was taught or practiced identifying letters and numbers						
d) your child was taught or practiced letter sounds						
e) your child was taught or practiced blending letter sounds to read words						
f) your child was taught or practiced reading words						

On the back, please provide an example of a literacy activity that your child did at home this summer.

Appendix 4. Pre-test scores by cohort by group: 2005 and 2006 cohorts

	parent +child			parent-only			child-only			low comparison group			
	2005 n=32	2006 n=23	total n=55	2005 n=23	2006 n=4	total n=27	2005 n=41	2006 n=17	total n=58	2004 n=13	2005 n=5	2006 n=13	total n=31
% Letter Names													
Mean	89.42	84.63	87.41	87.62	70.20	85.04	81.42	78.06	80.44		83.06	88.48	86.98
SD	16.56	20.61	18.33	21.36	33.28	23.53	26.42	25.08	25.86		8.43	12.37	11.45
% Letter Sounds													
Mean	58.16	60.37	59.08	61.20	67.28	62.10	64.72	56.78	62.39		50.78	62.42	59.19
SD	27.41	28.43	27.60	36.48	7.37	33.72	28.87	33.32	30.16		31.98	26.04	27.35
PPVT (std)													
Mean	101.13	102.30	101.62	102.22	96.00	101.30	100.37	101.18	100.60	94.54	105.00	101.86	99.38
SD	9.62	14.13	11.61	13.63	8.16	13.04	10.21	10.88	10.32	10.22	8.77	9.63	10.34
MAT (std)													
Mean	11.16	11.22	11.18	10.70	11.25	10.78	10.20	10.94	10.41	10.92	11.40	11.36	11.19
SD	1.99	1.62	1.83	2.48	0.50	2.29	2.24	2.08	2.20	2.40	2.19	1.69	2.02
Rhyme Oddity													
Mean	8.84	9.00	8.91	8.17	9.00	8.30	8.05	8.00	8.03	6.38	9.20	8.71	7.84
SD	3.48	2.43	3.06	2.95	3.37	2.96	3.16	3.20	3.15	3.48	1.92	3.31	3.36
Phoneme Oddity													
Mean	7.59	7.73	7.65	7.30	5.25	7.00	7.90	7.65	7.83	5.15	6.80	5.23	5.45
SD	2.88	3.09	2.94	3.64	3.77	3.66	3.06	3.20	3.07	3.05	0.84	2.95	2.77

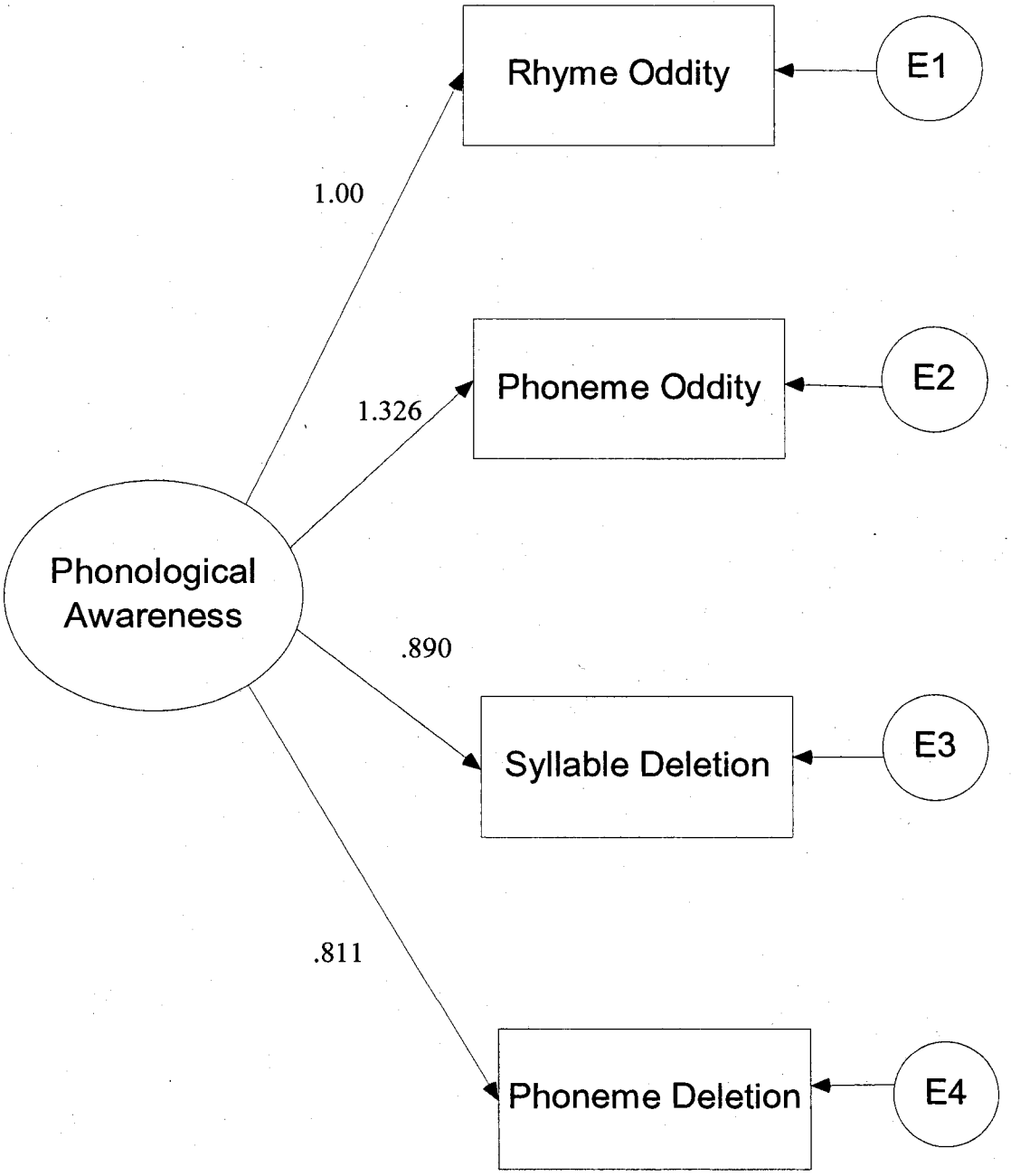
	parent +child			parent-only			child-only			low comparison group			
	2005 n=32	2006 n=23	total n=55	2005 n=23	2006 n=4	total n=27	2005 n=41	2006 n=17	total n=58	2004 n=13	2005 n=5	2006 n=13	total n=31
Syllable Deletion													
Mean	4.06	5.22	4.55	4.83	5.25	4.89	5.71	4.59	5.38	3.62	5.60	3.92	4.06
SD	2.51	1.91	2.33	2.31	2.50	2.29	2.23	3.12	2.55	1.71	1.95	2.14	2.00
Phoneme Deletion													
Mean	**0.16**	**1.39**	***0.67**	**2.61**	**0.00**	***2.22**	2.85	0.76	2.24	0.54	0.40	0.00	0.29
SD	0.88	3.12	2.19	3.80	0.00	3.62	4.17	1.89	3.76	1.45	0.55	0.00	0.97
Phonological Awareness													
Mean	20.66	23.50	21.81	22.91	19.50	22.41	24.51	21.00	23.48	15.69	22.00	16.50	17.07
SD	7.22	7.15	7.26	9.85	6.35	9.39	9.14	9.27	9.24	6.56	2.55	5.07	5.80
Word Reading													
Mean	**1.88**	**3.52**	***2.56**	**4.91**	**2.00**	***4.48**	**1.78**	2.31	1.93	**0.46**	**0.60**	**2.64**	***1.44**
SD	2.66	3.59	3.16	6.13	0.82	5.74	3.00	2.89	2.96	0.78	0.89	2.71	2.14

