

## Research Article

# Classroom Phonological Awareness Instruction and Literacy Outcomes in the First Year of School

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**Purpose:** Despite strong investment in raising literacy achievement for all children, significant inequalities in literacy outcomes continue to exist among some of the world's most advanced economies. This study investigated the influence of a short, intensive period of phonological awareness (PA) instruction implemented by classroom teachers on raising the literacy achievement of children with and without spoken language impairment (SLI).

**Method:** A quasi-experimental design was employed to measure the PA, reading, and spelling development of one hundred twenty-nine 5-year-olds. Thirty-four children received 10 weeks of PA instruction from their teachers. Ninety-five children continued with their usual reading program, which included phonics instruction but did not target PA.

**Results:** Children who received PA instruction demonstrated superior literacy outcomes compared to

children who followed the usual literacy curriculum. Children with SLI showed significant improvements in PA, reading, and spelling but had a different pattern of response to instruction compared to children with typical language. Importantly, the number of children experiencing word decoding difficulties at the end of the program was 26% among children who followed the usual literacy curriculum compared to 6% among children who received the PA instruction.

**Implications:** A short, intensive period of classroom PA instruction can raise the literacy profiles of children with and without spoken language difficulties.

**Key Words:** phonological awareness, classroom literacy instruction, reading and spelling instruction, duration and intensity of instruction

Ensuring that children become proficient readers through effective classroom instruction is a critical issue in reading education. International prevalence statistics suggest that up to one in three children struggles with the acquisition of basic reading and writing skills (National Assessment of Educational Progress [NAEP], 2003), and that large inequalities exist between good and poor readers residing in developed nations (United Nations Children's Fund [UNICEF], 2010). One method toward raising achievement and reducing inequality in reading statistics is to ensure that key predictors of early literacy success are taught effectively and efficiently in the classroom curriculum. Toward this goal, the current investigation examined the benefits of one key predictor of literacy success, namely, phonological awareness (PA), on reading outcomes when PA is taught in a time-efficient framework by teachers as part of the beginning literary curriculum.

New Zealand provides an interesting context to evaluate whether teacher-delivered PA programs at the class level can help raise reading achievement for all children. New Zealand has a strong reputation for achieving high literacy levels among school-age children and is ranked 3rd out of 34 countries within the Organization for Economic Co-operation and Development (OECD) in terms of average reading ability (OECD, 2010). However, OECD data also reveal a large gap between the ability of good and poor readers in New Zealand (Martin, Mullis, & Kennedy, 2007); thus, scrutiny of interventions that may contribute toward successful reading outcomes for all children are critical.

## *The Role of PA in Reading Development*

The development of proficient reading relies on the integration of a complex tapestry of knowledge and skills (Gillon, 2004). One widely recognized predictor and prognostic marker for early reading success is PA (Carroll & Snowling, 2004; Catts, Fey, Zhang, & Tomblin, 2001). PA can be defined as the purposeful ability to attend to and manipulate the sound structure of spoken words at the syllable, onset-rime, and phoneme levels (Gillon, 2004). The more sensitive that children are to the sound structure of spoken words, the more likely that the children will become stronger readers irrespective of educational measures such as socioeconomic status (SES), intelligence, and receptive

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vocabulary (MacDonald & Cornwall, 1995; Torgesen, Wagner, & Rashotte, 1994).

PA knowledge allows children to link phonemes to graphemes, which in turn supports word decoding ability and subsequent reading comprehension. Early difficulties in acquiring PA skills are linked to increasingly larger gaps in reading outcomes (Torgesen et al., 1994), similar to those inequalities reported in international studies of reading achievement. Of particular concern is the development of literacy skills in young children with spoken language impairment (SLI). These children are four to five times more likely than children with typically developing (TD) language to struggle with reading acquisition due to deficits in underlying skills, such as PA, that support written language development (Catts et al., 2001). Despite new initiatives over the last decade to improve reading standards, the gap between populations at high risk for poor reading skills and good readers does not appear to be closing (Morgan, Farakas, & Hibel, 2008). Thus, it seems worthwhile that educators and researchers investigate how to efficiently and effectively integrate key predictors of literacy success into the classroom to improve reading equality.

### **Classroom PA Instruction**

Understanding how to effectively and efficiently integrate PA instruction into everyday classroom environments is critical for supporting initiatives that aim to elevate reading achievement and reduce inequality in reading outcomes. The scientific evidence surrounding the benefits of PA instruction for literacy growth is well reported for TD children and children who are at risk for reading disorder. A majority of evidence supporting the benefits of PA instruction comes from studies that have been conducted in individual or small-group frameworks under controlled research settings outside of the classroom (Ehri et al., 2001; Gillon, 2000, 2005). Less is known about the effectiveness of PA instruction, in particular, optimal duration and intensity, when it is exported to the heterogeneous classroom environment.

Successful integration of teacher-delivered PA instruction into beginning reading curricula requires consideration of a number of classroom logistics. One key consideration is the time efficiency of the program. According to McLeod, Fisher, and Hoover (2003), the time required to implement in the classroom programs plays a critical role in determining whether certain programs can be implemented successfully as part of classroom practice. Activities that are too time consuming may be omitted by teachers in an attempt to balance a busy classroom schedule. Frequent and intensive sessions are considered an important component of effective PA instruction (Elbaum, Vaughn, Hughes, & Moody, 1999; Gillon, 2004).

In controlled clinical settings, two 1-hr individual sessions per week are considered high intensity (i.e., 2 hr per week). In particular, instruction of this intensity for 20 hr over a 10-week period focused at the phoneme level has proven effective in raising reading achievement for at-risk populations in individualized therapy settings using the

Gillon Phonological Awareness Training Program (PAT; Gillon, 2000, 2005). Adapting the PAT program to investigate whether the benefits of 10 weeks (20 hr) of PA instruction can be replicated when taught by teachers to an entire classroom will offer a valuable addition toward emerging research regarding the optimal duration and intensity of PA instruction in the classroom.

### **Recent Studies of Classroom PA Instruction**

Research into the effectiveness of classroom-based literacy programs that include a focus on PA have varied in their duration and intensity. Knowledge of these variables is critical for designing effective and efficient classroom reading programs. We reviewed the literature to identify research programs that included a focus on PA instruction and that were delivered by teachers to an entire classroom. Four studies met this criteria and were compared on the basis of their duration and intensity. Regarding duration, programs implemented for >1 academic year (i.e., >36 weeks) were considered *long* in duration, and programs implemented for <1 academic year (i.e., <36 weeks) were considered *short* in duration. Regarding intensity, programs involving  $\geq 2$  hr of instruction per week were viewed as *high* intensity, and programs involving <2 hr of instruction per week were considered *low* intensity. A cutoff of 2 hr per week was selected based on evidence demonstrating that this intensity of PA instruction over a 10-week period is sufficient for eliciting improved reading outcomes in at-risk children (Gillon, 2000, 2005), whereas <10 hr of instruction has proved less effective in improving reading accuracy ( $p < .05$ ) and reading comprehension ( $p < .001$ ) skills for an at-risk cohort of children (Gillon & Dodd, 1997).

