Effectiveness of Phonological Awareness Intervention for Kindergarten Children with Language Impairment

L'efficacité de l'intervention en conscience phonologique auprès d'enfants de la maternelle ayant des problèmes de langage.

Cecelia Hund-Reid
Phyllis Schneider

KEY WORDS
PHONOLOGICAL AWARENESS
LANGUAGE IMPAIRMENT
KINDERGARTEN
INTERVENTION
EMERGENT LITERACY

Abstract

Purpose: This study investigated the effectiveness of phonological awareness (PA) intervention in improving the PA skills of kindergarten children with moderate to severe language impairment.

Method: Thirty-seven kindergarten children aged between 4;9 and 6;3 (years;months) who demonstrated moderate to severe receptive or expressive or total language skills and low PA skills were randomly assigned to either an experimental group (n=22) and received PA and letter-sound awareness intervention or a no intervention control group (n=15). The intervention was implemented by educational assistants in groups of two children for 14 weeks, 20 minutes per day, 5 days per week, for a total 67 days. Participants received an average of 18.45 hours of intervention (SD 4.64, range 12.75-21.5 hours) that focused on initial sound identification, phonemic segmentation and blending, and letter-sound awareness.

Results: Participants in the experimental group made significantly greater gains than those in the control group on measures of initial sound fluency, phonemic segmentation fluency, and nonsense word fluency. Results were maintained for at least one month after intervention.

Conclusion: Kindergarten children with moderate to severe language impairment who receive direct, explicit, intensive, small group PA intervention demonstrate significantly better PA skills than children with moderate to severe language impairment who do not receive this intervention.

Abrégé

But : Cette étude visait l'évaluation de l'efficacité d'une intervention en conscience phonologique auprès d'enfants de la maternelle ayant un problème de langage modéré à sévère.

Méthodologie : Trente-sept enfants de la maternelle, de 4 ans, 9 mois à 6 ans, 3 mois ayant des problèmes de langage de degré modéré à sévère au plan réceptif ou expressif, ou dans les deux à la fois, ainsi que de faibles connaissances phonologiques ont participé à l'étude. Ils ont été assignés au hasard à un groupe expérimental (n=22) où ils recevaient une intervention visant à travailler la conscience phonologique et la conscience de l'association lettre-son ou à un groupe contrôle sans intervention (n=15). L'intervention a été effectuée par des assistants en éducation auprès de groupes de deux enfants pendant 14 semaines, vingt minutes par jour, cinq jours par semaine, pour un total de 67 jours. Les participants ont reçu en moyenne 18,45 heures d'intervention (SD 4.64, entre 12,75 et 21,5 heures) regroupant des activités d'identification initiale des sons, de segmentation et fusionnement phonémiques ainsi que des activités centrées sur l'association entre sons et lettres.

Résultats : Les participants du groupe expérimental se sont significativement améliorés comparativement à ceux du groupe contrôle sur des mesures de fluidité initiale de sons, fluidité de segmentation phonémique et fluidité de non-mots. Les résultats se sont maintenus pendant au moins un mois après l'intervention.

Conclusion : Les enfants de la maternelle ayant un problème de langage modéré à sévère ayant reçu une intervention directe, explicite et intensive à la conscience phonologique en petits groupes démontrent des aptitudes considérablement supérieures à ceux de même niveau de déficiences langagières qui n'ont pas reçu d'intervention.

Cecelia Hund-Reid, Ph.D., R.SLP, S-LP(C), CCC
Faculty of Rehabilitation Medicine, University of Alberta
Edmonton, AB
Canada

Phyllis Schneider, Ph.D.
Speech Pathology and Audiology, University of Alberta
Edmonton, AB
Canada

Introduction

Phonological awareness (PA) is a broad term that consists of an awareness of sound including rhyme and alliteration. It also takes into account identifying and manipulating larger parts of spoken language including words, syllables, and onsets and rimes. Phonemic awareness is a subcategory of PA and has a narrower focus. Phonemic awareness is the ability to identify, think about, and manipulate the individual sounds in words, and is an essential skill in the acquisition of early literacy skills (National Early Literacy Panel, 2008; National Reading Panel, 2000; National Strategy for Early Literacy, 2009). Most children at the kindergarten level who have well-developed PA skills—in the absence of higher level language problems, lack of motivation, or other reasons that impede development of early literacy skills—become better readers and spellers than children who lack phonological awareness skills (National Reading Panel, 2000). Children who lack PA skills may experience challenges in learning to read. Children who experience difficulties in reading may experience a widening academic distancing from their peers. This gap in reading ability between students who experience difficulty and students who experience success with learning to read continues to increase over time (Stanovich, 1986).

Phonological Awareness and Letter-Sound Awareness Intervention Studies for Children at Risk for Reading Failure

Many studies have been conducted in which children at risk for reading failure have been given PA intervention. The National Reading Panel (2000) reviewed the studies conducted prior to 2000 and concluded that PA intervention was effective at improving PA when it focused on phonemic segmentation and blending, and when it was accompanied by intervention in letter-sound correspondence. Three studies that incorporated phonemic segmentation and blending and letter-sound awareness into the interventions for kindergarten children are described below.

Blachman, Ball, Black, & Tangel, (1994) investigated a kindergarten phonological awareness intervention using explicit instruction in PA activities from *Road to the Code*: A Phonological Awareness Program for Young Children, a resource manual created byBlachman, Ball, Black, and Tangel (2000). The study involved 84 treatment children and 75 control children. Children, who scored in the low-average range of receptive vocabulary, had very limited knowledge of the alphabet, and were generally less skilled than students in a previous study by the researchers, participated in the study. They received forty-one 15 to 20 minute lessons in phoneme segmentation and letter name and sound instruction. The researchers expanded a 7-week intervention trialed in a previous study to 11 weeks. Kindergarten teachers and their classroom teaching assistants implemented the program with small groups of children. Children in the control group received whole class instruction in letter names and sounds. At the end of kindergarten, results from post-testing indicated that treatment children performed significantly better on tests of phoneme segmentation and letter-name and sound-knowledge, reading of phonetically regular words and non-words and on a measure of developmental spelling than the children in the control group. The researchers followed up with the kindergarten children who were the lowest scorers and provided additional PA and letter name and letter sound instruction for up to 12 weeks during grade one. The grade one intervention program continued to build on PA by emphasizing the alphabetic code. The researchers noted the most significant finding was that as length and complexity of the intervention increased, they had fewer non-responders to the intervention (Blachman, Tangel, Ball, Black, & McGraw 1999).

O'Connor, Bocian, Beebe-Frankenberger & Linklater (2010) conducted a study to evaluate the responsiveness of kindergarten children, described as having poor language skills, to an intervention that included phonemic awareness, alphabetic understanding, and oral language. The 69 students in this study presented with receptive vocabulary standard scores below 85 and were described as having mild cognitive impairments, students learning English, and students with low language skills because of other conditions. Letter-naming and initial sound identification screening scores for this sample were in an at-risk range and nearly half of the students were English language learners. Thirty-eight students were randomly assigned to an immediate intervention group that began intervention in September and continued for the full school year and 31 students were randomly assigned to a delayed treatment group that began intervention in mid-February. Students received pull-out sessions with a teacher assistant in 15 minute sessions three times per week in small groups of two or three students. The intervention included focused instruction on alphabet knowledge, phonemic awareness, and oral language. The authors report the differences between the immediate and delayed intervention groups on outcome measures of Letter Naming Frequency, Phonemic Segmentation Frequency, and Nonsense Word Frequency at year end were statistically significant in favour of the immediate intervention group. The researchers reported these

results suggested that longer interventions may be needed for students who grow slowly in these skills.

Schuele et al. (2008) reported on the outcomes of a two-tiered response to intervention model for delivering PA intervention. A total of 113 kindergarten children from six classrooms participated in the study. Fifty-seven kindergarten students from three comparison classrooms received the school-adopted literacy curriculum and 56 kindergarten students from three classrooms received a supplemental classroom PA program in addition to the school literacy program. A literacy battery was administered in October, January, and May. The literacy subtests included rhyme awareness, beginning sound awareness, alphabet knowledge, letter sounds, spelling and word recognition. Six low literacy achievers were identified in each supplemental classroom based on the January results of the literacy subtests. These 18 children received an additional 12-week small-group intervention administered by the school Speech Language Pathologist in a pull-out session with six children with three 30 minute sessions weekly. Skills targeted included letter-sound awareness, rhyme, initial sounds, final sounds, and segmentation and blending. Year-end measures included letter-sound knowledge, word recognition, and developmental spelling. The classroom based supplemental curriculum did not produce statistically significant gains for typically achieving children on these measures however the add-on tier of supplemental instruction resulted in statistically significant gains on a measure of developmental spelling for the low achieving children receiving the 12- week small group intervention.

The children in the above studies were described as having low receptive vocabulary, poor language skills, or low literacy achievers and not clearly identified as language impaired. Thus, it is unclear if the results would extend to children with a diagnosis of moderate to severe language impairment.

Kindergarten Children with Language Impairment

It is estimated that 7.4% of 5-year-olds have Specific Language Impairment (SLI) (Tomblin et al., 1997). Children diagnosed as having SLI demonstrate a significant deficit in production and/or comprehension of language in the absence of cognitive delay, hearing impairment, emotional or psychiatric disorders or evident neurological dysfunction (Leonard, 1997). The operation of both the semantic and phonological pathways of the majority of children with language impairments is compromised (Snowling, 2005). For children with language impairment whose language problems are still present at 5½ years of age, difficulties with language and learning to read and write are likely to continue into adolescence and even adulthood. Results from longer term follow up studies have revealed difficulties with reading decoding, spelling, and reading comprehension at 15 years of age even for a subgroup of children whose language impairments had resolved by 5½ years (Bishop & Adams, 1990; Boudreau & Hedberg, 1999).