* Indicates significant difference in scores (to $p<.05$) between cohorts within condition

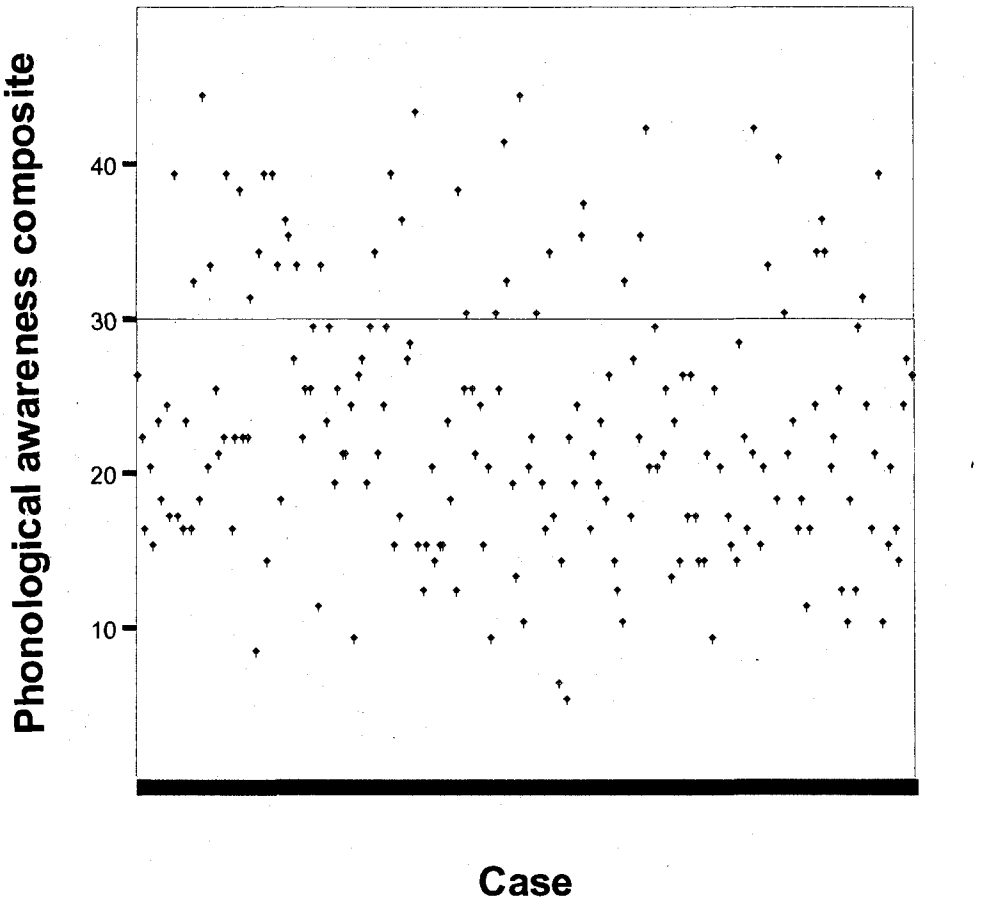
Appendix 5. Confirmatory Factor Analysis of Phonological Awareness Composite Variable

Chi-square = 14.610, $p < .001$
CMIN/DF = 7.305, $p < .001$
NFI = .904
CFI = .911
RMSEA = .101

(Unstandardized Estimates Shown)