An additional area of variability between studies of PA instruction concerns the content of instruction. To compare content, programs that target PA at the phoneme level (i.e., developing awareness of individual sounds in words, also known as phoneme awareness) were classified as *narrow*, and programs that target a wide range of PA skills (e.g., syllables, onset-rime, and phonemes) were classified as *broad*. Table 1 shows a comparison of the duration, intensity, and content of PA instruction on reading outcomes from four recent classroom studies.

Of the four studies we reviewed (Table 1), Shapiro and Solity (2008) demonstrated a significant reduction in the prevalence of reading disorder using a long-duration, high-intensity classroom program focused on PA at the phoneme level. For 2 years, 251 British schoolchildren were provided with explicit instruction in phoneme blending and segmentation, high-frequency phoneme-grapheme correspondences, and sight vocabulary over three 12-min sessions per day as part of the classroom reading program. This equated to ~110 hr of instruction. The prevalence of reading disorder reduced from 20% among the children who received the usual classroom program to 5% among the children who received instruction in phoneme awareness as part of their classroom literacy curriculum. Investigating whether a similar reduction in the number of children experiencing reading problems can be achieved through a shorter period

**Table 1.** Duration, intensity, and content of phonological awareness (PA) instruction on literacy outcomes in four recent classroom studies.

	Duration		Intensity		Content		Literacy outcome	
	Long	Short	High	Low	Broad	Narrow	Immediate	Sustained
Shapiro & Solity (2008)	+		+			+	+	+ (3 years)
Fuchs et al. (2001)		+		+	+		+	– (5 months)
Justice et al. (2010)		+		+	+		+	N/A
McIntosh, Crosbie, Holm, Dodd, & Thomas (2007)		+	+		+		+	– (2 years)

*Note.* + indicates the type of duration, intensity, and content that was included in each study; *Literacy outcome immediate* + refers to literacy improvements that were demonstrated immediately after instruction; *Literacy outcome sustained* + (duration post instruction) refers to literacy improvements that were still evident at least 5 months after instruction; *Literacy outcome sustained* – (duration post instruction) refers to literacy improvements that were not sustained at least 5 months after instruction; N/A indicates that follow-up assessment is unreported thus far.

of phoneme-focused instruction may contribute to the manageable integration of PA into the classroom.

Short-duration, low-intensity studies that have a broad PA focus have reported improved literacy outcomes immediately following instruction but have struggled to demonstrate sustained improvements beyond 5 months of the program's completion. Using a short 20-week program, Fuchs et al. (2001) compared the effectiveness of teacher-delivered PA instruction with and without instruction in decoding printed words. In their study, four hundred four 5-year-olds were provided with instruction in either (a) PA and word decoding instruction, (b) PA instruction, or (c) the usual literacy curriculum (i.e., control). Fifteen PA activities were taken from the *Ladders to Literacy* program (Notari-Syverson, O'Connor, & Vadasy, 2007) and targeted syllable, onset-rime, and phoneme awareness. Decoding instruction was based on Peer Assisted Learning Strategies (PALS; Fuchs, Fuchs, & Burish, 2000) and involved children working in pairs on word reading tasks. PA and word decoding instruction involved three 15-min sessions per week, totaling 15 hr of teaching, and was considered low intensity. The children who received the PA and word decoding instruction outperformed the children in the PA-only and control classrooms on reading and spelling tasks immediately following instruction. Similarly, the children in the PA-only classrooms performed significantly higher on the postinstruction literacy measures compared to the children in the control classrooms. Five months post instruction, the children who received the PA and word decoding instruction no longer demonstrated a statistically significant advantage in reading and spelling ability compared to the children in the PA-only and control conditions. These results suggest that teaching a broad range of PA skills with low intensity (i.e., 45-min per week) over a short period of time is not effective in achieving sustained improvements for literacy outcomes. It is possible that a narrow focus on phoneme-level skills with high intensity over a short time period may produce more promising results.

In a short-duration, low-intensity program focused on a wide range of PA skills, Justice et al. (2010) demonstrated the importance of including specific teaching in PA at the phoneme level for children who are vulnerable for reading disorder. Sixty-six children between ages 3;3 (years;months)

and 5;6 were provided with literacy and language instruction using a program called *Read It Again (RIA)* (Justice, McGinty, Beckman, & Kilday, 2006). The program involved two 20- to 30-min classroom sessions per week for 30 weeks that targeted PA, print, vocabulary, and narrative knowledge. PA instruction targeted syllable, onset-rime, and phoneme awareness and was taught at least once per week, equating to 10–15 hr of instruction. The children who received the RIA instruction performed significantly higher than the comparison children ( $n = 71$ ) on measures of language and literacy immediately following the instruction. For children with low language skills, this program did not advance their phoneme awareness and alphabetic knowledge to the same extent as it did for children with average to high language skills. It is important to note that additional risk factors beyond language capabilities (e.g., SES) may have moderated the results. Nonetheless, these results suggest that investigation into the benefits of specific phoneme-focused PA instruction appears worthwhile in a classroom context, particularly for children who are at risk for reading disorder.

McIntosh, Crosbie, Holm, Dodd, and Thomas (2007) investigated the benefits of a short-duration, high-intensity, broad PA program on the literacy outcomes of 97 preschool children from low SES localities. The children in this study received 10 weeks of daily PA instruction targeting syllable segmentation, onset-rime identification, and initial sound identification. Although significant improvements were identified in PA knowledge immediately following instruction, follow-up indicated that initial gains in PA in preschool did not support accelerated literacy development in the early school years. This study showed that a short 10-week period of high-intensity instruction focused on a broad range of PA skills did not generate sustained improvements for literacy outcomes. Thus, it could be argued that a similar 10-week high-intensity period of instruction focused specifically on phoneme-level knowledge, as opposed to syllables and onset-rime, could have a significant and sustained impact on literacy growth.

A comparison of the studies in Table 1 suggests that little is known about the benefits of a short-duration, high-intensity, teacher-delivered PA program focused at the phoneme level for children in the first year of formal schooling. Shorter programs are more cognizant than longer

programs to the time demands of the classroom environment and can help educators ensure that children have key foundation skills in place to take advantage of reading instruction (McLeod et al., 2003). Furthermore, research shows that larger sound units (e.g., syllables) may develop from general classroom instruction, but awareness of smaller sound units (e.g., phonemes) may require more explicit and direct instruction (Fletcher, Parkhill, & Gillon, 2010). A specific focus on PA at the phoneme level may provide a time-efficient alternative to the teaching of a broad range of PA skills while also enhancing skills that are strongly associated with early reading success.

### ***Children With SLI***

Children with SLI present with an elevated risk for reading difficulty (Gillon, 2004). Controlled research studies suggest that individual or small-group instruction can exert a positive effect on the early literacy skills of young children with SLI (Ehri et al., 2001). In particular, it has been shown that skills at the phoneme level can be effectively stimulated in children as young as 4 years of age with expressive phonological impairment (Gillon, 2005). Recent studies involving teacher-delivered PA instruction demonstrated that children with language or speech impairment show greater individual variation in their response to instruction compared to TD children. For example, Justice et al. (2010) found that children with inferior language skills who received instruction using the RIA program appeared to benefit less than TD peers who received the same program in terms of phoneme awareness, letter knowledge, and print awareness but showed equal benefit in the areas of vocabulary, syntax, and onset-rime. This result highlights the need for further research into the effect of specifically targeting phoneme-level skills on reading outcomes as part of the classroom program. Similarly, Fuchs et al. (2002) found that the number of children with speech and/or language impairment who demonstrated improvements in literacy skills following classroom PA and decoding instruction was equal to the number of children demonstrating no improvement. Individual variation in response to reading instruction suggests that a classroom PA program may help teachers narrow down which children among this cohort will respond to classroom instruction and which will require specialist support beyond the classroom setting.