Children with Language Impairment and Low PA and Letter-Sound Awareness

As with children with typically developing language, PA is correlated to early reading development in children with early language impairment (Boudreau & Hedberg, 1999; Catts, Fey, Tomblin, & Zhang, 2002; Catts, Fey, Zhang, & Tomblin, 1999). Problems in oral language are observable before children begin formal reading instruction, and variables that predict reading outcomes in Grade 2 include phonological awareness ability in kindergarten (Catts et al., 2002). Children with language impairment will often have low PA resulting in a large initial gap in PA between children with language impairment and children with typically developing language (Puranik, Petscher, Al Otaiba, Catts, & Lonigan, 2008). Children with language impairment and low PA and letter-sound awareness may run a high risk of experiencing literacy difficulties due to their early oral language and PA deficits. Specifically, these children may be slow to decode words and have less resources remaining for the higher level reading comprehension skills necessary for proficient reading (Snowling, 2005).

There is evidence that children with low PA and letter-sound awareness skills differ from their peers as a result of their difficulty in associating letters to sounds, segmenting words into individual speech sounds and blending sounds to form words (Adams, 1990; Muter, Hulme, Snowling, & Taylor, 1997; Stanovich, 1986; Torgesen, Wagner, Rashotte, Alexander, & Conway, 1997). Given these challenges with acquiring critical pre-literacy skills, it is essential that children diagnosed with language impairment receive intervention to help them understand that letters of the alphabet stand for sounds that occur in words (Adams, 1990; Bus & van Ijzendoorn, 1999).

Intervention Studies of Children with Language Impairment

A large body of research on the effectiveness of phonemic awareness and letter sound instruction exists. Despite the large body of research that has been conducted, few studies have specifically examined the effectiveness of PA intervention for children with language impairment (Scheule & Boudreau,

2008). However, children with language impairment experiencing difficulty with developing phonological awareness are 4 to 5 times more likely to have reading difficulties than children from the general population (Catts et al., 1999). Studies that describe PA intervention among children with language impairment are described below.

Fazio (1997a, 1997b) conducted two simple, brief exploratory studies in which preschool children with language impairments were trained to increase their rhyming skills. Although the author found that rhyme could be improved, these studies did not attempt to relate children's rhyming ability to later reading success. Rhyming was not found in other studies to be a predictor of reading and spelling ability (Nation & Hulme, 1997; Yeh, 2003). Blachman (2000) noted learning to recognize and produce rhyming words is not enough to bring children at risk for reading difficulties to the level of awareness of the phonological structure of words required to learn to read and spell.

In contrast to Fazio's focus on rhyme, Warrick, Rubin, & Rowe-Walsh (1993) explored teaching preschool children with language impairment in a developmental sequence including syllable awareness, initial sound awareness, onset-rime and rhyme recognition, and phonemic segmentation. The researchers found that children with language impairment who received the PA intervention demonstrated significantly better scores on measures of PA than did the children with language impairment in the no-intervention control group. Furthermore, in a 1 year follow up, children with language impairment compared with children with typically developing language skills were equivalent on the phoneme awareness tasks with the exception of one phoneme subtest (Repairs). The groups were also equivalent on word identification and word attack reading measures (Warrick et al., 1993). This suggests that children with language impairment can improve their PA using phonemic based tasks in a developmental sequence, and that such training can improve word identification and word attack skills. Research staff provided the intervention to children in small groups using researcher-made phoneme awareness tasks. No fidelity of treatment was reported.

Segers and Verhoeven (2004) investigated PA interventions for preschool children with language impairment and included three groups. Group 1 received a PA blending and segmenting computer program, Group 2 received the same program but with a slowed speech rate. A control group was assigned to a computer vocabulary game intervention. The researchers reported Group 1 made more progress on the PA tasks than the control group. No statistically significant differences were found between Group 1 and Group 2 or between Group 2 and the control group. No fidelity of treatment data was reported. Thus it appears that an intervention program focusing on blending and segmentation can be effective at increasing PA for children with language impairment when delivered at a normal speech rate. However, the results were not clear due to lack of information on whether treatment differences or implementation differences accounted for the pattern of performance among the groups.

The children in each of the above studies were not clearly identified as having a diagnosis of moderate to severe language impairment. It is possible that because of their weak language skills, children with moderate to severe language impairment would not benefit from PA intervention.

Implications of Intervention Studies of PA and Letter-Sound Awareness

Results from intervention studies indicate that explicit and systematic training in PA and letter-sound awareness has a positive impact on decoding and spelling skills and that these skills can be effectively trained with a subsequent positive impact on reading achievement (Blachman et al., 1994; Lundberg, 2009; Lundberg, Frost, & Petersen, 1988; National Reading Panel, 2000; O'Connor, Jenkins, & Slocum, 1995; Torgesen, Morgan, & Davis, 1992). More specifically, evidence from research studies indicates that the most effective strategy for intervention is to teach children to segment and blend sounds and to develop their letter-sound awareness. These skills are necessary to develop the alphabetic principle that will enable children to independently translate a graphic symbol into a sound and to more easily acquire word decoding skills (Ball & Blachman, 1991, Davidson & Jenkins, 1994; O'Connor, Jenkins, & Slocum, 1995). Ball and Blachman found in their research that training in PA alone can produce significant improvement in PA and subsequent reading growth; however, including activities consistently linking reading and phonology such as letter-sound associations was the most effective way to teach pre-reading skills. This approach consistently produced the largest gains in reading (Ball & Blachman, 1991; National Reading Panel, 2000; Bus & van Ijzendoorn, 1999).

Currently, there is limited knowledge about the effectiveness of PA intervention for kindergarten children with moderate to severe language impairment. The studies that did include children with specific diagnoses of language impairment did not conduct their studies in a school context, making them more difficult to adapt and implement in real-life settings (Al Otaiba, Puranik, Ziolkowski, & Montgomery, 2009; O'Connor et

al.,, 2010; Schuele & Boudreau, 2008). We do not know the extent to which kindergarten children with a diagnosis of moderate to severe language impairment respond or fail to respond to early intervention in phonological and letter sound awareness delivered in their school settings. Research is necessary to ensure that outcomes in phonological awareness and letter-sound awareness development for children with specific diagnosis of moderate to severe language impairment are as positive as possible.

Thus, as a first step, it is important to know whether or not these skills could be strengthened through intervention for these children. It is equally important to know whether intervention could be conducted in a school context, using school personnel and materials that are readily available. If intervention could be successfully conducted under these conditions, it is more likely to be adopted and implemented on a regular basis.

The Current Study

The purpose of the current study was to investigate the effectiveness of PA and letter-sound awareness intervention conducted in a school context in improving the PA and letter-sound awareness skills of kindergarten children with moderate to severe language impairment. To determine effectiveness, we compared the PA and letter-sound awareness skills of a group of children with language impairment who received small group, direct and explicit PA and letter-sound awareness intervention to the PA and letter-sound awareness skills of a no-intervention control group of children with language impairment. Segmenting and blending at the phoneme level and the ability to link letters with sounds was the primary focus of the intervention. These skills have been found to predict reading achievement in previous research (National Reading Panel, 2000). Three research questions were formulated for this study:

1. Do kindergarten children with moderate to severe language impairment and low PA and letter-sound awareness skills who receive small-group, direct, explicit PA and letter-sound awareness intervention show a greater increase in these skills than children with language impairment who do not receive this intervention (no-intervention control group)?
2. Were the effects of the intervention maintained for PA and letter-sound awareness performance after the intervention was discontinued?
3. How many children responded appropriately to the intervention provided?

METHOD

Setting. Ten kindergarten classrooms in nine elementary city centre schools in an urban school district in a western Canadian city participated in this study. The children attended full-day kindergarten, 5 hours per day, 5 days per week in an inclusive classroom setting. Children in both the experimental and control groups were in the same classrooms with the same teachers and educational assistants during the intervention period. Provincial education funding is provided for kindergarten children with challenging needs, including those with moderate to severe language impairment, and this funding is used for the hiring of educational assistants who provide support and assistance to qualifying children. Speech-language pathologists assigned to the classrooms provide assessments and participate with the classroom staff and parents in the development and implementation of communication goals for children receiving provincial educational funding.

Recruitment and Retention. Classroom based speech-language pathologists recommended potential candidates for the study based on the inclusion criteria of Clinical Evaluation of Language Fundamentals Preschool-2 (CELF P-2) scores (percentile score of 6 or below). Fifty children were identified as meeting these criteria. Parents of all participants were sent an information letter explaining the study, consent form, and demographic information form that included information about maternal education, language spoken in the home, and parental occupations. Parents of 39 of the eligible children returned the consent form. One child failed the hearing screening and was referred for medical follow-up, resulting in a total of 38 participants who began the study. One child, a boy, in the control group left the school district before the end of the intervention, resulting in a total of 37 participants completing the study.

Inclusion Criteria. Kindergarten children were selected for this study based on the following criteria:

(a) receptive or expressive language percentile rank score cut-offs at or below the 6th percentile as measured by the Clinical Evaluation of Language Fundamentals Preschool-2 (CELF P-2; Wiig, Secord, & Semel, 2004). All children were referred to this study from the cooperating school district and presented with developmental language scores of 1.5 standard deviations or greater below the mean. Language scores at this level qualified all children in this study for provincial funding for programming support (Alberta

Education, 2005; Alberta Health Standards, 1993). This language score criterion, established by the province in which this study took place, suggests that the participants had slightly more severe language impairment than would be found in the whole population of children with language impairment.

(b) hearing within normal limits (Hearing Identification Procedures, Alberta Speech, Language, Hearing Association, 2001)

(c) nonverbal performance score on the Kaufman-Brief Intelligence Test-2 (KBIT-2) (Kaufman, & Kaufman, 2004) no lower than 70. Thirty children scored at a nonverbal performance score of 85 or above. Seven children scored at 84 or below (5 in the experimental and 2 in the control group).

(d) PA scores at or below the 25th percentile as measured by the Test of Preschool Early Literacy (TOPEL) pre-published version (Lonigan, Wagner, Torgesen, & Rashotte, no date) Phonological Awareness subtest, or the presence of "at risk" indicators in two PA measures from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) subtests Initial Sound Fluency (score <10) or Phoneme Segmentation Fluency (<7) (Good, Simmons, Kame'enui, Kaminski, & Wallin, 2002). The DIBELS measures are described below. Three students scored higher than the 25th percentile on the TOPEL PA subtest. All three students scored in the "at risk" range on the DIBELS measures of Initial Sound Fluency and Phoneme Segmentation Fluency.