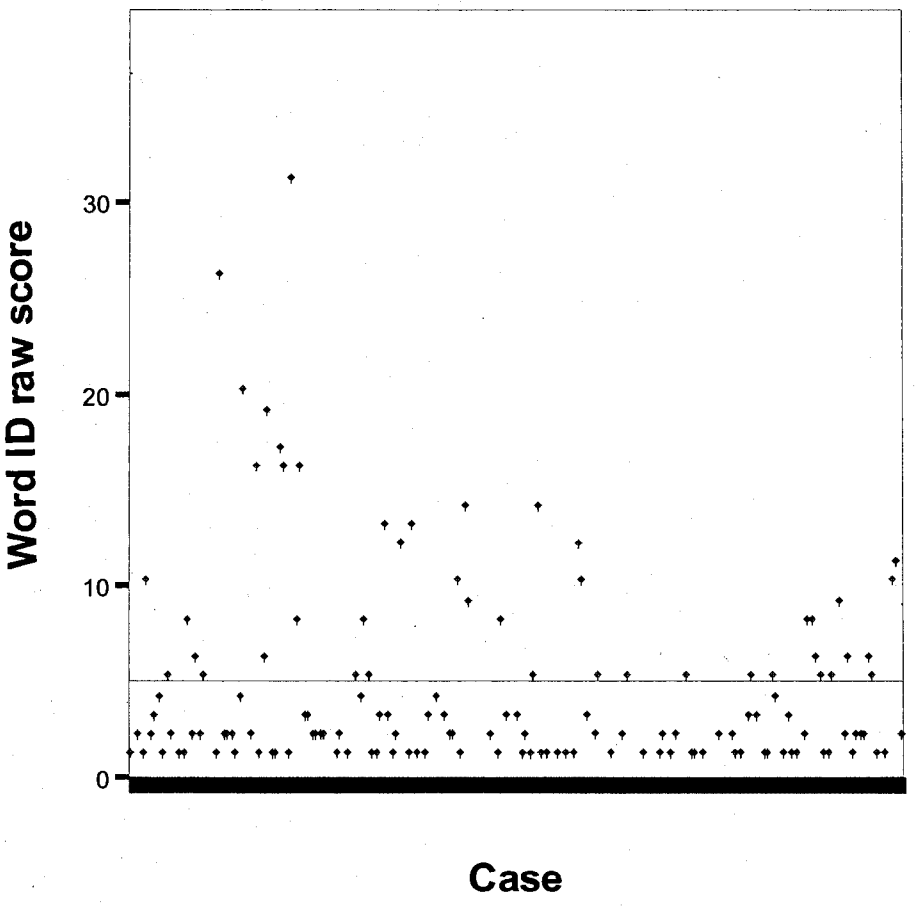


Appendix 6. Scatterplot of pre-test phonological awareness.



Appendix 6 is a scatterplot of pre-test phonological awareness for children in study two. A score of 30 was used as the cut-off to determine children low in phonological awareness. Scores are not clustered around the cut-off score of 30.

Appendix 7. Scatterplot of pre-test word reading.



Appendix 7 is a scatterplot of pre-test word reading for children in study two. A score of 5 was used as the cut-off to determine children low in word reading. There was a large floor effect for this test; many children scored between 0 and 2. Scores are not clustered around the cut-off score of 5.

Appendix 8. Correlation of assessment variables to follow-up responsiveness category

Spearman's Correlations

	Phonological Awareness				Word Reading			
	Benchmark	p	Slope	p	Benchmark	p	Slope	p
Time 1								
% Letter Names	0.180	0.31	-0.005	0.98	0.208	0.23	0.280	0.10
% Letter Sounds	**0.357**	0.04	-0.010	0.96	**0.296**	0.08	0.281	0.10
PPVT (std)	0.209	0.23	**0.482**	0.00	0.247	0.15	0.123	0.48
MAT (std)	-0.145	0.41	-0.079	0.66	-0.005	0.98	-0.178	0.31
Phonological Awareness	0.082	0.64	-0.212	0.23	0.046	0.79	0.011	0.95
Word Reading	**0.362**	0.04	**0.296**	0.09	**0.350**	0.04	0.072	0.68
Time 2								
% Letter Names	0.229	0.19	0.043	0.81	0.199	0.25	0.131	0.45
% Letter Sounds	**0.486**	0.00	0.133	0.45	0.247	0.15	0.201	0.25
PPVT (std)	0.264	0.13	**0.311**	0.07	0.283	0.10	0.285	0.10
MAT (std)	-0.095	0.59	-0.235	0.18	-0.200	0.26	-0.190	0.28
Phonological Awareness	**0.510**	0.00	-0.217	0.22	0.033	0.85	**0.304**	0.08
Word Reading	**0.525**	0.00	0.259	0.14	**0.744**	0.00	**0.446**	0.01
Listening Comprehension	**0.360**	0.04	0.274	0.12	**0.423**	0.01	0.268	0.12
RAN	0.241	0.17	0.113	0.52	0.060	0.73	0.057	0.74
Phonological Memory	0.244	0.16	0.040	0.82	0.165	0.34	0.191	0.27

Working Memory	-0.032	0.86	0.039	0.83	0.141	0.42	0.111	0.53
Time 3								
% Letter Sounds	0.249	0.16	-0.234	0.18	**0.418**	0.01	**0.580**	0.00
PPVT (std)	0.204	0.25	**0.293**	0.09	0.255	0.14	0.090	0.61
MAT (std)	0.144	0.42	0.029	0.87	-0.039	0.82	-0.207	0.23
Phonological Awareness	**0.828**	0.00	**0.515**	0.00	**0.424**	0.01	**0.313**	0.07
Word Reading	0.475	0.01	0.070	0.67	0.713	0.00	0.820	0.00
Listening Comprehension	0.126	0.48	**0.349**	0.04	0.226	0.19	0.132	0.45
RAN	**0.330**	0.06	0.144	0.42	-0.056	0.75	-0.038	0.83
Phonological Memory	0.210	0.23	0.232	0.19	0.085	0.63	0.140	0.42
Working Memory	0.110	0.54	0.109	0.54	**0.387**	0.02	0.280	0.10

Appendix 9. Home visit interview protocol

Part I
Home Observational Measure of the Environment-Early Childhood

Learning Stimulation Subscale

✓	Item (if item is not observable then ask parent)
	10 or more books for adults are visible in the home
	Parent reads a newspaper daily in the home
	Parent regularly buys or receives 1 or more magazines
	Child's art work is displayed in some visible place in the home
	Child is encouraged to learn the alphabet
	Child is encouraged to learn letters
	Child is encouraged to learn shapes
	Child is encouraged to learn numbers
	Child is encouraged to learn patterned speech
	Child is encouraged to learn spatial relationships
	Child is encouraged to learn to read few word
	Parent teaches child simple verbal manners
	Parent encourages child to talk and takes time to listen
	TV is used judiciously