### ***Modifying the PAT Program for the Classroom Environment***

The PAT program, which has been used successfully in a number of individual or small-group controlled studies (Gillon, 2000, 2005), was adapted for the current study and used in the classroom. The PAT program was originally designed to investigate the effect of PA instruction on the PA ability, speech production, and literacy development of 5- to 7-year-olds with SLI (Gillon, 2000). Children who received 20 hr of explicit PA instruction focused at the phoneme level over a 10-week period (two sessions per week) made significant improvements in PA and reading ability

compared to children who received traditional or minimal speech-language therapy. These benefits were maintained 11 months after intervention (Gillon, 2002). The current study investigated the effectiveness of a classroom-adapted version of this program as a supplement to the “usual” literacy curriculum. Adaptations to the original PAT program included (a) 8 hr of professional development inclusive of in-class support, (b) addition of program adaptation charts to ensure that teachers could adjust activities to meet the needs of children with a range of skills, and (c) use of classroom curriculum topics and resources (e.g., books, science tables, news) as a medium through which weekly PA targets could be addressed.

### ***The Usual Literacy Curriculum in New Zealand***

The usual classroom literacy curriculum employed by teachers in the present study consisted of a whole-language approach to literacy instruction in addition to phonics instruction to teach letter-sound knowledge. *Whole-language instruction* focuses on meaning and encourages children to read whole words and sentences in the context of real literacy experiences (Tunmer, Chapman, & Prochnow, 2006). *Phonics* is a method of teaching children to read by drawing attention to letters or letter patterns and the sounds they represent (Tunmer et al., 2006). PA is different from phonics in that it deals specifically with the sound structure of words only and does not focus on print. A combination of PA plus phonics instruction has demonstrated significant benefits for reading outcomes (Ehri et al., 2001). The usual literacy curriculum in the present study did not include a specific focus on teaching PA skills.

The goal of this investigation was to examine the effectiveness of a short, intensive PA program focused at the phoneme level—as a supplement to the usual class reading program—on the literacy outcomes of children with and without SLI in the first year of school. The study addressed the following hypotheses:

- Children who are exposed to teacher-delivered PA instruction focused at the phoneme level for 20 hr over a 10-week period in the classroom will demonstrate significantly higher phoneme awareness, reading, and spelling skills both immediately after instruction and sustained to the end of the school year as compared to children who receive the usual literacy curriculum only.
- Children with SLI will demonstrate significant improvements in phoneme awareness, reading, and spelling following teacher-directed PA instruction for 20 hr over a 10-week period. However, children with SLI may show less growth in phoneme awareness, reading, and spelling development when compared to TD children.

## **Method**

### ***Participant and School Selection***

One hundred twenty-nine New Zealand children (54 boys, 75 girls) between ages 5;0 and 5;2 ( $M = 60.41$  months,

*SD* = 0.59 months) from 12 classrooms and their respective teachers participated in this study. A stratification process was used to select and invite schools to participate in the study. One hundred ten government-funded primary schools in the Christchurch region were stratified into high, middle, and low SES groupings based on decile ranking (i.e., an indication of SES where 10 equals the highest SES and 1 equals the lowest SES [Ministry of Education, 2011]). In our study, a decile ranking from 1 to 4 was considered low, 5 to 7 was considered middle, and 8 to 10 was considered high. Ten schools from each SES grouping were selected at random and made up the 30 schools that were invited to participate in the study. From these 30 schools, 12 Year 1 teachers (i.e., a teacher for children in the first year of formal schooling) agreed to participate in the study. Two Year 1 teachers from different schools were asked to participate as PA teachers and the children in their classroom were randomly assigned as either Group A ( $n = 18$ ) or Group B ( $n = 16$ ). These two teachers were selected to implement the classroom PA program because the children in their classrooms presented with similar spoken and written language profiles and SES rankings. The remaining 10 teachers and a subset of children from their respective classrooms were automatically allocated to Group C ( $n = 95$ ) and were asked to continue with their usual literacy curriculum. The subset of children in these 10 classrooms ranged from seven to 14 participants. Groups A and B were located in high-middle SES areas, and comparison Group C represented an equal spectrum of SES backgrounds. Group A, B, and C teachers were appropriately qualified and were registered to teach in New Zealand. Table 2 illustrates the demographic characteristics of the teachers in Groups A, B, and C.

**Table 2.** Demographic characteristics of the teachers in experimental Groups A and B and the teachers in comparison Group C.

Teacher	Age (years)	Experience (years)	Decile <sup>a</sup>	Gender	Class size
Group A	39	13	7	F	18
Group B	40	14	8	F	16
Group C-1	37	15	10	F	7
Group C-2	38	13	10	F	8
Group C-3	39	16	9	F	8
Group C-4	37	12	6	F	7
Group C-5	37	11	7	F	14
Group C-6	37	14	6	F	13
Group C-7	39	18	6	F	10
Group C-8	38	16	4	F	10
Group C-9	39	13	3	F	8
Group C-10	38	6	2	F	10

Note. Each numeral beside a label *Group C* represents one teacher in the comparison group.

<sup>a</sup>In New Zealand, each school is assigned a decile ranking that provides an indication of the socioeconomic community within which the school is located and is based on national census data (Ministry of Education, 2011).

## Child Participants

Year 1 teachers distributed consent forms to parents asking permission for their child to participate in the study. To ensure representation of a range of skill levels present in the classroom, the study inclusion criteria were broad. Participants were required to (a) be enrolled to commence their first year of formal education at the start of 2010; (b) have written parental permission to participate in the study; (c) present with sensory, neurological, and physical skills that did not require specialized equipment and/or additional professional support (e.g., use of sign language or a language interpreter) to achieve accurate testing; and (d) be present at school during the prescribed assessment periods.

Parental consent was obtained for all children in the classrooms who were assigned to experimental Groups A and B. Four children in Group A and three children in Group B presented with SLI at school entry as determined by standardized testing procedures. A subset of seven to 14 children from the 10 classrooms that made up comparison Group C received parental consent to participate in the study. In New Zealand, children typically start Year 1 on the day of their fifth birthday or as close to this day as practically possible. All participants spoke standard New Zealand English as their first language.

## Procedure

A quasi-experimental design was used to investigate the PA, reading, and spelling development of 5-year-old children who received teacher-delivered PA instruction or the usual literacy curriculum during the first year of school. This design was chosen because the research was conducted in everyday classroom environments as opposed to a highly controlled clinical setting. This research design was inclusive of a delayed treatment approach whereby Group A received classroom PA instruction before Group B. This was done in order to achieve replication of study results and to enable Groups A and B to act as an additional control for each other.

The study took place over a full school year, which in New Zealand runs from February through December and is divided into four terms; each ~10 weeks in duration and separated by a 2-week holiday break. The study was designed around the four school terms as follows: (a) Term 1: the usual literacy curriculum for all groups; (b) Term 2: PA instruction for Group A and the usual curriculum for Groups B and C; (c) Term 3: PA instruction for Group B and the usual curriculum for Groups A and C; and (d) Term 4: the usual literacy curriculum for Groups A, B, and C.