(e) may have articulation delay or phonological disorder, but not so severe as to preclude understanding their responses.

(f) not yet reading words, as reported by the kindergarten teachers and school speech-language pathologists.

(g) English spoken in the home.

Sample. Thirty-seven kindergarten children with language impairment participated in the study (27 boys, 10 girls). Participants were randomly assigned to either an experimental group (n=22) and received the intervention and whole class instruction in PA and letter-sound awareness or the non-intervention control group (n=15). Portney and Watkins (2000) note random assignment means that each subject has an equal chance of being assigned to any group; that this assignment will be independent of personal judgment or bias. The process of assigning children at random to groups in the study was followed. Departures from random assignment in this study were not based on pretest scores or other personal characteristics of the children but on administrative requirements for having two children per group from the same classroom.

Schulz and Grimes (2002) note that equal sample sizes in a randomized controlled trial contribute little to statistical power. However, an attempt was made to access a comparison group that was at least 1/3 the size and, if possible half the size of the intervention group. There were 17 males and 5 females in the experimental group, and 10 males and 5 females in the control group. Participants were ages 4;9 to 6;3 (Experimental mean 66.68, SD 4.81; Control mean 64.13, SD 4.22) at the beginning of the study. Eighteen children (49%) were First Nations Canadians (i.e., Aboriginal, predominantly Cree, who spoke English in the home as their first language). Eight First Nations children were in the experimental group and 10 were in the control group. Three children in the experimental group resided in homes where the parents' first language was not English; however, the parents reported that the language spoken in the home was English. Parents reported maternal education, based on the highest grade completed (Experimental grade mean: 11.45, SD 1.41; Control grade mean: 11.47, SD 1.25). Socio-economic information was gathered for all participants based on parents reporting occupations, which were then assigned values according to a list of numerical values for occupations, weighted equally for education and income (Ganzeboom, Treiman, & Donald, 1996). The mean occupations for parents for both groups were equivalent to values in the skilled manual worker category including a range from factory or plant worker to clerk, secretary, and sales person (Experimental SES mean: 3.61, SD 2.25, range: 1-8; Control SES mean 2.83, SD 1.43, range: 1-6).

Group Equivalence at Pre-Intervention. Independent t-test analysis was conducted to examine whether or not there was a significant difference between the experimental group (n=22) and control group (n=15) before the intervention began. As Table 1 shows, there were no statistically significant differences between the experimental and the control group on the variables measured: age, SES, maternal education, nonverbal intelligence, receptive language, expressive language, and print knowledge. All PA and early reading measures were not significantly different at pretest with the exception of the DIBELS Initial Sound Fluency subtest which was statistically different in favor of the experimental group. Given the sample size was small, the recommended procedure of Brace, Kemp, and Snelgar (2006) was followed and pretest scores were used as covariates in the ANCOVAs to control for any differences prior to the intervention.

Table 1. Comparisons of Pre-intervention Measures between Groups (E=22, C=15, n=37)

	Experimental			Control				
Measure	Mean	SD	Range	Mean	SD	Range	*t*	*p*
Age (months)	66.68	4.81	58-74	64.13	4.22	57-75	1.661	.247
SES (occupation scale)	3.61	2.26	1.0-8.0	2.83	1.44	1.0-5.5	1.183	.067
Mother's Education (grade)	11.45	1.41	8-13	11.47	1.25	9-14	-.027	.483
K-BIT Nonverbal Intelligence	91.68	11.73	75-127	88.67	7.18	73-100	.886	.182
CELF-P2 Receptive Language	73.86	8.99	53-86	73.40	11.11	50-87	.140	.474
CELF-P2 Expressive Language	75.95	9.67	57-96	72.60	12.25	50-92	.930	.314
TOPEL Print Knowledge	90.59	13.74	70-117	84.33	10.55	69-104	1.487	.302
TOPEL Phonological Awareness	82.64	9.53	55-101	77.60	12.08	55-96	1.416	.079
DIBELS Initial Sound Fluency	7.64	6.84	0-27	3.87	3.09	0-11	2.267	.030
DIBELS Phonemic Segmentation Fluency	2.05	4.27	0-18	3.40	5.14	0-17	-.872	.389
DIBELS Letter Naming Fluency	13.18	13.19	0-48	8.20	10.21	0-32	1.23	.226
DIBELS Nonsense Word Fluency	2.73	4.67	0-14	1.07	2.92	0-10	1.22	.230

Note. K-BIT = Kaufman Brief Intelligence Test; CELF-P2 = Clinical Evaluation of Language Fundamentals – Preschool, 2nd Ed.; TOPEL = Test of Early Preschool Literacy; DIBELS = Dynamic Indicators of Basic Early Literacy Skills. Standard scores are reported for the K-BIT, CELF-P2, and TOPEL tests. Raw scores are reported for the DIBELS subtests.

Psychometrics of the Measures

KBIT-2. The KBIT-2 Matrices is designed as a screening tool to identify high-risk children who require subsequent in-depth evaluation. The Matrices subtest is a nonverbal measure comprising items involving meaningful pictures (people and objects) for children in the 4- to 7-year range. The internal consistency reliability for age 5 years is .78. Test-retest reliability is .76 for children age 4 to 12 years as reported in the KBIT-2 manual.

Language Measure. The CELF P-2 is used for identifying, diagnosing, and performing follow-up evaluations of language deficits in children ages 3 to 6 years. Test-retest reliability coefficients for the 5; 0-5; 11 age range are from .79 to .95.

PA and Early Reading Measures. It was recognized that different types of PA tasks place different demands on PA abilities (Phillips, Clancy-Menchetti, & Lonigan, 2008). The intent for including the TOPEL PA subtest and the DIBELS subtests in the inclusion criteria was to capture kindergarten children with language impairment who had any indication of delay in PA and letter-sound skills. The 27-item Phonological Awareness subtest of the pre-published version of the TOPEL was individually administered to measure elision and blending abilities. The developmental continuum of phonological awareness skills was sampled across both elision and blending items. The internal consistency reliability of the items for the phonological awareness subtest of the TOPEL at age 5 years is .88. The test-retest reliability score is .83, and the inter scorer

reliability is .97 as reported in the test manual. The 36-item Print Knowledge subtest of the pre-published version of the TOPEL was individually administered to measure early knowledge about written language conventions and form as well as alphabet knowledge. The internal consistency reliability of the items for the print knowledge subtest of the TOPEL at age 5 years is .96. The test-retest reliability is .89, and the interscorer reliability is .96 as reported in the test manual (Lonigan et al., n.d.).

The DIBELS subtests were selected for use in participant selection and as an outcome measure because the subtests were designed specifically to measure and track progress in early reading skills. Unlike standardized tests, which are not designed to show progress over time, the DIBELS was specifically developed for this purpose. It consists of sets of measures of specific skills. For example, the materials for Initial Sound Fluency contain 3 Benchmark and 20 Progress Monitoring sets with 16 items each; all containing items that ask children to isolate the first sounds in words. The DIBELS materials are intended to be administered repeatedly throughout a school year, using a different set each time. Alternate-forms reliability is reported to be .72 for an earlier version of ISF, Onset Recognition Fluency. For the other measures, alternate-forms reliability is reported as follows: Phonetic Segmentation Fluency, .88; Letter Naming Fluency, .88; Nonsense Word Fluency, .83.

A description of the DIBELS subtests follows:

The *Initial Sound Fluency* (ISF) subtest is designed to measure the student's ability to match and produce initial phonemes or blends. The student answers 16 questions, presented in sets of 4 questions. To answer the first 3 questions in each set, the student selects a picture that begins with a target sound. To answer the fourth question, the student produces the initial phoneme or blend for a given picture. The formula used to calculate the score incorporates both the number of questions answered correctly and the cumulative time required to respond to all 16 questions.

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

The *Phonemic Segmentation Fluency* (PSF) subtest is designed to measure the student's ability to segment one-syllable words with two to five phonemes into component parts. The examiner asks the student to segment each sound in the word and the student earns 1 point for each correctly segmented sound. The student's score is the number of correctly segmented sounds in 1 minute. The examiner stops administering the assessment if the student does not accurately provide any sound segments in the first five words.

The *Nonsense Word Fluency* (NWF) subtest generally measures decoding and specifically measures two skills: (a) whether or not students can name letter sounds, and (b) whether or not students can blend sounds to read unfamiliar words with short vowels in consonant-vowel-consonant or vowel-consonant syllable patterns. One point is awarded for each letter sound in the nonsense word and the total score is the number of letter sounds the student says correctly in 1 minute. The student is given credit regardless of whether the letter is read correctly as an individual sound or is blended into a word or word part. The maximum number of points a student can receive is the number of letters in the word. The examiner stops administering the assessment if the student gives no correct sound segments in the first five words (Farrell, Hancock, & Smartt, 2006). Additional information about the DIBELS is available at dibels.uoregon.edu.

Data Collection

The duration of data collection was from October through May. Identifying participants, obtaining parental consents, and administering the CELF P-2 extended from October through December. Classroom-based speech-language pathologists administered the CELF P-2, identifying children with moderate to severe language impairment eligible for specialized services. The hearing screening, KBIT-2 nonverbal performance test, and TOPEL Print Knowledge and Phonological Awareness subtests were administered to potential participants immediately before the intervention began. Pre-intervention assessments for the study were conducted by four community based speech-language pathologists (not the authors or classroom-based speech-language pathologists) and three second-year speech-language pathology masters students. The speech-language pathology masters students administered the tests with the supervision of the first author. Each assessment session lasted between 45 minutes and 1 hour. All assessors were blind to the assignment of the children to either the experimental or control group.