Parent-Child Behaviours Subscale

✓	Item (if item is not observable then ask parent)
	Parent introduces visitor to child
	Parent uses correct grammar and pronunciation
	Parent uses complex sentence structure and vocabulary
	Parent usually responds verbally to child's speech
	Parent answers child's questions or requests verbally
	Parent converses with child 2 or more times during visit
	Parent voice conveys positive feelings about child
	Parent praises child's qualities twice during visit
	Parent helps child demonstrate some achievement during visit
	Parent does not scold or derogate or yell at child more than once during visit
	Parent does not use physical restraint during visit
	Parent neither slaps nor spanks child during visit

Part II
Parent & Child Literacy Activities

Weigel, Martin, & Bennett (2005)

- How often read aloud to children
- How often children look at books independently
- How often child asks adult to read to them
- Number of minutes children read to on previous day
- Number of picture books in home for child's use
- How often parents visited library with children

- How often parents engage in reciting rhymes to child
- How often parents engage in telling stories to child
- How often parents engage in drawing pictures with child
- How often parents engage in playing games with child

- How old was child when began reading to him/her
- How often child watches education programs on tv (like Sesame Street)

Rashid, Morris, & Sevcik (2005)

- how often parents read a newspaper
- amount of time parent spend watching tv
- how often child visits the library
- age of child when others began reading to him/her
- how much time child spends watching tv

References

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

Alexander, K. L., Entwisle, D. R., & Olsen, H. R. (1997). *Early schooling and inequality: Socioeconomic disparities in children's learning.* London, UK: Falmer Press.

Alexander, K. L., Entwisle, D. R., & Olsen, H. R. (2001). Schools, achievement, and inequality: A seasonal perspective. *Educational Evaluation and Policy Analysis, 23*, 171-191.

Arnold, D. H., Lonigan, C. J., Whitehurst, G. J., & Epstein, J. N. (1994). Accelerating language development through picture book reading: Replication and extension to a videotape training format. *Journal of Educational Psychology, 86*, 235-243.

Aarnoutse, C. & van Leeuwe, J. (2000). Development of poor and better readers during the elementary school. *Educational Research and Evaluation, 6*, 251-278.

Anthony, J. L. & Lonigan, C. J. (2004). The nature of phonological awareness: Converging evidence from four studies of preschool and early grade school children. *Journal of Educational Psychology, 96*, 43-55.

Aulls, M. W. & Sollars, V. (2003). The differential influence of the home environment on the reading ability of children entering grade one. *Reading Improvement, 40*, 164-179.

Baddeley, A. D. & Logie, R. H. (1999). The multiple-component model. In A. Miyake & P. Shah (Eds.) *Models of working memory: Mechanisms of active maintenance and executive control* (pgs 28-61). New York, NY: Cambridge University Press.

Baker, L., Scher, D., & Mackler, K. (1997). Home and family influences on motivations for reading. *Educational Psychologist, 32*, 69-82.

Bast, J. & Reistma, P. (1998). Analyzing the development of individual differences in terms of Matthew Effects in reading: Results from a Dutch longitudinal study. *Developmental Psychology, 34,* 1373-1399.

Baydar, N., Brooks-Gunn, J., & Furstenberg, F. F. (1993). Early warning signs of functional illiteracy: Predictors in childhood and adolescence. *Child Development, 64*, 815-829.

Blaiklock, K. E. (2004). The importance of letter knowledge in the relationship between phonological awareness and reading. *Journal of research in reading, 27*, 36-57.

Bradley, L. & Bryant, P. E. (1983). Categorizing sounds and learning to read: A causal connection. *Nature, 301*, 419-421.

Bradley, R. H., Caldwell, B. M., Rock, S. L. & Ramey, C. T. (1989). Home environment and cognitive development in the first three years of life: A collaborative study involving six sites and three ethnic groups in North America. *Developmental Psychology, 25*, 217-235.

Bradley, R. H., Corwyn, R. F., Pipes McAdoo, H., & Garcia Coll, C. (2001a). The home environment of children in the United States Part I: Variations by age, ethnicity, and poverty status. *Child Development, 72*, 1844-1867.

Bradley, R. H., Corwyn, R. F., Burchinal, M., McAdoo, P., & Garcia Coll, C. (2001b). The home environments of children in the Unites States Part II: Relations with behavioural development through age thirteen. *Child Development, 72*, 1868-1886.

Bruck, M. (1998). Outcomes of adults with childhood histories of dyslexia. In C. Hulme & R. M. Joshi (Eds.), *Reading and Spelling: Development and Disorders* (pp. 179-200). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Bowers, P. G., Sunseth, K., & Golden, J. (1999). The route between rapid naming and reading progress. *Scientific Studies of Reading, 3*, 31-53.

Bowers, P. G. & Wolf, M. (1993). Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Reading and Writing, 5, 69*-85.

Bus, A. G., van IJzendoorn, M. H., Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis of intergenerational transmission of literacy. *Review of Educational Research, 65*, 1-21.

Bus, A. G. & van IJzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology, 91*, 403-414.

Cardoso-Martins, C. & Pennington, B. F. (2004). The relationship between phoneme awareness and rapid serial naming skills and literacy acquisition: The role of developmental period and reading ability. *Scientific Studies of Reading, 8*, 27-52.

Caldwell, B., & Bradley, R. (1984). *Home Observation for Measurement of the Environment.* Little Rock, AR: University of Arkansas.

Carroll, J. M., Snowling, M. J., Hulme, C., & Stevenson, J. (2003). The development of phonological awareness in preschool children. *Developmental Psychology, 39*, 913-923.

Castles, A. & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91*, 77-111.

Celano, M., Hazzard, A., McFadden-Garden, T., & Swaby-Ellis, D. (1998). Promoting emergent literacy in a paediatric clinic: Predictors of parent-child reading. *Children's Health Care, 27,* 171-183.

Chall, J. S. (1996). *Learning to read: The great debate (3rd Ed.)*. New York: McGraw-Hill.