## Professional Development for Classroom PA Teachers

Three levels of professional development were provided to the teachers of Groups A and B. The first level involved two 1-hr meetings with the lead researcher to discuss the program theory and structure. The second level involved providing teachers with an instruction manual

outlining the goals, program content, suggested activity dialogue, and premade resources. The third level involved the lead researcher coteaching the first 3–4 weeks of the program alongside the experimental teachers before these teachers independently administered the program from weeks 6 to 10. Approximately 8 hr of professional development was provided to each teacher. Group C teachers did not receive any professional development.

### ***Assessment Phases and Measures***

All child participants received a comprehensive baseline assessment of their language, PA, and early literacy skills at school entry in addition to follow-up assessments of their PA, reading, and spelling skills at the middle and end of the school year. Additional assessment periods were warranted for children in Groups A and B to measure any pre- to postinstruction change. Children in Groups A and B were assessed at the start of the school year, the start of Term 2 (i.e., just before Group A PA instruction), the end of Term 2 (i.e., after Group A PA instruction, just before Group B PA instruction), the end of Term 3 (i.e., after Group B PA instruction), and the end of Term 4 (i.e., end-of-year assessment).

### ***Formal Assessment Measures of Language and Nonverbal Skills***

The following formal assessment measures were administered at school entry to profile the language, speech, PA, and nonverbal intellectual skills of all participants.

- The Clinical Evaluation of Language Fundamentals Preschool—2nd Edition—Australian and New Zealand Edition (CELF-P2; Wiig, Secord, & Semel, 2006) was administered to obtain a detailed profile of the children's receptive, expressive, and core language skills. It is norm-referenced for children ages 3;0–6;11. The children were required to complete the following six subtests with an examiner: (a) Sentence Structures, (b) Concepts and Following Directions, (c) Basic Concepts, (d) Word Structures, (e) Expressive Vocabulary, and (f) Recalling Sentences. Results from these subtests were collated to produce a receptive language index score and an expressive language index score. Test–retest reliability correlation coefficients range from excellent (0.90) to adequate (0.78). Measures of internal consistency range from 0.80 to 0.96 across the subtests.
- The New Zealand Articulation Test (NZAT; Ministry of Education, 2004) was administered to evaluate the children's speech sound development. The NZAT is appropriate for children ages 5;0–8;11 and includes norm-referenced tasks for the production of single consonants and initial consonant blends in words. The children were required to complete the Single Consonant and Initial Consonant Blends subtests by naming pictures that are presented by an examiner. Interrater reliability is 98% for single consonants in words and 92% for initial consonant blends. Results from the NZAT were entered into Profile

of Phonology (PROPH) software (Long, Fey, & Channell, 2002) to obtain a percentage of consonants correct (PCC) score for use in data analysis.

- The Preschool and Primary Inventory of Phonological Awareness (PIPA; Dodd, Crosbie, McIntosh, Teitzel, & Ozanne, 2000) was administered to obtain a profile of PA skills. It is suitable for children ages 3;0–6;11. The children were required to complete the Rime Oddity, Initial Phoneme Identity, and Letter Knowledge subtests with an examiner. Test–retest reliability coefficients are 0.87, 0.95, and 0.98 for Rime Oddity, Initial Phoneme Identity, and Letter Knowledge, respectively.
- The Primary Test of Nonverbal Intelligence (PTONI; Ehrler & McGhee, 2008) was administered to obtain a measure of the children's nonverbal intellectual ability. This test is appropriate for children ages 3;0–9;11. The children were required to examine pictures on a page and identify which picture does not belong. This test progresses in difficulty, beginning with lower order reasoning skills such as visual and spatial recognition and moving toward more advanced reasoning skills such as sequential reasoning and categorical formulation. Internal consistency reliability coefficients are >0.90 from 3 to 9 years of age. Test–retest reliability is excellent (0.97).
- The Neale Analysis of Reading Ability—3rd Edition (NARA; Neale, 1999) was administered when participants turned 6 years of age and coincided with the end of the school year. This test measures reading accuracy (decoding) and reading comprehension of connected text and is standardized on Australian children from 6 years of age. The children were required to read aloud a series of passages of increasing difficulty, which provides a reading accuracy score. After each passage, the children were required to answer a series of comprehension questions, which provides a reading comprehension score. Test–retest reliability coefficients are reported as 0.95 for reading accuracy and 0.93 for reading comprehension. Internal consistency reliability coefficients range from 0.71 for accuracy and 0.95 for comprehension in the first year of school.

### ***Informal Assessment Measures of PA, Reading, and Spelling Skills***

The following informal assessment measures were administered to all participants at the start, middle, and end of the school year and were also used as pre- and postinstruction measures for children in Groups A and B:

- PA was measured using a computer-based PA assessment (Carson, Gillon, & Boustead, 2011) that measures rime oddity, initial phoneme identity, final phoneme identity, phoneme blending, phoneme deletion, and phoneme segmentation skills as well as letter-name and letter-sound knowledge. The Rime Oddity, Initial Phoneme Identity, and Letter Knowledge subtests are modeled on paper-based probes that were developed and reported by Gillon

(2000, 2002), which in turn were based on earlier work by Bradley and Bryant (1983). The Final Phoneme Identity, Phoneme Blending, Phoneme Deletion, and Phoneme Segmentation subtests are modeled on work that was developed and reported by Stahl and Murray (1994). The children were required to watch the computer present each test item (i.e., verbal instructions and pictures/letters as multiple-choice response options) and then click their response (i.e., click a picture/letter) using the computer mouse. The computer then scored each response. Test-retest reliability estimates and internal consistency reliability coefficients are  $>0.70$  for all PA and letter knowledge tasks.

- Real-word reading was measured using the Burt Word Reading Test—New Zealand Revision (Gillmore, Croft, & Reid, 1981). Children were required to read single words across a test sheet until 10 consecutive errors were made. Words are represented in a graded order of difficulty. Internal reliability is excellent (0.97). Although this test does not provide normative data for children  $<6$  years of age, it was used to provide information on the child participants' early decoding and sight word abilities. Nonword reading was measured using the 10 nonwords (i.e., 10 simple CVC words using short vowels) from the nonword reading task in the Reading Freedom Diagnostic Reading Test (Calder, 1992). The children were required to read nonwords across a test sheet until 10 nonwords were attempted. This nonword reading task has been used to track PA development in a number of PA intervention studies (Gillon, 2000, 2002, 2005).
- Real-word spelling was measured using the Schonell Essential Spelling Test (Schonell, 1932). This test required children to spell single words spoken by an examiner until 10 consecutive words are spelled incorrectly. The words are graded in order of difficulty. Satisfactory correlations

between the Schonell test and the Phonic Inventories (0.60) (Potter, 2009) have been reported. Nonword spelling was measured using 10 nonwords from the Pseudoword Spelling subtest of the Test of Phonological Awareness—Second Edition (TOPA-2+; Torgesen & Bryant, 2004). This subtest required children to spell 10 nonwords presented one-by-one by an examiner. Internal reliability, interrater reliability, and test-retest reliability estimates are  $>0.80$  for all age groups in the TOPA-2+.