DIBELS testing was administered by educational assistants with the supervision of the first author. DIBELS pre-intervention testing occurred in early

January. DIBELS testing was carried out at several points during the intervention to permit us to track and graph changes in the skills of interest between the pre- and post-testing points that were to be used for statistical analyses; it was conducted on days 24, 47, and 65 of the study. The number of DIBELS probes and the day intervals between probes during the intervention were scheduled in an attempt to have an even number of days between probes to track changes and also with consideration for the schedule of the kindergarten school year. DIBELS post-intervention testing was conducted to obtain measures for comparison of change in the intervention and control groups; it took place two weeks and again one month after the final day of the intervention. Each testing session lasted between 8 to 10 minutes. All tests for the study were administered in a quiet location in the children's schools.

Assessment Fidelity

To ensure fidelity of administration of assessments, speech-language pathologist assessors participated in 5 hours of assessment training conducted by the first author that included simulated administration, and scoring and calculating test scores. Review of hearing screening procedures was conducted by two community based pediatric audiologists. Spoken responses were recorded at the time of the assessment by an Olympus VN-480 PC audio recorder. To establish inter-rater reliability of the scoring procedures, 25% of the pre- and post-intervention test protocols were randomly selected for independent scoring by a registered speech-language pathologist (not the authors or assessors) using the audiotapes. Reliability for pre- and post-intervention scoring ranged from .99 to 1.00.

To ensure fidelity of DIBELS testing, educational assistant assessors participated in 4 hours of training on the four DIBELS subtests implemented by the first author. DIBELS administration and scoring simulations were conducted during the training sessions. Consistent following of the test administration script, accurate use of the stop watch, accurate scoring, calculating, and recording the test results was emphasized in the training. The first author filmed each educational assistant conducting a DIBELS assessment session with a study participant and completed the DIBELS Observational Checklist during the session. The checklist was discussed with the educational assistant immediately after the session while reviewing the filmed session. After the administration of the third DIBELS probe, the researcher met with the whole group of educational assistants to review specific aspects of the DIBELS test administration process with the intent of ensuring that the administration and scoring of the subtests was consistent across educational assistants.

PA and Letter-Sound Awareness Intervention

The intervention chosen for this study was *Road to the Code: A Phonological Awareness Program for Young Children* (Blachman et al.,2000). *Road to the Code* was chosen for the proposed research because this phonological awareness training program incorporates principles that include the explicit teaching of one or two types of phoneme manipulations (e.g., initial sound isolation and/or initial sound identification) and blending and segmenting in each lesson, as well as sound-symbol awareness activities (phoneme manipulation with letters). The program allows for flexibility in small-group instruction, and provides suggestions for instructional adaptations based on the individual child's needs. The program is 15 hours long and contains material sufficient for 20 hours of phonological awareness programming (Blachman et al., 1994; National Reading Panel, 2000; Torgesen et al., 1992). The intervention components were:

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

Letter Names and Sounds. A letter name and sound instruction exercise was included in each lesson to teach the children that all letters have both a name and a sound. Explicit connections were repeatedly made between the letter name and sound ("All letters have both a name and a sound."). Illustrated alphabet cards were used to reinforce initial sounds. After initial introduction, each letter and letter sound was reviewed in subsequent lessons across the remainder of the

program. The authors (Blachman, et al., 2000) noted that many phonetically regular consonant-vowel-consonant words could be made using these letters and the knowledge of these letter sounds. A variety of game-like activities (e.g. hand clapping, sound bingo, go fish, concentration, letter-sound matching, and sound boards) focused on the correspondence between sound segments in words and the letters that represented the sound segments. Each letter-sound activity took 7 minutes of each 20 minute lesson.

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

Educational assistants. The treatment program was implemented by 10 educational assistants, each of whom worked with the same children each session in groups of two. The range of years of education included one educational assistant with a Grade 12 diploma and three educational assistants with undergraduate university degrees. Two educational assistants reported thirteen years of education. Four educational assistants held diplomas from post-secondary institutions in areas such as early childhood development, educational assistant, and nursing assistant. The range of educational assistants' experience working with kindergarten children ranged from 4 months to 60 months with a mean of 30 months. The first language of two of the educational assistants was not English however both spoke fluent English.

Length of Intervention. Instruction began in early January and concluded the end of April. The lessons were implemented for 14 weeks, 20 minutes per day, 5 days per week, for a total of 67 days, which corresponds to 22.33 hours of program time. The average time that children spent in PA intervention was 18.45 hours (*SD* = 4.64, range 12.75-21.5). Seven children received between 12.75 and 16.0 hours; the remaining 14 received between 16.5-21.5 hours. Illness on the part of the children or educational assistant or low school attendance accounted for the lower number of intervention hours.

Groups. Of the 10 classrooms with participating students, 5 had both treatment and control students, 4 had treatment students only and one had only one student in the control group. Two of the students in this study received individual sessions because each of them was the only child in these classrooms enrolled in the study.

Classroom PA and letter-sound awareness instruction. To gather information on the phonological awareness and letter-sound awareness programming the children in the study received in their classrooms, all eleven kindergarten teachers independently completed a questionnaire at the end of the study (Smith, 2004). The information from the teacher questionnaire revealed that nine teachers (82%) had heard of phonological awareness programming and two (18%) had not. Teacher understanding of the skills in phonological awareness ranged from five teachers (45%) reporting having full understanding, four (36%) having an adequate grasp, to two teachers (18%) reporting having somewhat of an understanding of the skills in phonological awareness. Seven teachers (64%) reported attendance at a phonological awareness in-service and four (36%) reported not having attended an in-service. Ten teachers (91%) responded that the concepts in phonological awareness training were very beneficial in enhancing reading skills in young children. The range of time reported by teachers providing phonological awareness instruction on a daily basis ranged from 15 to 30 minutes, with the average amount of time 21.3 minutes. The amount of time spent on letter naming represented the greatest amount of time spent on a skill, followed by letter-sounds. Each teacher committed some time to segmenting and blending activities; however, some teachers spent considerably more time (i.e., daily) on this literacy activity than did others (i.e., weekly or monthly). Although teachers were supportive of the theoretical basis of phonological awareness intervention, instruction in the most essential instructional components, that of segmenting and blending, was provided less than letter naming.

Instructional Setting. The setting for instruction was established outside participants' regular classrooms to prevent migration effects that might have occurred if the intervention had been implemented in the classroom and to attempt to provide a quieter, less distracting acoustical environment. With a few exceptions, students received the lessons in the same room each day. Teachers were not informed about the specific content of the intervention and while educational assistants also worked within classrooms, they worked on activities

provided by classroom teachers that did not include the phonological awareness activities provided in the study.

Scheduling of the Lessons. The lesson delivery schedule was developed in keeping with the principles of instruction appropriate for children at risk for reading difficulties. Intensive scheduling in groups of two children provided predictable and extensive opportunities for scaffolded practice and many opportunities for error correction and feedback (Foorman & Torgesen, 2001). All 44 lessons from *Road to the Code* were taught to the children receiving the intervention. Lessons that included a note from the author indicating that the lesson was a major transition point or suggesting scaffolded instruction within the lesson's activities were conducted two days in a row. Twenty-three complete lessons (52%) were repeated on successive days. Each educational assistant followed the lesson schedule so that the lessons were presented on approximately the same day across the groups. In cases of absences, the children were scheduled for two sessions per day until they caught up to the other students. In other cases—when extended or frequent absences occurred, for example—the educational assistants provided as much programming as schedules would permit on the days the children attended school. Lessons were not scheduled during breakfast, lunch, snack, or recess.

Intervention fidelity. To ensure fidelity of administration of the intervention, educational assistants participated in an initial 3 hour training session. Four hours of additional training on implementation of the lessons occurred during monthly educational assistant training sessions. Training focused on researcher modeled lessons and opportunities for the educational assistants to practice implementing the lessons. The educational assistants were requested to read verbatim the bold script from the *Road to the Code* manual for each lesson activity to ensure consistency of instructional language across the groups. The educational assistants set a timer at the beginning of each component of the lesson to ensure consistency of intervention time across the groups. The total number of minutes of daily programming time for each lesson was documented and submitted to the researchers. All educational assistants participated in an email listserv that facilitated an exchange of information between the researcher and educational assistants when questions, concerns or observations arose regarding intervention implementation.

Throughout the study, the first author conducted 54 fidelity-of-implementation observations, representing 10% of the total number of intervention sessions. During these observations the researcher filmed the 20-minute phonological awareness intervention session and used an observational checklist that included criteria for the instructional activities. Instructional behaviours were rated on a scale of 0–4, with higher scores indicating better performance. The video and checklist were reviewed with the educational assistant immediately after the lesson and feedback was provided. To establish inter-rater reliability with respect to lesson implementation, 10 filmed sessions representing approximately 20% of the total 54 filmed sessions were randomly selected for independent scoring by a registered speech-language pathologist and independent scorer. The independent observer was asked to observe the sessions and complete the observational checklist with the researcher. Reliability scores on observations indicated 100% agreement. The independent observer noted that, across the filmed sessions, each educational assistant's strict adherence to the script from the manual for each component of the lesson contributed to the overall fidelity of implementation. Further information is available from the first author.

RESULTS

Analyses

Each dependent variable was analyzed using a separate analysis of covariance (ANCOVA) with pretest scores as covariates to examine whether or not there were statistically significant differences between the groups. The assumptions of ANCOVA including normality, linearity, homogeneity of variances, and homogeneity of regression slopes were verified. The variables were four DIBELS subtests: initial sound fluency, phonemic segmentation fluency, letter naming fluency and nonsense word fluency.

ANCOVA allowed the investigation of the effect of the intervention on each post-test score while removing the effect of the pre-test score by using it as the covariate (Brace et al., 2006). The between-groups factor was used for two comparisons for each variable. The first comparison was effectiveness of intervention during the final week of the intervention, for which the dependent variable was the post-intervention probe; the second was at the second maintenance probe, given one month after the intervention. To correct for multiple ANCOVA tests, Holm's procedure (Aicken & Gensler, 1996) was applied, in which obtained p-values are ranked from smallest to largest and each is compared to an adjusted alpha value until a p-value larger than its adjusted alpha is encountered; all larger p-values are considered to be non-significant. All significant p-values remained significant after Holm's procedure was applied.