Compton, D. L. (2005). Modelling the relationship between growth in rapid naming speed and growth in decoding skill in first-grade children. *Journal of Educational Psychology, 95*, 225-239.

Compton, D. L., DeFries, J. C., & Olson, R, K. (2001). Are RAN- and phonological awareness-deficits additive in children with reading disabilities? *Dyslexia, 7*, 125-149.

Coyne, M. D., Kame'enui, E. J., Simmons, D. C., & Harn, B. A. (2004). Beginning reading intervention as inoculation or insulin: First-grade reading performance of strong responders to kindergarten intervention. *Journal of Learning Disabilities, 37*, 90-104.

Crain-Thoreson, C., Dahlin, M. P., & Powell, T. A. (2001). Parent-child interaction in three conversational contexts: Variations in style and strategy. In P. Rebello Britto & J. Brooks-Gunn (Eds.), *The Role of Family Literacy Environment in Promoting Young Children's Emerging Literacy Skills* (pp.22-37). San Francisco, CA: Jossey-Bass.

Crijnen, A. A. M., Feehan, M., & Kellam, S. G. (1998). The course of malleability of reading achievement in elementary school: The application of growth curve modeling in the evaluation of a master learning intervention. *Learning and Individual Differences, 10*, 137-152.

Cunningham, A. E. & Stanovich, K. E. (1998). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33*, 934-945.

Denton, C. A., Fletcher, J. M., Anthony, J. L., & Francis, D. J. (2006). An evaluation of intensive intervention for students with persistent reading difficulties. *Journal of Learning Disabilities, 39*, 447-466.

De Jong, P. F. (1998). Working memory deficits of reading disabled children. Journal of *Experimental Child Psychology, 70*, 75-96.

Dufva, M., Niemi, P. & Voeten, M. J. M. (2001). The role of phonological memory, word recognition, and comprehension skills in reading development: From preschool to grade 2. *Reading and Writing, 14*, 91-117.

Dunn, L. M. & Dunn, L. M. (1997). *Peabody Picture Vocabulary-Test – Third Edition*. Circle Pines, MN: AGS Publishing.

Duncan, G. L. G. & Seymour, P. H. K. (2000). Socio-economic differences in foundation-level literacy. *British Journal of Psychology, 91*, 145-166.

Echols, L. D., West, R. E., Stanovich, K. E., & Zehr, K. S (1996). Using children's literacy activities to predict growth in verbal cognitive skills: A longitudinal investigation. *Journal of Educational Psychology, 88*, 296-304.

Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading. 9*, 167-188.

Ehri, L. C., Nunes, S. R., Stahl, S. A., & Willows, D. M. (2001). Systematic phonics instruction helps students learn to read: Evidence from the National Reading Panel's meta-analysis. *Review of Educational Research, 71*, 393-447.

Elbro, C. (1996). Early linguistic abilities and reading development: A review and a hypothesis. *Reading and Writing, 8*, 453-485.

Entwisle, D. R. & Alexander, K. L. (1994). Winter setback: Race, poverty, school composition, and mathematics achievement in the first two years of school. *American Sociological Review, 57*, 72-84.

Evans, M. A., Shaw, D., & Bell, M. (2000). Home literacy activities and their influence on early literacy skills. *Canadian Journal of Experimental Psychology, 54*, 65-75.

Faires, J., Nichols, W. D., & Rickelman, R. J. (2000). Effects of parental involvement in developing competent readers in first grade. *Reading Psychology, 21*, 195-215.

Fantuzzo, J., Tighe, E., & Childs, S. (2000). Family involvement questionnaire: A multivariate assessment of family participation in early childhood education. *Journal of Educational Psychology, 92,* 367-376.

Fletcher, K. L. & Reese, E. (2005). Picture book reading with young children: A conceptual framework. *Developmental Review, 25*, 64-103.

Foorman, B. R., Francis, J. M., & Fletcher, D. J., (1995). Preventing reading failure by ensuring effective reading instruction. In S. Patton & M. Holmes (Eds.), *The keys to literacy* (pp. 29-39). Washington, DC: Council for Basic Education.

Foorman, B. R., Francis, D. J., Fletcher, J. M., Schatschneider, C., & Mehta, P. (1998). The role of instruction in learning to read: Preventing reading failure in at-risk children. *Journal of Educational Psychology, 90*, 37-55.

Foorman, B. R., Francis, D. J., Novy, D. M. & Liberman, D. (1991). How letter-sound instruction mediates progress in first-grade reading and spelling. *Journal of Educational Psychology, 83*, 456-469.

Foy, J. G. & Mann, V. (2003). Home literacy environment and phonological awareness in preschool children: Differential effects for rhyme and phoneme awareness. *Applied Psycholinguistics, 24*, 59-88.

Frijters, J. C., Barron, R. W., & Brunello, M. (2000). Direct and mediated influences of home literacy and literacy interest on prereaders' oral vocabulary and early written language skill. *Journal of Educational Psychology, 92*, 466-477.

Fuchs, D., Fuchs, L. S., & Compton, D. L. (2004). Identifying reading disabilities by responsiveness-to-instruction: Specifying measures and criteria. *Learning Disability Quarterly, 27*, 216-227.

Fuchs, D., Fuchs, L. S., Thompson, A., Al Otaiba, S., Yen, L., Yang, N. J., Braun, V., & O'Connor, S. E. (2001). Is reading important in reading-readiness programs? A randomized field trial with teachers as program implementers. *Journal of Educational Psychology, 93*, 251-267.

Fuchs, D., Mock, D., Morgan, P. L., & Young, C. L. (2003). Responsiveness-to-intervention: Definitions, evidence, and implications for the learning disabilities construct. *Learning Disabilities Research & Practice, 18*, 157-171.

Fuchs, L. S. (2003). Assessing intervention responsiveness: Conceptual and technical issues. *Learning Disabilities Research & Practice, 18*, 172-186.

Gathercole, S. E. & Baddeley, A. D. (1993). *Working memory and language: Essays in cognitive development.* Hillside, NJ: Lawrence Erlbaum Associates.