Tables 3 and 4 illustrate the language and literacy skills of participants in Groups A, B, and C at the start of the school year. These tables include one-way analysis of variance (ANOVA) results that did not reveal any significant between-group differences at baseline.

### Assessment Administration and Scoring Reliability

Assessments were administered individually to each child by the primary researcher or a qualified speech-language pathologist (SLP) who was trained in test administration procedures for this study. Children were tested in a quiet area near their classroom across two sessions for the initial school-entry testing and then across one session for the middle and end-of-year assessments. Data were scored in real time, with 50% of the measures being scored twice using DVD recordings. Interrater reliability for the language, nonverbal, and PA measures was 100%. Interrater reliability for speech sound performance on the NZAT was 98.2%.

### Classroom PA Program

We adapted the PAT program (Gillon, 2000) for the classroom environment and used it as the instructional program for this study. The content of the PAT program covers onset-rime knowledge, phoneme analysis, phoneme identity, phoneme segmentation, phoneme blending, and

**Table 3.** Group performance at school entry on formal assessment measures of language and nonverbal skills.

Participants	CELF-P2			PIPA			
	RLI	ELI	PTONI	RO	IPI	LS	PCC
Group A (n = 18)							
M	102.7	100.3	106.2	5.9	7.9	6.3	94.1
SD	8.3	2.2	6.1	2.2	3.7	2.0	11.7
Range	85–115	83–110	92–115	0–9	0–11	4–9	63–100
Group B (n = 16)							
M	102.9	100.6	106.9	6.4	7.9	6.9	94.2
SD	7.0	2.3	5.1	2.1	2.7	1.5	11.1
Range	85–110	80–111	95–113	3–9	0–10	0–8	64–100
Group C (n = 95)							
M	98.3	96.8	103.2	6.3	9.1	7.2	93.2
SD	10.8	1.1	7.3	2.5	2.6	2.1	11.0
Range	79–119	80–116	85–116	2–13	3–15	4–11	61–100

*Note.* CELF-P2 RLI = receptive language index of the Clinical Evaluation of Language Fundamentals—Preschool 2 (Wiig, Secord, & Semel, 2006); CELF-P2 ELI = expressive language index of the CELF-P2; PTONI = standard scores of the Primary Test of Non Verbal Intelligence (Ehrlir & McGhee, 2008); PIPA = standard score of the Preschool and Primary Inventory of Phonological Awareness (Dodd, Crosbie, McIntosh, Teitzel, & Ozanne, 2000) where RO = rhyme oddity, IPI = initial phoneme identity, LS = letter-sound knowledge; PCC = percentage of consonants correct using data from the New Zealand Articulation Test (Ministry of Education, 2004).

**Table 4.** Group performance at school entry on informal assessment measures of PA, reading, and spelling.

Participants	Phonological awareness <sup>a</sup>								Reading		Spelling	
	RO	IPI	FPI	PB	PD	PS	LN	LS	Real word	Non-word	Real word	Non-word
Group A (n = 18)												
M	5.4	5.4	0.3	1.3	0.3	0.3	13.7	10.9	4.06	2.3	1.1	2.7
SD	2.4	2.2	0.5	1.1	0.5	0.4	4.3	4.7	3.2	3.9	0.9	1.9
Range	0–8	1–8	0–1	0–3	0–1	0–1	4–18	1–16	0–10	0–4	0–3	0–6
Group B (n = 16)												
M	5.7	4.8	0.5	1.6	0.5	0.4	13.9	11.5	3.9	2.6	1.1	2.8
SD	2.4	1.8	0.7	1.2	0.5	0.5	3.9	4.7	2.7	3.6	0.7	1.8
Range	1–9	1–6	0–2	0–3	0–1	0–1	3–18	1–16	0–10	0–4	0–2	0–6
Group C (n = 95)												
M	5.3	5.3	0.6	1.3	0.5	0.6	13.4	11.1	3.7	2.2	1.2	2.5
SD	2.5	3.0	0.7	1.2	0.8	0.9	4.6	5.4	4.5	3.4	1.7	0.3
Range	0–10	0–10	0–2	0–5	0–4	0–4	2–18	0–18	0–10	0–7	0–9	0–9

Note. RO = rhyme oddity, IPI = initial phoneme identity, FPI = final phoneme identity, PB = phoneme blending, PD = phoneme deletion, PS = phoneme segmentation, LN = letter-name, LS = letter-sound; Real-word reading = The Burt Word Reading Test—New Zealand Revision (Gillmore, Croft, & Reid, 1981); Nonword reading = Calder Non-Word Reading Probes (Calder, 1992); Real-word spelling = Schonell Spelling Test (Schonell, 1932); Nonword spelling = Pseudoword Spelling subtest of the Test of Phonological Awareness—2nd Edition (Torgesen & Bryant, 2004).

<sup>a</sup>Phonological awareness was measured using a computer-based PA assessment (Carson, Gillon, & Boustead, 2011).

linking speech to print. The PAT program was adapted for the classroom in three primary ways. First, the teachers were provided with 8 hr of professional development that included discussion regarding program theory to in-class support for the first 4 weeks of the program. Second, activity adaptation charts were created so that the teachers could adjust each activity to meet a wide range of ability levels in the classroom. For example, when using the word *nest* in a phoneme blending activity, the teacher could make the task easier for children with lower ability by asking them to identify the first sound in the word. The task could be made harder for children with higher ability by asking them to manipulate sounds to create new words. Third, classroom resources were used alongside activities in the original PAT program. For example, when linking speech to print during PA sessions, classroom library books could be used to target the PA skill of the week (e.g., for initial phoneme identity, the teacher may say, “This book is about a cat. What sound do you hear at the start of *cat*?”). In addition, classroom topics (e.g., going to the beach) or news (e.g., school productions) were used to reinforce the PA targets. This adapted version of the program required ~20% of the classroom literacy teaching time.

The original PAT program involves two 1-hr sessions per week until 20 hr of instruction is complete. Following collaboration with the teachers of Groups A and B, we agreed that four 30-min sessions per week for 10 weeks during the morning literacy block were most cognizant to the needs of the classroom timetable. PA instruction targeted rime oddity for 1 week before progressing to explicit teaching of phoneme-level skills for 9 weeks. Outside of the specified instructional periods, Groups A and B continued with the usual literacy curriculum, which involved whole-language instruction in addition to Jolly

Phonics (Lloyd, 1992). Table 5 illustrates the weekly schedule of PA skills targeted.

A 30-min session involved a 5-min review of the activities from the previous session and discussion about how listening for sounds in words helps with reading and spelling. The next 20 min were devoted to two activities of ~10 min each in duration. Each 10-min activity targeted the PA skill for that week and ensured that an explicit link to print was demonstrated. For example, when listening for initial sounds in words, the children were encouraged to write the letters that represented those sounds on a laminated piece of card in front of them. Each session finished with 5 min of shared reading using a book from the classroom, with emphasis being placed on the PA target for that week.

The children in Groups A and B were not required to reach a predetermined performance criterion before moving on to the next PA skill in the program. Instead, the children were exposed to a range of PA activities known to support literacy development, and the teachers were encouraged to modify and scaffold the activities to match different ability levels using program adaptation charts.