The standardized effect size Cohen's d was calculated for each measure. It was computed by dividing the mean difference by the pooled standard deviation (Cohen, 1988). Conventional guidelines consider effect sizes as large if the intervention versus control difference is at least 0.80, moderate if the impact is 0.50 to 0.79, and small if the impact is 0.20 to 0.49; anything smaller than 0.20 is considered trivial (Cohen, 1988).

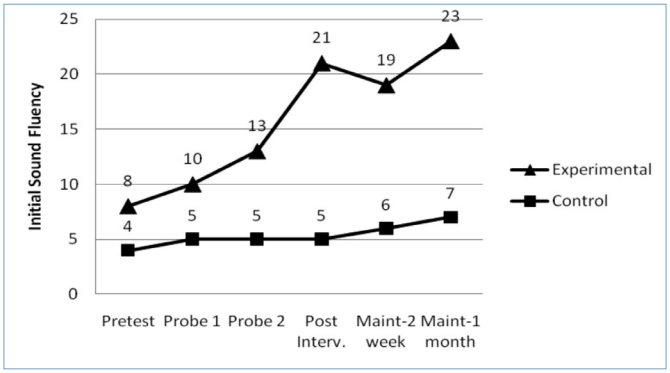
Additionally, discriminant analysis was used to identify the non-responders to the intervention using the DIBELS subtests. Data from the probe given in the last week of the intervention were used in this analysis to assess the accuracy of classification of children into pre-existing groups—in this case, children who received the intervention and children in the no-intervention control group—to identify children in the experimental group who did not benefit from the intervention (i.e., children in the intervention group who were classified as being in the non-intervention group).

Initial Sound Fluency (ISF)

ISF is designed to measure children's ability to recognize and produce the initial sound of a word. Figure 1 displays data for all time points at which ISF was administered from pre-test to one month post intervention. ANCOVA was used to examine the effect of the intervention on this variable by comparing groups at post-intervention and again at maintenance one month later; pre-intervention ISF scores were entered as the covariate. At post-intervention, the analysis revealed a statistically significant difference between the groups, indicating the intervention group was higher than the control group on ISF, F (1, 34) = 39.52, p < .001, d = 2.17. At maintenance-one month there was also a statistically significant difference between the groups, indicating the intervention group remained higher than the control group on ISF, F (1, 34) = 16.21, p =.009, d =1.33. The effect sizes indicate a large effect of the intervention on this variable.

According to DIBELS guidelines (Good et al., 2002), kindergarten students are expected to achieve an ISF score of 25 or higher by the middle of kindergarten in order to be on target for meeting the Phonemic Segmentation Fluency benchmark score at the end of kindergarten. Thus, for typically developing children, ISF would not be administered past midyear. However, for the children in the present study whose language was moderately to severely impaired, the ISF measure was administered beyond the middle of the year because the students had not yet demonstrated an established skill in this area. Children in the intervention group maintained and increased their scores to the second maintenance probe. Goals and indicators of risk for

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



Post-intervention and Maintenance-one month scores were used for the ANCOVA. Means (standard deviations-SDs) for post-intervention scores: Experimental 20.95 (8.655), Control 5.13 (5.579); Means (SDs) for Maintenance-one month: Experimental 23.36 (16.253), Control 6.60 (7.219).

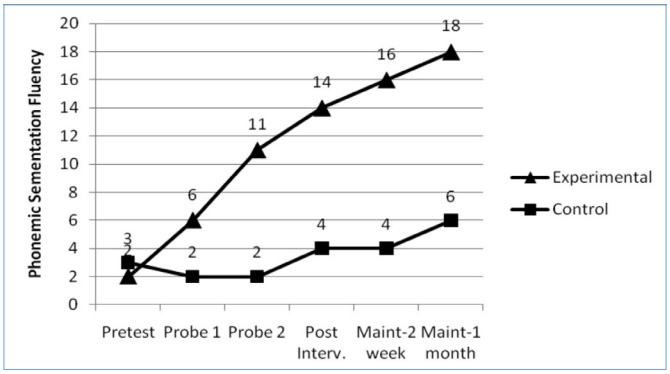
the ISF measure at the middle of kindergarten are: 0–9, Deficit; 10–24, Emerging; 25+, Established. The group mean for children in the intervention group, who had pre-intervention ISF group mean scores in the "deficit" range, increased to 2 points below the "established" range for the skill at maintenance-one month. The group of children in the non-intervention control group, who also had Pre-intervention ISF group mean scores in the deficit range, demonstrated maintenance-one month group mean scores that remained well within the deficit range.

Phonemic Segmentation Fluency (PSF)

PSF measures children's ability to segment words into individual phonemes. Figure 2 displays data for all time points at which PSF was administered from pre-test to one month post intervention. ANCOVA was used to examine the effect of the intervention on this variable by comparing groups at post-intervention and again at maintenance one month later; pre-intervention PSF scores were entered as the covariate. Results of the analysis revealed a statistically significant difference between the groups on the PSF Subtest at post-intervention, with the intervention group higher than the control group, F (1, 34) = 17.00, p < .001, d = 1.39. At maintenance-one month, the results of the analysis reveal a statistically significant difference between the groups on the PSF Subtest; again the intervention group was higher than the control group, F (1, 34) = 12.86, p = .001, d = 1.25. The effect sizes at both time points indicate a large effect of the intervention on this variable.

Kindergarten students are expected to achieve a PSF score of 35 by the end of kindergarten in order to be on track to meet the Nonsense Word Fluency benchmark score by the middle of first grade. Goals and indicators

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



Post-intervention and Maintenance-one month scores were used for the ANCOVA. Means (standard deviations-SDs) for post-intervention scores: Experimental 13.82 (8.894), Control 3.53 (5.553); Means (SDs) for Maintenance-one month: Experimental 18.45 (12.523), Control 5.53 (7.643).

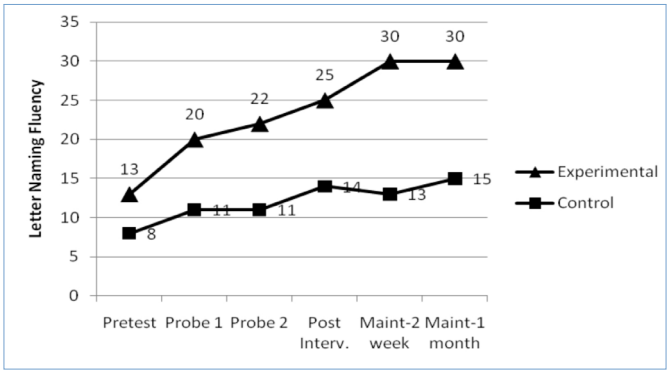
of risk for the PSF measure at end of the kindergarten year (month 7–10) are: 0–9, Deficit; 10–34, Emerging; 35+, Established. Based on the goals and indicators of the DIBELS subtest of PSF, the group of children in the intervention group, who had pre-intervention PSF skills in the "deficit" range, demonstrated maintenance-one month skills in the "emerging" range. The group of children in the non-intervention control group, who also had pre-intervention PSF skills in the deficit range, demonstrated maintenance-one month skills that remained within the deficit range.

Letter Naming Fluency (LNF)

LNF measures children's ability to name letters rapidly. Figure 3 displays data for all time points at which LNF was administered from pre-test to one month post intervention. ANCOVA was used to examine the effect of the intervention at the post-intervention time point and again at maintenance-one month, with pre-intervention LNF scores as the covariate. At post-intervention no statistically significant difference between groups was found, F (1, 34) = 3.17, p = .084, d = .72. However, at maintenance-one month, the intervention group was higher than the control group, F (1,34) = 8.36, p = .007, d = 1.06. The effect size indicates a large effect of the intervention on this variable.

Kindergarten students are expected to achieve a LNF score of 40 by the end of kindergarten, according to DIBELS guidelines. Goals and indicators of risk for the LNF measure at the end of the kindergarten year (month 7–10) are: 0–29, At Risk; 29–40, Some Risk; 40+, Low Risk. Based on these goals and indicators, the group of children in the intervention group,

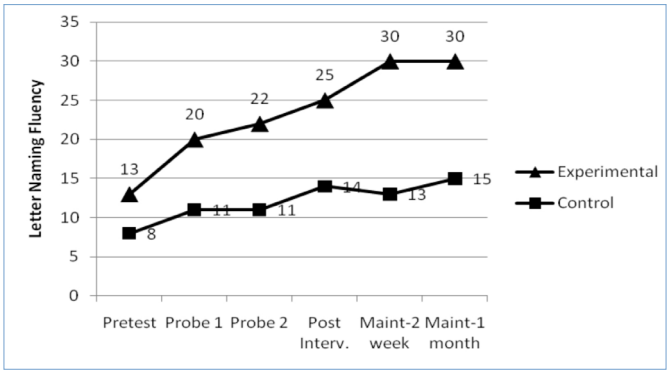
Figure 3. Children's Performance on the Letter Naming Fluency Measure from Pre-intervention to Maintenance-one month.



Post-intervention and Maintenance-one month scores were used for the ANCOVA. Means (standard deviations-SDs) for post-intervention scores: Experimental 24.55 (13.773), Control 14.33 (14.475); Means (SDs) for Maintenance-one month: Experimental 30.18 (16.823), Control 14.80 (11.749).

who had pre-intervention LNF scores in the "at risk" range, demonstrated maintenance-one month group mean LNF scores in the "some risk" range. The group of children in the non-intervention control group with pre-intervention LNF scores in the at risk range demonstrated maintenance-one month skills that remained within the at risk range.

Figure 4. Children's Performance on the Nonsense Word Fluency Measure from Pre-intervention to Maintenance-one Month.



Post-intervention and Maintenance-one month scores were used for the ANCOVA. Means (standard deviations-SDs) for post-intervention scores: Experimental 14.91 (9.446), Control 3.00 (6.547); Means (SDs) for Maintenance-one month: Experimental 17.82 (12.105), Control 3.00 (6.897).