Gebotys, R. (2007). *Personal communication, March 2007.*

Goff, D. A., Pratt, C., & Ong, B. (2005). The relations between children's reading comprehension, working memory, language skills and components of reading decoding in a normal sample. *Reading and Writing, 18*, 583-616.

Goswami, U. & Bryant, P. E. (1990). *Phonological skills and learning to read.* East Sussex, UK: Psychology Press.

Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (1998). Role of cognitively stimulating home environment in children's academic intrinsic motivation: A longitudinal study. *Child Development, 69*, 1448-1460.

Gough, P. B. (1996). How children learn to read and why they fail. *Annals of Dyslexia, 46*, 3-20.

Haney, M. & Hill, J. (2004). Relationships between parent-teaching activities and emergent literacy in preschool children. *Early Child Development and Care, 174*, 215-228.

Hart, G. & Risley, T. R. (1995). *Meaningful Differences in the Everyday Experience of Young American Children*. Baltimore, MD: P. H. Brookes Publishing.

Hatcher, P. J. & Hulme, C. (1999). Phonemes, rhymes, and intelligence as predictors of children's responsiveness to remedial reading instruction: Evidence from a longitudinal intervention study. *Journal of Experimental Child Psychology, 72*, 130-153.

Hecht, S. A. & Close, L. (2002). Emergent literacy skills and training time uniquely predict variability in responses to phonemic awareness training in disadvantaged kindergartners. *Journal of Experimental Child Psychology, 82*, 93-115.

Hoff-Ginsberg, E. (1991). Mother-child conversation in different social classes and communicative settings. *Child Development, 62*, 782-796.

Hoien, T., Lundberg, I., Stanovich, K. E., & Bjaalid, I. K. (1995). Components of phonological awareness. *Reading and Writing, 7*, 171-188.

Hogan, T. P., Catts, H. W., & Little, T. D. (2005). The relationship between phonological awareness and reading: Implications for the assessment of phonological awareness. *Language, Speech, and Hearing Services in Schools, 36*, 285-293.

Hulme, C., Hatcher, P. J., Nation, K., Brown, A., Adams, J., & Stuart, G. (2002). Phoneme awareness is a better predictor of early reading skill than onset-rime awareness. *Journal of Experimental Child Psychology, 82*, 2-28.

Jeynes,W. H. (2005). A meta-analysis of the relation of parental involvement to urban elementary school academic achievement. *Urban Education, 40*, 237-269.

Johnston, R. S. & Anderson, M. (1998). Memory span, naming speed, and memory strategies in poor and normal readers. *Memory, 6*, 143-163.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first to fourth grades. *Journal of Educational Psychology, 80*, 437-447.

Juel, C. (1996). What makes literacy tutoring effective. *Reading Research Quarterly, 31*, 268-289.

Leach, D. J. & Siddall, S. W. (1990). Parental involvement in the teaching of reading: A comparison of hearing reading, paired reading, pause, prompt, praise, and direct instruction methods. *British Journal of Educational Psychology, 60*, 349-355.

Leseman, P. P. M. & de Jong, P. F. (1998). Home literacy : Opportunity, instruction, cooperation, and social-emotional quality predicting early reading achievement. *Reading Research Quarterly, 33*, 294-318.

Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology, 36*, 596-613.

Luftig, R. L. (2003). When a little bit means a lot: The effects of a short-term reading program on economically disadvantaged elementary schoolers. *Reading Research and Instruction, 42*, 1-13.

Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23*, 263-284.

Mann, V. A., Liberman, I. Y., & Shakweiler, D. (1980). Children's memory for sentences and word strings in relation to reading ability. *Memory & Cognition, 8*, 329-335.

Marjanovic Umek, L., Podlesek, A., & Fekonja, M. (2005). Assessing the home literacy environment: Relationship to child language comprehension and expression. European *Journal of Psychological Assessment, 21*, 271-281.

McBride-Chang, C. (1995). What is phonological awareness? *Journal of Educational Psychology, 87*, 179-192.

McBride-Chang, C. (1996). Models of speech perception and phonological processing in reading. *Child Development, 67*, 1836-1856.

McBride-Chang, C. & Manis, F. R. (1996). Structural invariance in the association of naming speed, phonological awareness, and verbal reasoning in good and poor readers: A test of the double deficit hypothesis. *Reading and Writing, 8*, 323-339.

McBride-Chang, C., Wagner, R. K., & Chang, L. (1997). Growth modeling of phonological awareness. *Journal of Educational Psychology, 89*, 621-630.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*, 185-204.

McNamara, J. K., Scissons, M., & Dahleu, J. (2005). A longitudinal study of early identification markers for children at-risk for reading disabilities : The Matthew Effect and the challenge of over-identification. *Reading Improvement, 42*, 80 – 97.

Madelaine, A. & Wheldall, K. (2005). Identifying low-progress readers: Comparing teacher judgments with a curriculum-based measurement procedure. *International Journal of Disability, Development and Education, 52*, 33-42.

Mathes, P. G., Denton, C. A., Fletcher, J. M., Anthony, J. L., Francis, D. J., & Schatschneider, C. (2005). The effects of theoretically different instruction and student characteristics on the skills of struggling readers. *Reading Research Quarterly, 40*, 148-182.

Metsala, J. L. & Walley, A. C. (1998). Spoken vocabulary growth and the segmental restructuring of lexical representations: Precursors to phonemic awareness and early reading ability. In J. L. Metsala & L. C. Ehri (Eds.) *Word recognition in beginning literacy*. (pp. 89-120). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Molfese, V. J., Modglin, A., & Molfese, D. L. (2003). The role of environment in the development of reading skills: A longitudinal study of preschool and school-age measures. *Journal of Learning Disabilities, 36*, 59-67.

Morais, J., Clay, L., Alegria, J., & Bertelson, P. (1979). Does awareness of speech as a sequence of phonemes arise spontaneously? *Cognition, 7*, 323-331.