### Usual Literacy Curriculum

The usual literacy curriculum consisted of a whole-language approach to the teaching of reading, but each classroom in this study also incorporated a phonics program. The teachers of Groups A and B and eight teachers from Group C specifically used the Jolly Phonics program. This program involves teaching children letter-sound correspondences and includes a section that instructs children on how to blend sounds together to form simple words (e.g., CVC) (Lloyd, 1992). Groups A and B teachers used this program to teach letter-sound skills and used the concept of blending sounds together during shared book

reading. Seven Group C teachers used the Jolly Phonics program to teach letter-sound knowledge but did not use the blending section of the program. One Group C teacher reported using the blending section of the program regularly. Two teachers from Group C used school-developed programs to teach letter-sound knowledge. No Group C teacher used a program that specifically targeted PA knowledge in an explicit and systematic manner.

The usual literacy curriculum across Groups A, B, and C involved 15 min of guided reading with the teacher in small groups in which meaning-based strategies such as using knowledge of sight words, looking at the pictures, and attempting to read to the end of the sentence were used. Shared book reading as a whole class for ~10–15 min also involved the use of meaning-based strategies. Each day, children were given up to 15 min for silent reading during which they selected a book from the class or school library. The teaching of letter-sound knowledge using the Jolly Phonics program or a school-developed program usually involved 20–25 min of instruction at the start of the day.

### **Independent Review of Posttreatment Data**

An independent examiner conducted all postinstruction testing for both Groups A and B to ensure that the data were collected by an individual who was blinded to the experimental versus comparison conditions (Troia, 1999). Furthermore, 30% of the postinstruction assessment measures from DVD recordings were randomly selected and were reviewed by an independent examiner with a qualification in speech and language pathology. A 100% agreement rate was achieved between the real-time examiner results and the independent review of DVD recordings of the post-assessment measures.

### **Treatment Fidelity**

The teachers of Groups A and B were required to complete a PA teaching log for each week of instruction. In this log, the teachers had to name the PA skill that was targeted (e.g., phoneme blending), the activities that were used from the program to address that target (e.g., phoneme blending bingo), and the duration of time spent on each activity. The teachers were also required to write a short paragraph outlining the responses of the children to this instruction, in particular, the responses of any children who were demonstrating difficulty relative to their peers. Out of 10 log entries for the teacher of Group A and 12 log entries for the teacher of Group B, all were validated as accurately matching the activities described in Table 5.

The teachers of children in Group C were also required to complete a weekly teaching log for the same periods over which Groups A and B were receiving PA instruction. In this log, the teachers had to document the types of literacy activities that were implemented in the classroom (e.g., guided reading), the types of teaching methods and strategies employed (e.g., context-based cues, letter-sound knowledge), and the duration of time spent on each activity. Out of 82 log entries for the teachers of children in Group C, all were validated as matching a whole-language approach to reading instruction with the supplementation of phonics instruction. In addition, the lead researcher visited each teacher in the study twice during each school term and twice during Group A and Group B's 10-week period of instruction to observe in the classroom and recorded details of the classroom literacy program for treatment validity purposes.

All PA sessions were recorded using a Sony DCR-DVD201 camcorder. Twenty percent of the DVD footage was randomly selected and was reviewed by an independent

**Table 5.** Content of the classroom PA program.

<b>Week</b>	<b>PA skill</b>	<b>Activity description</b>
1	Rhyme	Rhyme bingo and odd-one-out activities were used by the teachers to encourage the children to listen for rhyming components of spoken words.
2	Initial phoneme identity	Initial sound bingo, initial sound matching, and odd-one-out activities were used to draw the children's attention to the first sound in spoken words. Medial or final sounds were included for children with more advanced skills.
3	Final phoneme identity	Final sound bingo, final sound matching, and odd-one-out activities were used to draw the children's attention to the final sound in spoken words. Medial or final sounds were introduced for children with advanced skills.
4 & 5	Phoneme blending	Drawing, singing, and bingo games were used to teach the children to blend words together. Two- and three-phoneme words were predominantly used; however, four-phoneme words and initial and final consonant blends were used for children with more advanced abilities.
6 & 7	Phoneme segmentation	Drawing, singing, and bingo games were used to teach the children how to segment sounds in words. Two- and three-phoneme words were used; however, four-phoneme words and initial and final blends were used to extend students.
8 & 9	Manipulation	Large letter cards or a white board were used to teach the children to manipulate letter sounds in words to create new words.
10	Review	Activities from each of the 9 weeks of instruction were reviewed. Focus was directed toward phoneme segmentation and blending activities.

*Note.* Linking speech to print: All activities required a demonstration of how the PA task related to print. For example, during or after initial sound bingo, the children were asked to select three pictures from the bingo board, articulate the first sound they heard, and then write the letter for that sound.

researcher to ensure that each PA skill (e.g., phoneme blending, phoneme segmentation) was targeted during the program and that the link between speech and print was emphasized. The DVD footage was coded by having the independent researcher tick a box to indicate whether or not the PA activities (i.e., listed in Table 5) were targeted in the DVD sessions viewed. One hundred percent of the reviewed data was validated as accurately illustrating the instructional content reported in Table 5. Ten teachers in the comparison classrooms participated in four recording sessions (i.e., approximately one per term) to enable data gathering on what constituted activities and strategies within the usual literacy curriculum. To ensure that Groups A and B returned to the usual literacy curriculum following classroom PA instruction, Group A received recording sessions in Terms 3 and 4, and Group B received one recording session in Term 4. Twenty percent of the data from Group C was reviewed by an independent researcher who validated that the instructional strategies consisted of guided, shared, and silent reading with a focus on meaning-based cues. The researcher also validated the use of letter-sound knowledge instruction and the absence of explicit and systematic teaching in phoneme identification, phoneme blending, phoneme segmentation, phoneme deletion, and phoneme manipulation skills. The independent researcher also investigated the instructional strategies used in the usual literacy curriculum by teachers of Groups A and B following their 10-week implementation of classroom PA. It was possible that exposure and practice at implementing the PA activities and strategies would affect the reversal back to the usual literacy curriculum. Review of each recording session showed that the instructional strategies and resources were predominantly focused on whole-language instruction (e.g., there were no time slots allocated specifically to PA), but the teachers were more likely to spontaneously draw children's attention to the initial sounds in words and how to blend and segment sounds in words during classroom reading and spelling activities.

## Results

### *Literacy Outcomes Following Classroom PA Instruction*

Group performances on measures of PA, reading, and spelling were compared at the start, middle, and end of the school year. A multivariate approach to repeated measures, Wilk's lambda (Assessment T1, T2, and T3  $\times$  Group), was used to explore between-group differences on measures of PA, reading, and spelling development over time. A significant Group  $\times$  Time effect when adjusted for sphericity using the Greenhouse-Geisser correction method was identified for measures of initial phoneme identity,  $F(3.403, .851) = 9.095, p = .000$ ; final phoneme identity,  $F(2.820, .705) = 22.306, p = .000$ ; phoneme blending,  $F(3.554, .889) = 9.171, p = .000$ ; phoneme deletion,  $F(3.650, .912) = 16.723, p = .000$ ; phoneme segmentation,  $F(3.580, .895) = 23.996, p = .000$ ; real-word reading,  $F(3.078, .769) = 18.540, p = .000$ ; nonword reading,  $F(3.091, .773) = 16.817, p = .000$ ;

real-word spelling,  $F(2.961, .745) = 31.450, p = .000$ ; and nonword spelling,  $F(3.698, .925) = 13.677, p = .000$ . A significant Group  $\times$  Time effect was not identified for rime oddity,  $F(3.758, .940) = .971, p = .420$ . Linear and quadratic Group  $\times$  Time results from repeated measures analyses validated significantly different growth trajectories for phoneme-level skills and literacy measures, but not for rime oddity. Tamhane's T2 post hoc tests showed that Groups A and B did not perform significantly different to each other on measures of phoneme awareness and early reading and spelling development, but they did perform significantly different to Group C on all measures except for rime oddity.