Nonsense Word Fluency (NWF)

NWF is designed to measure children's ability to apply letter-sound correspondence to reading words that were not real words. Figure 4 displays data for all time points at which NWF was administered from pre-test to one month post intervention. ANCOVA was

used to examine the effect of the intervention on this variable by comparing groups at post-intervention and again at maintenance, with pretest scores as the covariate. At post intervention, the ANCOVA analysis revealed a statistically significant difference between the groups on the NWF subtest, with the intervention group higher than the control group, F (1,34) = 19.12, p < .001, d = 1.47. At maintenance-one month, analysis again revealed a statistically significant difference between the groups on the NWF Subtest with the intervention group higher than control group, F (1,34) =16.30, p < .001, d = 1.50. The effect sizes at both time points indicate a large effect of the intervention on this variable.

Kindergarten students are expected to achieve a NWF score of 25 by the end of kindergarten. Goals and indicators of risk for the NWF measure at the end of the kindergarten year (month 7–10) are: 0–15, At Risk; 15–25, Some Risk; 25+, Low Risk. The group of children in the intervention group, who had pre-intervention NWF scores in the "at risk" range, demonstrated maintenance-one month group mean scores in the "some risk" range. The group of children in the non-intervention control group, who also had pre-intervention NWF scores in the at risk range, demonstrated maintenance-one month group mean scores that remained within the at risk range.

Table 2. Comparisons of Pre-intervention Measures between Responders and Non-responders to the Intervention (E=19, C=3, n=22)

Variables	Responders		Non-Responders		Comparison	
Measure	Mean	SD	Mean	SD	*t*	*p*
Age (months)	66.21	4.99	69.67	1.52	-1.17	.26
SES (occupation scale)	3.84	2.29	2.16	1.60	1.21	.24
Mother's Education (grade)	11.47	1.46	11.33	1.15	.157	.88
Minutes of PA Intervention	1066.89	165.47	1031.33	185.58	.342	.74
K-BIT Nonverbal Intelligence	91.95	12.17	90.0	10.39	2.61	.80
CELF-P2 Receptive Language	74.47	9.45	70.00	4.35	.794	.44
CELF-P2 Expressive Language	76.53	9.31	72.33	13.31	.689	.50
TOPEL Print Knowledge	90.58	14.3	90.67	12.01	-.01	.99
TOPEL Phonological Awareness	83.16	6.66	79.33	23.11	.285	.80
DIBELS Initial Sound Fluency	7.68	7.34	7.33	2.51	.081	.94
DIBELS Phonemic Segmentation Fluency	2.37	4.52	.00	.000	.888	.39
DIBELS Letter Naming Fluency	13.79	13.29	9.33	14.46	.535	.60
DIBELS Nonsense Word Fluency	2.95	4.94	1.33	2.30	.547	.59

Note. K-BIT = Kaufman Brief Intelligence Test; CELF-P2 = Clinical Evaluation of Language Fundamentals – Preschool, 2nd Ed.; TOPEL = Test of Early Preschool Literacy; DIBELS = Dynamic Indicators of Basic Early Literacy Skills. Standard scores are reported for the K-BIT, CELF-P2, and TOPEL tests. Raw scores are reported for the DIBELS subtests.subtests.

Amount of treatment time

As noted earlier, the amount of time received by individual children ranged from 12.75 to 21.5 hours. To investigate whether amount of treatment time was related to post-treatment DIBELS scores, we calculated correlations between number of treatment minutes and the 8 DIBELS scores (4 immediately post-intervention, four 1-month post-intervention). To correct for multiple tests, Holm's correction was applied to obtain adjusted alpha levels (Aicken & Gensler, 1996). Of the eight correlations, none was significant. Thus we conclude that amount of treatment time was not related to post-treatment DIBELS scores.

Discriminant Analysis

A discriminant analysis was performed with group as the dependent variable and DIBELS Initial Sound Fluency, Phonemic Segmentation Fluency, Letter Naming Fluency, and Nonsense Word Fluency subtest scores from the post-intervention time point as predictor variables. The discriminant analysis permitted us to determine the number of children for whom the intervention was successful and to identify individual children for whom it had not been effective. Children in the intervention group classified as being in the control group by the analysis would be considered to be children for whom the intervention was not successful.

The total sample of 37 cases was analyzed. A single discriminant function was calculated, which is a mathematical formula that combines the predictor variables to discriminate between the groups (Brace et al., 2006). If the discriminant function is statistically significant, then the predictor variables are successfully discriminating between groups.

Results indicated the value of the discriminant function was statistically significant (Wilks $\lambda = .401$, $\chi^2 = 30.124$, $df = 4$, $p = .000005$). The magnitude of the correlations indicates the strength of the prediction of each variable. Correlations between predictor variables and the discriminant function were as follows: Initial Sound Fluency, .86; Phonemic Segmentation Fluency, .55; Letter Naming Fluency; .30; Nonsense Word Fluency, .59. Each of these scores contributed to the prediction of group membership.

Discriminant analysis yields measures of accuracy of classification for both groups (in this case, the percentage of children demonstrating phonological awareness performance scores indicative of experimental group or control group membership and classified as such). Overall, 89.2% of children were correctly classified. Nineteen children in the intervention group (86.4%) were correctly classified, indicating that the intervention was effective for 19 of the 22 children receiving the intervention. Accurate classification of children in the control group was 93.3%, with only one child misclassified.

Three children in the experimental group were classified as children in the control group, indicating that their scores were not at a level that would differentiate them from children who had not received intervention at post-test. We had expected that children who were not successful might have pre-test measures that were different in some way and thus could be used to predict children's likelihood of success in future research and clinical practice. We compared the responders and non-responders on pretest variables that possibly could account for different responses to intervention. None of the groups were significantly different on any of the variables (See Table 2). Note that the 3 nonresponders obtained scores of 0 for Phonetic Segmentation Fluency, but the group comparison was still not significant, most likely due to the high degree of variance among the responders, many of whom also had scores of 0 at pretest. Thus none of the pretest variables appear to account for the nonresponsiveness of the three children. It is possible that other information such as speech sound abilities that were not collected in this study might help to distinguish responders from non-responders.

DISCUSSION

This study examined the effectiveness of PA and letter-sound awareness intervention in improving these skills for kindergarten children with moderate to severe language impairment and low phonological awareness skills. This group was compared with a no-intervention control group with language impairment. Both groups received their usual classroom instruction. Intervention focused on phoneme segmentation and blending and provided instruction and practice in these skills.

Results indicate that the intervention program was successful at raising the phonological awareness and letter sound-awareness of the intervention group as measured by four DIBELS subtests. Children in the experimental group increased their scores on Initial Sound Fluency, Phonemic Segmentation Fluency, and Nonsense Word Fluency by the end of treatment and maintained their gains one month after the intervention ended. They did not have scores on Letter Naming Fluency that were statistically significantly higher than the control group immediately post-treatment, but did show significantly higher scores at maintenance, one month after intervention. We suspect that the initial lack of a difference is due to an emphasis in children's classrooms on letter naming, which both groups would have experienced. The emergence of a difference by

the maintenance point could be due to a consolidation of skills post-treatment in the experimental group, resulting in a smaller standard deviation and a significant group difference.

Thus, by 1 month after the intervention ended if not sooner, children in the experimental group had significantly higher scores on DIBELS measures than children in the control group. Comparison of group scores to indicators of risk provided by the DIBELS indicated that both groups scored in the lowest range of indicators at pretest on all four measures. After intervention, the experimental group scores had moved to levels just below the target for kindergarten children -- levels that indicate that the skill was emerging. Control children remained in the lowest level of the indicators, suggesting that they remained at risk for reading difficulties. While the intervention did not bring experimental group children to a level considered appropriate for their grade, their scores indicated that they were developing their phonological awareness skills, in contrast to the control group, who remained at risk.

It is likely that the focus on initial sound identification and phonemic segmentation skills provided during the intervention positively influenced children's performance on the Nonsense Word Fluency measure. A review of the scoring sheets for the Nonsense Word Fluency measure indicated that each of the students in the intervention decoded the words phoneme by phoneme. This finding was confirmed throughout the assessment fidelity sessions, during which the students were observed pointing to each letter and providing an associated sound. These observations suggest that explicit instruction in initial sound identification and phoneme segmentation, as well as in instruction in connections between letter sounds, may have helped children to apply their phonological awareness skills and letter-sound knowledge more effectively to the phonemic decoding of nonsense words. These results are consistent with research suggesting that the effectiveness of phonemic awareness is enhanced when combined with letter-sound instruction (Bus & van Ijzendoorn, 1999; Byrne & Fielding-Barnsley, 1989; Davidson & Jenkins, 1994; Fox & Routh, 1984; O'Connor et al., 1995; Torgesen et al., 1992). The intervention was effective in helping children phonemically decode nonsense words. Follow-up is required to answer definitively whether children with moderate to severe language impairment blend individual phonemes into nonsense words or not and whether there is generalization from the ability to decode nonsense words to real word recognition as children begin to receive formal reading assessment and instruction in Grade 1.

Visual inspection of the probe data indicates that progress was slow but steady for the children receiving the intervention; children in the control group made little progress on the outcome measures. Children in both groups attended special classrooms for children at risk for academic underachievement, supported by educational assistants and speech-language pathologists. Nevertheless, only the children in the PA intervention increased their phonological and letter-sound awareness. The children who received our intervention appeared to have required explicit, systematic, and focused PA and letter-sound awareness instruction to improve these skills. This finding was consistent with the research for low literacy achievers (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Torgesen, 2000). The consistent, repetitive, and predictable components in the intervention combined with a higher rate of responding opportunities in groups of only two students appeared to facilitate the increase in these PA skills. There was a possibility that the children in the intervention group would become satiated with the programming. However, the videotaped sessions and educational assistant reports indicate that the children demonstrated a consistent interest for the daily 20-minute sessions.