Muter, V., Hulme, C., & Snowling, M. (1997). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology, 65*, 370-396.

Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1998). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology, 71*, 3 – 12.

Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes, vocabulary, and grammatical skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology, 40*, 665-681.

Nation, K. & Hulme, C. (1997). Phonemic segmentation, not onset-rime segmentation, predicts early reading and spelling skills. *Reading Research Quarterly, 32*, 154-167.

Dickinson, D. K. & Neuman, S. B. (2006). *Handbook of Early Literacy Research. Vol 2.* New York, New York: Guilford Press.

Oakhill, J. & Kyle, F. (2000). The relation between phonological awareness and working memory. *Journal of Experimental Child Psychology, 75*, 152-164.

Passolunghi, M. C. & Siegel, L. S. (2001). Short-term memory, working memory, and inhibitory control in children with difficulties in arithmetic problem solving. *Journal of Experimental Child Psychology, 80*, 44-57.

Pennington, B. F. & Lefly, D. L. (2001). Early reading development in children at family risk for dyslexia. *Child Development, 72*, 816-833.

Perfetti, C. A. (1985). *Reading ability*. New York: Oxford Press.

Peralta de Mendoza, O. A. (1995). Developmental changes and socioeconomic differences in mother-infant picturebook reading. *European Journal of Psychology of Education, 10,* 261-272.

Pokorni, J. L., Worthington, C. K., & Jamison, P. L. (2004). Phonological awareness intervention: Comparison of Fast ForWord, Earobics, and LiPS. *Journal of Educational Research, 97*, 147-157.

Purcell-Gates, V. (2001). Emergent literacy is emerging knowledge of written, no oral, language. In P. Rebello Britto & J. Brooks-Gunn (Eds.), *The Role of Family Literacy Environment in Promoting Young Children's Emerging Literacy Skills* (pp.6-22). San Francisco, CA: Jossey-Bass.

Rack, J., Hulme, C., Snowling, M., & Wightman, J. (1994). The role of phonology in young children learning to read words: The direct-mapping hypothesis. *Journal of Experimental Child Psychology, 57*, 42-71.

Rack, J. P., Hulme, C., & Snowling, M. J. (1993). Learning to read: A theoretical synthesis. In H. W. Reese (Ed.*), Advances in child development and Behavior, Vol 24 (pp. 99-132*). San Diego, CA: Academic Press.

Rashid, F. L., Morris, R. D., & Sevcik, R. A. (2005). Relationship between home literacy environment and reading achievement in children with reading disabilities. *Journal of Learning Disabilities, 38*, 2-11.

Rack, J. P., Snowling, M. J., & Olsen, R. K. (1992). The nonword reading deficit in developmental dyslexia: A review. *Reading Research Quarterly, 27*, 28-53.

Raz, I. S. & Bryant, P. (1990). Social background, phonological awareness and children's reading. British *Journal of Developmental Psychology, 8*, 209-225.

Reese, E., Cox, A., Harte, D., & McAnally, H. (2003). Diversity in adults' styles of reading books to children. In A. vanKleeck, S. A. Stahl, & E. B. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 37-57). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Roberts, J., Jurgens, J., & Burchinal, M. (2005). The role of home literacy practices in preschool children's language and emergent literacy skills. *Journal of Speech, Language, and Hearing Research, 48*, 345-359.

Rosner, J. & Simon, D. P. (1971). The auditory analysis test: An initial report. *Journal of Learning Disabilities, 4*, 384-392.

Saint-Laurent, L. & Giasson, J. (2005). Effects of a family literacy program adapting parental intervention to first graders' evolution of reading and writing abilities. *Journal of Early Childhood Literacy, 5*, 253-278.

Scarborough, H. S. (1998). Predicting the future achievement of second graders with reading disabilities: Contributions of phonemic awareness, verbal memory, rapid naming, and IQ. *Annals of dyslexia, 68*, 115-136.

Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In Neuman, S. B., & Dickinson, D.K. (Eds.), *Handbook of early literacy research* (pp 97-110). New York, NY: Guilford Press.

Scarborough, H. S. & Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental Review, 14*, 245-302.

Schacter, J. (2003). Preventing summer reading declines in children who are disadvantaged. *Journal of Early Intervention, 26*, 47-58.

Schacter, J. & Jo, B. (2005). Learning when school is not in session: A reading summer day-camp intervention to improve the achievement of exiting first-grade students who are economically disadvantaged. *Journal of Research in Reading, 28*, 158-169.

Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C. D., & Foorman, B. R. (2004). Kindergarten Prediction of Reading Skills: A Longitudinal Comparative Analysis. *Journal of Educational Psychology, 96*, 265-282.

Schatschneider, C., Francis, D. J., Foorman, B. R., Fletcher, J. M., & Mehta, P. (1999). The dimensionality of phonological awareness: An application of item response theory. *Journal of Educational Psychology, 91*, 439-449.

Schnieder, W., Roth, E., & Ennemoser, M. (2000). Training phonological skills and letter knowledge in children at risk for dyslexia: A comparison of three kindergarten interventions. *Journal of Educational Psychology, 92*, 284-295.

Schwartz, R. M. (2005). Literacy learning of at-risk first-grade students in the Reading Recovery early intervention. *Journal of Educational Psychology, 97*, 257-267.

Senechal, M. & LeFevre, J. (2001). Storybook reading and parent teaching: Links to language and literacy development. In P. Rebello Britto & J. Brooks-Gunn (Eds.), *The Role of Family Literacy Environment in Promoting Young Children's Emerging Literacy Skills* (pp.39-52). San Francisco, CA: Jossey-Bass.

Senechal, M. & LeFevre, J. (2002). Parental involvement in the development of children's reading skill: A five-year longitudinal study. *Child Development, 73*, 445-460.

Senechal, M., LeFevre, J., Hudson, E., & Lawson, P. (1996). Knowledge of picture-books as a predictor of young children's vocabulary. *Journal of Educational Psychology, 88*, 520-536.