The NARA was administered after 1 year of schooling when the participants were 6 years of age. This was 6 months after instruction for Group A and 3 months after instruction for Group B. A one-way ANOVA followed by post hoc tests showed that Groups A and B performed significantly better than Group C in reading accuracy,  $F(2, 126) = 39.937, p = .000, \eta^2 = .39$ , and comprehension,  $F(2, 126) = 38.434, p = .000, \eta^2 = .38$ . The resulting effect sizes using eta squared were considered large (Cohen, 1988). Importantly, only 5.88% of the children who received PA instruction performed below an age-expected level in reading accuracy after 1 year of school compared to 26.32% of the children who received the usual literacy curriculum. Similarly, 5.88% of the children who received PA instruction performed below the age-expected range in reading comprehension at 6 years of age compared to 31.58% of the children who received the usual literacy curriculum. These results demonstrate that sustained benefits for literacy were achieved beyond the immediate conclusion of the classroom PA program.

### *Classroom PA Instruction and SLI*

Data were analyzed to examine the response of children with SLI to the classroom PA instruction and to compare this response to that of TD children. To achieve a larger sample size of children with SLI who received classroom PA instruction, data from Groups A and B were aggregated to form one experimental group. It is important to acknowledge that aggregation of Groups A and B may have introduced an error margin because Group A received instruction 12 weeks earlier than Group B did. In total, the experimental condition consisted of seven children with SLI and 27 TD children. Paired-samples  $t$  tests showed that the children with SLI who received 10 weeks of classroom PA instruction showed significant improvements (i.e.,  $p < .01$ ) on the measures of initial phoneme identity,  $t(6) = 7.33, p < .0001, d = 3.92$ ; final phoneme identity,  $t(6) = 9.98, p < .0001, d = 5.34$ ; phoneme blending,  $t(6) = 3.90, p = .002, d = 2.08$ ; phoneme deletion,  $t(6) = 3.70, p = .003, d = 1.98$ ; phoneme segmentation,  $t(6) = 8.08, p < .0001, d = 4.32$ ; letter-name recognition,  $t(6) = 3.71, p = .003, d = 3.03$ ; letter-sound knowledge,  $t(6) = 6.40, p < .0001, d = 5.23$ ; real-word reading,  $t(6) = 8.49, p < .0001, d = 4.54$ ; nonword reading,  $t(6) = 3.81, p = .0025, d = 2.04$ ; real-word spelling,  $t(6) = 9.17, p < .0001, d = 4.90$ ; and nonword spelling,  $t(6) = 7.69, p = .0001, d = 4.11$ . Paired-samples  $t$  tests did not reveal

any significant pre-to postinstruction differences for rime oddity,  $t(6) = 1.86, p = .09, d = 0.1$ .

Gain scores were calculated to measure growth in response to the classroom PA instruction and to determine whether the children with SLI benefited equally from instruction in comparison to the TD children. Independent-samples  $t$  tests on gain scores showed that the children with and without SLI differed in how they benefitted from the classroom PA instruction. The children with and without SLI appeared to gain equally in the development of deeper level phoneme awareness skills including phoneme blending,  $t(32) = 0.69, p = .50, d = 0.24$ , and phoneme segmentation,  $t(32) = 1.22, p = .23, d = 0.43$ : The TD children showed significantly more growth in phoneme deletion,  $t(32) = 8.83, p < .0001, d = 3.12$  than the children with SLI. This skill was not taught as part of the classroom PA program, suggesting that the TD children were more readily able to transfer PA knowledge to an untrained task. Compared to the TD children, the children with SLI demonstrated significantly more growth on measures of rime oddity,  $t(32) = 3.11, p = .004, d = 1.10$ , and initial phoneme identity,  $t(32) = 8.43, p < .0001, d = 2.98$ . The TD children were approaching mastery of, or had already mastered, these skills before instruction. Therefore, they had less potential for gain on these tasks compared to the children with SLI.

The TD children showed significantly greater gains in reading and spelling development compared to the children with SLI. Specifically, the TD children produced significantly higher gain scores on measures of nonword reading,  $t(32) = 4.27, p = .0002, d = 1.51$ ; real-word spelling,  $t(32) = 9.20, p < .0001, d = 3.25$ ; and nonword spelling,  $t(32) = 3.06, p = .004, d = 1.08$ . The resulting effect sizes were large. Comparison of gain scores in real-word reading revealed no significant differences between the children with and without SLI,  $t(32) = 0.50, p = .62, d = 0.18$ . The Burt Word Reading Test, which was used to measure real-word reading, may have been too difficult for this age group, resulting in low and nonsignificant results. These results suggest that the TD children in this sample were more readily able to transfer their enhanced PA knowledge to reading and spelling tasks. Although the children with SLI made significant improvements in reading and spelling relative to their own pre-instructional skills, they did not demonstrate as much growth in these literacy areas as did the TD children who received the same classroom PA instruction.

Finally, we compared the performance of the children with SLI who received classroom PA instruction to that of the children in Group C who followed the usual literacy curriculum. At the start of the school year, the PA and letter knowledge skills of the children with SLI were significantly lower than those of the children in Group C. However, at the end of the year, the PA and literacy profiles of the children with SLI following classroom PA instruction were not significantly different to those of the children in Group C, who did not receive classroom PA instruction: phoneme blending,  $t(100) = 1.0184, p = .311, d = .20$ ; phoneme deletion,  $t(100) = 1.5745, p = .184, d = .31$ ; phoneme segmentation,  $t(100) = 1.7801, p = .078, d = .36$ ; nonword

reading,  $t(100) = .1185, p = .906, d = .02$ ; and real-word spelling,  $t(100) = .5152, p = .608, d = .10$ . At 6 years of age, only one child in Group A and one child in Group B performed below the age-expected level in reading accuracy and comprehension. This suggests that it is possible to raise the literacy abilities of at-risk children to a typical level following exposure to classroom instruction that includes a short-term intensive focus on phoneme-level skills.

## Discussion

This study investigated the impact of a short, intensive, teacher-directed classroom PA program on raising literacy achievement for children with and without SLI in the first year of school. Understanding variables such as the duration, intensity, and content of PA instruction may help with effective and efficient integration of PA teaching into the classroom environment. This in turn may contribute to the elevation of reading achievement in the early school years.