It is possible that the different child outcomes between the groups could have been due to attention received in intervention sessions (i.e., Hawthorne Effect) rather than to the intervention itself, especially since the variation in the time in treatment did not correlate to differences in outcomes for children in the experimental group. However, previous studies of children with typical language that included groups receiving a non-targeted intervention still found effects for PA intervention (Ball & Blachman, 1991; Blachman et al., 1994; Lundberg et al., 1988; O'Connor, Notari-Syverson, & Vadasy, 1996; Tangel & Blachman, 1992). The National Research Panel summary of findings reported some studies compared PA treatment groups to control groups that were given some other treatment while other studies used untreated control groups. Neither type of control group consistently produced larger effect sizes. Failure to find larger effects for untreated than for treated control groups indicates that Hawthorne effects did not inflate effect sizes (National Reading Panel, 2000). While Hawthorne effects are a concern with interventions that are likely to show improvement when participants are simply motivated to perform better due to the attention they receive, we feel that this is not likely with a complex skill such as phonological awareness or with a population such as children with language impairment. As Scheule, Spencer, Barako-Arndt, & Guillot (2007) noted:

"When skill deficiencies are identified, appropriate intervention efforts should be set in motion; for children with LI, assuming that time (i.e. general maturation) and/or increased oral language ability will lead to adequate early literacy achievement appears misguided. Instruction and intervention are the keys to learning; time or maturation alone is not (pp 37-38)."

We would add that motivation to please is also not sufficient to account for skill improvements in these children.

Clinical Implications

Results of the present study have important implications for children with moderate to severe language impairment and low phonological awareness skills. We found that when direct, explicit, intense, and small-group instruction in initial sound identification, phonemic segmentation and blending, and letter-sound awareness was provided, children with moderate to severe language impairment and low PA skills demonstrated superior performance in their ability to identify, segment, and relate the sounds to letters in a word when compared to a no-intervention control group. Although these findings are consistent with prior research suggesting that children with low phonological awareness skills can develop PA when explicit instruction is provided, much of the research into phonological awareness intervention has excluded children with a diagnosis of moderate to severe language impairment.

Prior studies of PA interventions demonstrated their effectiveness for children at risk for reading difficulties. The knowledge that phonological awareness and letter-sound awareness are strong predictors of later reading skills (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Snow, Burns, & Griffin, 1998; Storch & Whitehurst, 2002) and that effective kindergarten phonological awareness intervention skills helps children attain these skills (Blachman et al., 1994; Foorman et al.,1998) should inform kindergarten curriculum and programming decisions for school districts.

One implication for practice based on the results of the current study is that it is possible to provide intensive, direct, and explicit phonological awareness and letter-sound awareness intervention for children with moderate to severe language impairment who are at risk for reading difficulties and that this intervention will increase these skills. These children should be considered primary candidates for early intervention programs designed to prevent or limit reading disabilities. Identifying and referring these children for effective preventive intervention that includes developing PA prior to formal reading instruction in Grade 1 would decrease the potential challenges these children face when learning to read.

A second implication for practice suggested by intervention results is the effectiveness of implementation of PA programming based on research evidence. The intervention involved teaching that focused on developing skills on a phonemic awareness level and included activities that made explicit the identification of sounds in words, associated sounds with letters, and blended sounds into words, all of which has been found to be effective for children with typical language development in previous studies. Based on evidence from previous research, instruction was of an intensive nature and provided in small groups. However, to confirm that the intensive and small group conditions contributed to the positive effects of the intervention for children with language impairment, future research should include another condition that would compare on these factors.

A third implication for practice is that where educational assistants are available, successful programs can be run with existing personnel; focused allocation of staffing resources would permit the intensive intervention that was effective in this study. Additionally, ongoing instructional support and mentoring is essential for classroom staff that express commitment to such intervention.

A fourth implication for practice is that educational assistants trained on implementation of a commercially available program obtained the findings reported here. Previous studies of PA and letter-sound awareness instruction for students with language impairment have included training by research staff, speech-language pathologists or classroom teachers (Al Otaiba et al., 2009). This study provides an example of the implementation of PA and letter-sound awareness instruction under routine school conditions with trained educational assistants; similar programs could be implemented within existing schools on a regular basis, with similar results.

Study Limitations and Future Directions

These findings are constrained by several limitations. Firstly, a small sample was used. Replicating the findings of this study with a larger participant sample would yield additional data with increased statistical power. Secondly, the consistent following of the DIBELS test script, the filming and reviewing of the test sessions with each educational assistant, and the group meetings focused on assessment procedures contributed to fidelity of implementation of the DIBELS probes; however, the educational assistants were not blind to the students

who were in the experimental and control groups. Thirdly, a teacher survey to gather information regarding the teaching of PA and letter-sound awareness was administered to classroom teachers; however classroom observation to assess the impact of PA and letter-sound awareness instruction within the classroom setting was not scheduled. Fourthly, the generalizability will be limited to intensive small-group treatment using the same or a similar intervention program. Finally, the children in the current study were from a lower socio-economic group. The results may not generalize to other groups. However, since this group is considered to have a higher risk of academic underachievement in general, we believe that there is a high likelihood that it would work with groups in higher socio-economic groups as well.

Future Research

This study explored the effect of a direct, explicit, and intense phonological awareness intervention on the phonological awareness skills of initial sound identification, phonemic segmentation and blending, and letter-sound awareness for kindergarten children with moderate to severe language impairment. Prior research studies with children who did not have a diagnosis of language impairment have followed children after treatment and have found that children receiving direct, explicit, and intensive intervention have better early reading skills than children not receiving intervention (Ball & Blackman, 1988, 1991; Byrne & Fielding-Barnsley, 1991, 1993, 1995; Foorman et al., 1998). However, the effects of PA intervention on early reading with children with a diagnosis of moderate to severe language impairment has not yet been examined. To evaluate the effectiveness of prevention efforts, it would be necessary to examine the subsequent reading progress of the children who receive intervention similar to those in the current study to determine if PA and letter-sound awareness intervention has an effect on reading ability.

More research is needed to examine efficient and effective ways to teach phonological awareness and letter-sound awareness to children with moderate to severe language impairment. Treatment that resulted in children reaching age-appropriate indicators on the DIBELS would be an optimal target. Additional research is needed to examine whether enhanced results would occur if children with moderate to severe language impairment received increased initial sound identification, phonemic segmentation and blending instruction in the classroom in addition to supplemental small-group, direct, explicit, and intensive treatment. For example, if the classroom teachers provided explicit reinforcement of skills taught in the small groups during direct and center time classroom instruction. Additionally, intervention began early in the fall term with a focus on earlier PA skills (e.g., initial sound identification) coinciding with the kindergarten classroom curriculum for PA instruction and extended to the end of the kindergarten year. Future research focused on the development of PA assessment instruments for this population that had the sensitivity to measure small changes in PA growth over time is needed. For example, one student, during the tenth week of intervention, began saying sounds when given a word to segment. They were not the sounds in the word but this progress was significant because, prior to this, the DIBELS PSF score results indicated this student was unaware that there were individual sounds in words. Further, investigation into the relative contribution of vocabulary knowledge to success with phonemic segmentation is necessary. For example, the students in this study were reticent to try to segment words that were unfamiliar to them.

The speech profiles of the students in this study were not thoroughly examined. It would be of benefit if research was conducted with kindergarten children with speech difficulties and oral language impairment accompanied by poor PA skills to learn if intervention begun prior to when PA skills are required to learn to read would increase their success in learning to read.

Studies that include the systematic observation of classroom instruction in PA and letter-sound awareness is necessary to document content, delivery (e.g. scaffolded instruction for struggling PA learners) and amount of instructional time devoted to these activities.

Of crucial importance, we have yet to determine the effectiveness of the intervention if the schools implementing PA intervention in kindergarten utilized the results to guide decisions about supplemental phonological awareness and letter-sound awareness instruction for children continuing to require intervention in Grade 1. Controlling or adjusting the type of instruction that students receive after completing an intervention program should enable them to maintain intervention gains (Coyne, Kame'enui, Simmons, & Harn, 2004). For example, in order to maximize the effect of the intervention, children receiving kindergarten intervention may require a literacy program in first grade that systematically addresses developmentally appropriate phonological and alphabetic instructional principles. Continued intervention with progress monitoring is warranted to ensure stability of these skills.

Conclusion

This study investigated the effectiveness of PA intervention in improving the phonological awareness skills of kindergarten children with moderate to severe language impairment. There were statistically significant differences between the groups and a large effect of the intervention on three of the four immediate-post-intervention measures and on all four of the maintenance measures. This study provides an example of the implementation of PA and letter-sound awareness instruction under routine school conditions with trained educational assistants. This indicates that similar programs could be implemented within existing schools for English speaking students on a regular basis.

Acknowledgements

The authors gratefully acknowledge funding support from the Alberta Centre for Child, Family, and Community Research. We wish to sincerely thank the parents, children, teachers, educational assistants, and principals who supported this project. Appreciation is extended to Maureen Gates and Raelene Finlayson, Kindergarten Inclusive Developmental Services (KIDS). Gratitude is expressed to the graduate students and community speech-language pathologists and audiologists that have participated in various aspects of this research work. This article is based on the first author's doctoral thesis in the Faculty of Rehabilitation Medicine, University of Alberta. A poster based on this work was presented at the ASHA Convention in November 2009.

References

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

Aickin, M., & Gensler, H. (1996). Adjusting for multiple testing when reporting research results: The Bonferroni vs Holm methods. *American Journal of Public Health, 86*, 726-728.

Al Otaiba, S., Puranik, C. S., Ziolkowski, R. A., & Montgomery, T. M. (2009). Effectiveness of early phonological awareness interventions for students with speech or language impairments. *The Journal of Special Education, 43*(2), 107-128.

Alberta Education. (2005). Special education coding criteria. Retrieved from comm.contact@learning.gov.ab.ca

Alberta Health Standards (1993). Developmental Language Severity Rating Scale. Speech and Language Pathology Working Group.

Alberta Speech, Language, Hearing Association (2001). Hearing Identification Procedures. Retrieved from www.acslpa.ab.ca

Ball, E. W., & Blachman, B. A. (1988). Phoneme segmentation training: Effect on reading readiness. *Annals of Dyslexia, 38*, 208–225.