Senechal, M., LeFevre, J., Smith-Chant, B. L., & Colton, K. (2001). On refining theoretical models of emergent literacy: The role of empirical evidence. *Journal of School Psychology, 38,* 439-460.

Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition, 55*, 151-218.

Share, D. L., Jorm, A. F., Maclean, R., & Matthews, R. (1984). Sources of individual differences in reading acquisition. *Journal of Educational Psychology, 76*, 1309-1324.

Shaywitz, B. A., Holford, T. R., Holahan, J. M., & Fletcher, J. M. (1995). A Matthew effect for IQ but not for reading: Results from a longitudinal study. *Reading Research Quarterly, 30*, 894-906.

Siegel, L. S. (1989a). Why we do not need intelligence test scores in the definition and analyses of learning disabilities. *Journal of Learning Disabilities, 22*, 514-518.

Siegel, L. S. (1989b). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities, 22*, 469-472.

Siegel, L. S. (1993). Phonological processing deficits as the basis of a reading disability. *Developmental Review, 13*, 246-257.

Siegel, L. S. & Linder, B. A. (1984). Short-term memory processes in children with reading and arithmetic learning disabilities. *Developmental Psychology, 20*, 200-207.

Spira, E. G., Bracken, S. S., & Fischel, J. E. (2005). Predicting improvement after first-grade reading difficulties: The effects of oral language, emergent literacy, and behaviour skills. *Developmental Psychology, 41*, 225-234.

Stahl, S. A. & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*, 221-234.

Stanovich, K. E. (1986). Matthew Effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360-407.

Stanovich, K. E. (1988). The right and wrong places to look for the cognitive locus of reading disability. *Annals of Dyslexia, 38*, 154-177.

Stanovich, K. E. (1992). Stanovich's Reply. *Reading Research Quarterly, 27*, 175-176.

Stanovich, K. E. (1999). The sociopsychometrics of learning disabilities. *Journal of Learning Disabilities, 32*, 350-361.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues in task comparability. *Journal of Experimental Child Psychology, 38*, 175-190.

Stanovich, K. E. & Siegel, L. S. (1994). Phenotype performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. *Journal of Educational Psychology, 86*, 24-53.

Storch, S. A. & Whitehurst, G. J. (2001). The role of family and home in the literacy development of children from low-income backgrounds. In P. Rebello Britto & J.

Brooks-Gunn (Eds.), *The Role of Family Literacy Environment in Promoting Young Children's Emerging Literacy Skills* (pp.53-71). San Francisco, CA: Jossey-Bass.

Swanson, H. L. (1994). The role of working memory and dynamic assessment in the classification of children with learning disabilities. *Learning Disabilities Research & Practice, 9*, 190-202.

Swanson, H. L. (2003). Age-related differences in learning disabled and skilled readers' working memory. *Journal of Experimental Child Psychology, 85*, 1-31.

Swanson, H. L., Howard, C. B., & Saez, L. (2006). Do different components of working memory underlie different subgroups of reading disabilities? *Journal of Learning Disabilities, 39*, 252-269.

Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research & Practice, 15,* 55-64.

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

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

Vaughn, S., Linan-Thompson, S., & Hickman, P. (2003). Response to instruction as a means of identifying students with reading/learning disabilities. *Exceptional Children, 69*, 391-409.

Vellutino, F. R., Scanlon, D. M., Sipay, E. R., Small, S. G., Pratt, A., Chen, R., & Denckla, M. B. (1996). Cogntive profiles of difficult-to-remediate and readily remediated poor readers: Early intervention as a vehicle for distinguishing between cognitive and

experiential deficits as basic causes of specific reading disability. *Journal of Educational Psychology, 88*, 601-638.

Vukovic, R. K. & Siegel, L. S. (2006). The double-deficit hypothesis: A comprehensive analysis of the evidence. *Journal of Learning Disabilities, 39*, 25-47.

Wagner, R. K. & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*, 192-212.

Wagner, R, K., Torgesen, J. K., & Rashotte, C. A. (1999). *Comprehensive Test of Phonological Processing*. Austin, TX: Pro-Ed.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J., & Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology, 33*, 468-479.

Wagner, R. K., Torgesen, J. K., Laughton, P., Simmons, K., & Rashotte, C. A. (1993). Development of young readers' phonological processing abilities. *Journal of Educational Psychology, 85*, 83-103.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1994). Development of reading-related phonological processing abilities: New evidence of bidirectional causality from a latent variable longitudinal study. *Developmental Psychology, 30*, 73-87.

Walberg, H. J. & Tsai, S. L. (1983). Matthew effects in education. *American Educational Research Journal, 20,* , 359-373.

Weigel, D. J., Martin, S. S., & Bennett, K. K. (2006). Contributions of the home literacy environment to preschool-aged children's emerging literacy and language skills. *Early Child Development and Care, 176*, 357-378.

Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1998). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology, 91*, 261-272.

Whitehurst, G. J. & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*, 848-872.

Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology, 91*, 261-272.

Whitehurst, G. J., Arnold, D. H., Epstein, J. N., Angell, A. L., Smith, M., Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30*, 679-689.

Whitehurst, G. J., Epstein, J. N., Angell, A. L., Payne, A. C., Crone, D. A., & Fischell, J. E. (1994). Outcomes of an emergent literacy intervention in Head Start. *Journal of Educational Psychology, 86*, 542-555.

Wolf, M., & Bowers, P. G. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology, 91*, 415–438.

Wolf, M., O'Rourke, A. G., Gidney, C., Lovett, M., Cirino, P., & Morris, R. (2002). The second deficit: An investigation of the independence of phonological and naming-speed deficits in developmental dyslexia. *Reading and Writing, 15*, 43-72.

Woodcock, R. W. (1991). *Woodcock Language Proficiency Battery-Revised*. Itasca, IL: Riverside Publishing Company.

Wilks, R. T. & Clarke, V. A. (1988). Training versus non-training of mothers as home reading tutors. *Perceptual and Motor Skills, 67*, 135-142.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. R*eading Research Quarterly, 23*, 159-177.