### *The Positive Impact of Classroom PA Instruction on Reading Outcomes*

The first study hypothesis stated that children who received a short, intensive period of classroom PA instruction focused at the phoneme level would show significantly higher scores on PA and early literacy measures immediately after instruction and sustained to the end of the school year compared to children who followed the usual literacy curriculum only. This hypothesis was supported by statistical analyses of the data. The children who received the teacher-directed classroom PA instruction performed significantly higher on the end-of-year reading and spelling measures compared to the children who continued with the usual classroom reading program. For example, by 6 years of age, 5.88% of the children who received the PA instruction performed below the age-expected level in word decoding ability compared to 26.32% of the children who did not receive the PA instruction. Furthermore, after 1 year of school, 5.88% of the children who received the PA instruction compared to 31.58% of the children who continued with the usual curriculum performed below the age-expected level in reading comprehension. This represents a 20% reduction in the number of children presenting with reading difficulties through modification of the classroom curriculum to include a short-term focus on PA. This initial finding holds promise for establishing comprehensive evidence-based classroom programs aimed at raising reading achievement and reducing reading inequality.

Collecting information that will contribute to a greater understanding regarding the optimal duration and intensity of classroom PA instruction is critical for ensuring that educators can teach PA efficiently and effectively in the classroom. The current study differs from previous studies referred to in Table 1 by employing a short-duration, high-intensity, phoneme-focused PA program. Previous classroom-based studies of shorter duration have generally

struggled to show maintenance of reading improvements (e.g., Fuchs et al., 2001) compared to studies of longer duration and higher intensity (e.g., Shapiro & Solity, 2008), which have reported sustained improvements for literacy development. Contrastingly, the results of the current investigation demonstrate that a short-duration, high-intensity teacher-directed PA program can result in improved reading outcomes both immediately and up to 6 months after instruction. A reduction in the percentage of children experiencing reading difficulties was similar to that reported by Shapiro and Solity (2008) and was achieved in a shorter time frame (e.g., 10 weeks compared to 2 years). This result holds educational implications for classroom practice in that a shorter period of PA instruction may be more manageable for teachers to integrate into existing curriculums. Time-efficient periods of PA instruction may help ensure that children possess the necessary precursory skills to take advantage of beginning reading instruction, thereby minimizing the possibility of growing inequality in reading outcomes. In addition, these results demonstrate that the efficacy of the PAT program, which was previously used in individual or small-group clinical settings, is maintained when it is modified for the classroom and administered by teachers to a large group of children with differing skill levels.

Another key variable that may underpin the positive literacy outcomes reported in the current study is the specific focus on developing PA skills at the phoneme level. Skills at the phoneme level are critical to early literacy success, are often deficient in children who are at risk for reading disorder, and can be stimulated in children as young as 4 years of age with spoken language difficulties (Gillon, 2005). As indicated in Table 1, classroom-based studies of shorter duration have often taught a broad number of PA skills (e.g., syllables, onset-rime, and phonemes) and do not appear to consistently achieve sustained literacy improvements. In the current study, a specific focus on skills at the phoneme level, as opposed to a broad focus on PA, may have allowed a shorter period of instruction to contribute to the maintenance of improved literacy outcomes by maximizing teaching time on the level of PA that is most strongly associated with early reading success. In our study, the first week of instruction was directed at onset-rime awareness before moving to an explicit focus at the phoneme level for 9 weeks. The children in Group A maintained their enhanced performance on both the PA and literacy measures 6 months following instruction. Similarly, the children in Group B maintained their advances in PA and literacy development 3 months following instruction. In addition, onset-rime awareness developed similarly across the three groups, irrespective of their exposure to PA. This suggests that classroom instruction may be sufficient in scaffolding the awareness of larger sound units but less efficient in raising awareness at the phoneme level without supporting PA instruction. The educational implication of this finding posits that PA teaching time should include a comprehensive focus on developing children's awareness at the phoneme level.

### ***Children With SLI and Response to Classroom PA Instruction***

The second study hypothesis stated that children with SLI would show significant improvements in reading and spelling following short, intensive phoneme awareness instruction. However, in line with previous research (e.g., Fuchs et al., 2001, 2002; Justice et al., 2010), children with SLI may show less growth in phoneme awareness, reading, and spelling development due to lower language skills. In our study, the children with and without SLI who received classroom PA instruction showed significant improvements on all of the PA, reading, and spelling measures (except onset-rime awareness). The children with and without SLI benefited equally from instruction in growth of final phoneme identity, phoneme blending, and phoneme segmentation skills. However, the children with SLI showed less ability to transfer phoneme-level knowledge to an untrained PA activity, namely, phoneme deletion, compared to the TD children. The children with SLI showed significantly more growth in initial phoneme identity and onset-rime awareness compared to the TD children. This is most likely because the children with SLI had more scope for growth in these early PA skills. These findings may suggest that children with SLI can benefit equally if not greater than TD children in the development of phoneme awareness, and are in contrast to the latter part of the second hypothesis stating that children with SLI may benefit less in development of skills at the phoneme level. This suggests that an explicit focus on phoneme-level skills is necessary to enhance knowledge at this critical level of PA.

The TD children showed significantly higher gain scores in reading and spelling development compared to the children with SLI. That is, the children with poorer language skills appeared less able to transfer their enhanced PA knowledge to the processes of reading and spelling compared to children with strong language abilities. Ongoing support in applying phonologically based knowledge to the written language process may therefore be necessary for this group of children. Although the children with SLI who received the classroom PA instruction did not demonstrate as much growth in reading and spelling development compared to the TD children, this cohort did perform at similar reading and spelling levels to the children in the comparison group who did not receive PA instruction, thereby suggesting that inclusion of a short period of phoneme-focused instruction as part of the beginning reading program can exert a positive influence on the reading outcomes of children who enter school with an increased risk for reading disorder. It is important to acknowledge that these results are based on a small sample size, which may limit generalization of the results. Despite this, these results provide promise for future initiatives aimed at achieving greater equality in reading outcomes.

### ***Limitations***

A number of study limitations must be acknowledged. First, the use of a quasi-experimental design in which participants were not randomly assigned at an individual

level to each instructional condition may limit the causal relationships postulated in this study. A quasi-experimental design was employed because participants were already found as part of “intact” (i.e., classrooms) groups in their local areas. Attempts to counteract this lack of random assignment included the use of comparison Group C and ensuring that Groups A, B, and C were not significantly different at the start of the study. Furthermore, it is plausible that generalization of the findings may be confounded by variability in the teacher, child, and location factors that exist between educational settings. All participants resided in the same metropolitan city, and those participants who received intervention came from average SES backgrounds. It must also be acknowledged that the gains in reading and spelling may in part be related to the quantity of professional development that the experimental teachers received. The teachers of Groups A and B received 8 hr of professional development and in-class support, whereas the teachers of Group C did not receive any formal professional development. These limitations warrant further investigation through replication studies involving a range of education contexts. The limited number of children with SLI necessitates future investigation through the use of larger sample sizes to ensure that improvements are not mediated by regression toward the mean. Research to help children with SLI transfer their phonological knowledge into written language is also necessary.

In summary, teaching children to become efficient readers in their own classrooms is paramount to their future academic learning and lifelong success. The findings from this study contribute to existing literature by demonstrating that a short, intensive period of teacher instruction in PA focused at the phoneme level during the first year of schooling has the potential to exert a significant and positive influence on the reading and spelling development of children with and without SLI. Pursuing improved literacy outcomes for all children requires exposure to a comprehensive multifocal curriculum. This study suggests that such a curriculum should include a period of concentrated and time-efficient instruction in PA.

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