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

Bishop, D. V. M., & Adams, C. (1990). A prospective study of the relationship between specific language impairment, phonological disorders and reading retardation. *Journal of Child Psychology and Psychiatry, 31*, 1027–1050.

Blachman, B.A. (2000). Phonological awareness. In M. Kamil, P. Mosenthal, D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research, Vol. 3*, (pp. 483–502). Mahwah, NJ: Lawrence Erlbaum Associates.

Blachman, B., Ball, E., Black, R., & Tangel, D. (1994). Kindergarten teachers develop phoneme awareness in low-income, inner-city classrooms: Does it make a difference? *Reading and Writing, 6*, 1–17.

Blachman, B. A., Ball, E. W., Black, R., & Tangel, D. M. (2000). *Road to the code: A phonological awareness program for young children* (5th ed.). Baltimore, MD: Brookes.

Blachman, B. A., Tangel, D. M., Ball, E. W., Black, R., & McGraw, C. K. (1999). Developing phonological awareness and word recognition skills: A two-year intervention with low-income, inner-city children. *Reading and Writing: An Interdisciplinary Journal, 11*, 239-273.

Boudreau, D., & Hedberg, N. (1999). A comparison of early literacy skills in children with specific language impairment and their typically developing peers. *American Journal of Speech-Language Pathology, 8*, 249-260.

Brace, N., Kemp, R., & Snelgar, R. (2006) *SPSS for psychologists: A guide to data analysis using SPSS for Windows* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

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.

Byrne, B., & Fielding-Barnsley, R. (1989). Phonemic awareness and letter knowledge in the child's acquisition of the alphabetic principle. *Journal of Educational Psychology, 81,* 313–321.

Byrne, B., & Fielding-Barnsley, R. (1991). Evaluation of a program to teach phonemic awareness to young children. *Journal of Educational Psychology, 83*, 451–455.

Byrne, B., & Fielding-Barnsley, R. (1993). Evaluation of a program to teach phonemic awareness to young children: A 1-year follow-up. *Journal of Educational Psychology, 85*, 104–111.

Byrne, B., & Fielding-Barnsley, R. (1995). Evaluation of a program to teach phonemic awareness to young children: A 2- and 3-year follow-up and a new preschool trial. *Journal of Educational Psychology, 87*, 488–503.

Catts, H. W., Fey, M. E., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairment. *Journal of Speech, Language, and Hearing Research, 45*, 1142–1157.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (1999). Language basis of reading and reading disabilities: Evidence from a longitudinal investigation. *Scientific Studies of Reading, 3*(4), 331–361.

Cohen, J. (1988). Statistical power analysis for the behavioural sciences (2nd ed.). Hillside, NJ: Erlbaum.

Coyne, M. D., Kame'enui, E. G., 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.

Davidson, M., & Jenkins, J. (1994). Effects of phonemic processes on word reading and spelling. *Journal of Educational Research, 87*, 148–157.

Farrell, L., Hancock, C., & Smartt, S. (2006). *DIBELS the practical manual.* Longmont, CO: Sopris West Educational Services.

Fazio, B. (1997a). Learning a new poem: Memory for connected speech and phonological awareness in low-income children with and without specific language impairment. *Journal of Speech, Language, and Hearing Research, 40*, 1285-1297.

Fazio, B (1997b). Memory for rote linguistic routines and sensitivity to rhyme: A comparison of low income children with and without specific language impairment. *Applied Psycholinguistics, 18,* 345-372.

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., & Torgesen, J. (2001). Critical elements of classroom and small-group instruction promote reading success in all children. *Learning Disabilities, Research and Practice, 16*, 203–212.

Fox, B., & Routh, D. (1984). Phonemic analysis and synthesis as word-attack skills: Revisited. *Journal of Educational Psychology, 76*, 1059–1064.

Ganzeboom, H. B. G., Treiman, D. J., & Donald, J. (1996). Internationally comparable measures of occupational status for the 1988 international standard classifications of occupations. *Social Science Research, 25*, 201–239.

Good, R. H., Simmons, D. S., Kame'enui, E. J., Kaminski, R. A., & Wallin, J. (2002). *Summary of decision rules for intensive, strategic, and benchmark instructional recommendations in kindergarten through third grade* (Technical Report No. 11). Eugene, OR: University of Oregon.

Kaufman, K., & Kaufman, N. L. (2004). *Kaufman Brief Intelligence Test* (2nd ed.). Toronto, ON: Psycan.

Leonard, L. B. (1997) *Children with specific language impairment.* Cambridge, MA: MIT Press.

Lonigan, C. J., Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (no date). Test of Preschool Early Literacy (TOPEL pre-published version). Austin, TX: Pro-Ed.

Lundberg, I., (2009). Early precursors and enabling skills of reading acquisition. *Scandinavian Journal of Psychology, 50*, 611-616.

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

Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1997). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology, 65*, 370–398.

Nation, K., & Hulme, C. (1997). Phonemic segmentation, not onset-rime segmentation, predicts early reading and spelling skills. *Reading Research Quarterly, 32*, 154–167.

National Early Literacy Panel Report. (2008. Retrieved from http://www.nifl.gov/publications/pdf/NELPReport09.pdf

National Reading Panel (2000, April). Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769) Washington, DC: U.S. Government Printing Office. Retrieved from http://www.nichd.nih.gov/publications/nrp/smallbook.htm

National Strategy for Early Literacy (2009) Report and recommendations prepared by the Canadian Language and Literacy Research Network. Retrieved from http://docs.cllrnet.ca/NSEL/finalReport.pdf

O'Connor, R. Bocian, K., Beebe-Frankenberger, M., & Linklater, D. (2010). Responsiveness of students with language difficulties to early intervention in reading. *Journal of Special Education, 43*, 220-235.

O'Connor, R., Jenkins, J., & Slocum, T. (1995). Transfer among phonological tasks in kindergarten: Essential instructional content. *Journal of Educational Psychology, 81*, 202–217.

O'Connor, R., Notari-Syverson, A., & Vadasy, P. (1996). Ladders to literacy; The effects of teacher-led phonological activities for kindergarten children with and without disabilities. *Exceptional Children, 63*, 117-130.

Phillips, B., Clancy-Menchetti, J., Lonigan, C. (2008). Successful phonological awareness instruction with preschool children: Lessons from the classroom. T*opics in Early Childhood Special Education, 28*, 03-17.

Portney, L., & Watkins, M. (2000). *Foundations of clinical research: Applications to practice.* Toronto, ON: Prentice-Hall Canada, Inc.

Puranik, C., Petscher, Y., Al Otaiba, S., Catts, H., & Lonigan, C. (2008). Development of oral reading fluency in children with speech or language impairments: A growth curve analysis. *Journal of Learning Disabilities, 41*, 545-560.

Schatschneider, C., Fletcher, J., Francis, D., Carlson, C., & Foorman, B. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology, 96*, 265–282.

Scheule, C. M., & Boudreau, D. (2008). Phonological awareness intervention: Beyond the basics. *Language, Speech, and Hearing Services in Schools, 39*(1), 3-20.

Scheule, C. M., Justice, L., Cabell, S., Knighton, K., Kingery, B., & Lee, M. (2008). Field-based evaluation of two-tiered instruction for enhancing kindergarten phonological awareness. *Early Education and Development, 19*, 726-752.

Scheule, C. M. Spencer, E., Barako-Arndt, K., & Guillot, K. (2007). Literacy and children with specific language impairment. *Seminars in Speech and Language, 28*(1), 35-47.

Schulz, K. F., & Grimes, D. A. (2002). Unequal group sizes in randomized trials: Guarding against guessing. *Lancet, 359*, 966-70.

Segers, E., & Verhoeven, L. (2004). Computer-supported phonological awareness intervention for kindergarten children with specific language impairment. *Language, Speech, and Hearing Services in Schools, 35*, 229-239.

Smith, V. (2004). Preventing early reading failure: An examination of the implementation of a phonological awareness program for young children. *Dissertation Abstracts International, 65* (08), 2939.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children: Committee on the prevention of reading difficulties in young children.* Washington, DC: National Academy Press.

Snowling, M. J. (2005). Literacy outcomes for children with oral language impairments: Developmental interactions between language skills and learning to read. In H. W. Catts & A. G. Kamhi (Eds.). *The connections between language and reading disabilities* (pp. 55-75). Mahwah, NJ: Erlbaum.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in reading. *Reading Research Quarterly, 21*, 360–407.

Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38*, 934–947.

Tangel, D., & Blachman, B. A. (1992). Effect of phoneme awareness instruction on kindergarten children's invented spelling. *Journal of Reading Behavior, 24*, 233–261.

Tomblin, J. B., Records, N., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech, Language, and Hearing Research, 40*, 1245–1260.

Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities, Research and Practice 15*, 55–64.

Torgesen, J. K., Morgan, S., & Davis, C. (1992). The effects of two types of phonological awareness training on word learning in kindergarten children. *Journal of Educational Psychology, 84*, 364–360.

Torgesen, J. K., Wagner, R. K., Rashotte, C., Alexander, A., & Conway, C. (1997). Preventive and remedial interventions for children with severe reading disabilities. *Learning Disabilities: A Multi-Disciplinary Journal, 8*(1), 51–61.

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

Wiig, E. H., Secord, W., & Semel, E. (2004). *Clinical Evaluation of Language Fundamentals-Preschool-2.* Toronto, ON: The Psychological Corporation.

Yeh, S. (2003). An evaluation of two approaches for teaching phonemic awareness to children in Head Start. *Early Childhood Research Quarterly, 18,* 513–529.

Authors' Note

Cecelia Hund-Reid, Faculty of Rehabilitation Medicine, University of Alberta; Phyllis Schneider, Speech Pathology and Audiology, University of Alberta.

Cecelia Hund-Reid was with Edmonton Regional Educational Consulting Services, Edmonton, Alberta during the time this study was conducted.

Correspondence concerning this article should be addressed to Phyllis Schneider, Speech Pathology and Audiology, University of Alberta, 2-70 Corbett Hall. Edmonton, AB T6G 2G4. Email: ps5@ualberta.ca

Received date: October 21, 2011

Accepted date: April 2, 2012