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# The impact of an early intervention on vocabulary, phonological awareness, and letter–sound knowledge among Spanish-speaking kindergarteners

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## ABSTRACT

This study examined the impact of two different interventions: Phonological Awareness PA–only versus PA, vocabulary, and Morphological Awareness (MA) on Spanish-speaking kindergarteners' language and literacy skills. We took measures on PA, vocabulary, letter-name and sound knowledge, and MA. Children in the comprehensive intervention condition showed significant growth from pretest to posttest on all measures and an overall vocabulary knowledge advantage over children in the PA-only intervention. Children in the PA condition showed significant growth on vocabulary out of context, letter-name sound knowledge, initial syllable identity, and rhyme identity. Results support the integration of PA, vocabulary, and MA in kindergarten interventions. The importance of including MA in kindergarten vocabulary interventions and the feasibility of classroom interventions by trained teachers are discussed.

## KEYWORDS

Early intervention; language and literacy; morphological awareness; phonological awareness; vocabulary

Early language development sets the tone for later language and literacy development and academic performance. Unfortunately many children, notably those from low SES backgrounds, arrive to kindergarten with insufficient development in several areas of language. As such, they begin their academic career at a position of disadvantage, which, rather than diminishing over time, increases unless intentional, systematic, and effective intervention is provided. To give these children a fair chance, it is critical to intervene early and effectively. The importance of early intervention is well established and understood, and widely accepted. However, there is less clarity on the nature of the intervention and its focus, particularly in a less studied language such as Spanish. This paper reports on a study that compared two types of intervention. One intervention focused on phonics (correspondences between letters and sounds) and phonological awareness (PA), which refers to the ability to recognize and manipulate individual units of sound in words, and which has been found to be a prerequisite for learning to read. A more robust intervention included also a minor component of PA, but focused mainly on explicit vocabulary instruction and morphological awareness (MA), the ability to identify and manipulate the smallest segments of meaning in words, which has been identified as

playing a significant role, mainly in vocabulary learning, but also in reading.

## *The importance of early intervention*

Over decades, researchers have argued and demonstrated that kindergarten and Grade 1 are the prime periods for effective literacy intervention (Ozernov-Palchik & Gaab, 2016; Torgesen, 2000, 2002). If not addressed, early literacy deficits discourage children from reading (Oka & Paris, 1986), exacerbate throughout the school years, and have a long-lasting negative impact on vocabulary development, reading comprehension, and academic performance (Cunningham & Stanovich, 1998). By contrast, early intervention prevents later reading difficulties (Foorman et al., 2016; Scarborough, 2001; Snow, Burns, & Griffin, 1998).

Important considerations in effective early intervention are explicit, systematic, and intensive instruction (National Early Literacy Panel, 2008; Torgesen, 2002). Children who enter kindergarten with literacy weaknesses are not able to develop preliterate skills by themselves; they need intentional and explicit teaching (Gaskins, Ehri, Cress, O'Hara, & Donnelly, 1997). As demonstrated by several studies (e.g., Bonnes Bowne, Yoshikawa, & Snow, 2016; Damhuis, Segers, &

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Verhoeven, 2014; Piasta & Warner, 2010; Torgesen et al., 1999; Tyler, Osterhouse, Wickham, Mcnutt, & Shao, 2014), children in explicit instruction conditions show significantly larger growth than children receiving implicit instruction. The intervention is also more effective if the instruction is scaffolded through a sensible sequence of skills (National Institute of Child Health and Human Development, 2000; Richards & Leafstedt, 2010; Swanson, 1999). Whether kindergarteners' literacy weaknesses are the result of cognitive differences or lack of exposure to rich language, they need more instructional opportunities than their peers, thus repetition is key in advancing these learners (Torgesen, 2002). Research-based interventions in phonological awareness include focused instruction (one or two skill areas) rather than a multitasked approach, small-group teaching for 15–20 min a day (although instruction may be done with the whole class as well), instruction that is adjusted to students' ability level, and a combination of phonological skills and phonics (letter–sound correspondences) instruction (National Institute of Child Health and Human Development, 2000).

### ***The importance of phonological awareness***

Phonological awareness has been identified as a critical precursor of reading across numerous typologically diverse languages (Branum-Martin, Tao, & Garnaat, 2015; Caravolas et al., 2012; Goswami, 2008; Koda, 2007); however, the aspects of phonological awareness that play a most critical role in reading vary across languages. In English, for example, phonemic awareness (the ability to identify or manipulate the individual sounds in words that are presented orally) is the strongest predictor of reading (National Early Literacy Panel (NELP), 2008; National Institute of Child Health and Human Development, 2000), and thus should be the main focus of early intervention (Foorman et al., 2016). Phonemic awareness is critical for phonemic decoding of words with regular letter-to-sound correspondence, but it also supports the memorization of spelling patterns required for sight-word reading (Ehri, 1998). If, by the end of kindergarten, children have not developed strong phonemic awareness, they find it very hard to learn the letter-to-sound correspondences (Torgesen, 2002; Wagner, Torgesen, & Rashotte, 1994; Wagner et al., 1997), which are the basis of decoding typically taught in Grade 1; in other words, children with poor phonemic awareness cannot crack the written language code.

There are differences between English and Spanish orthographic systems. A key difference relevant to early

stages of reading development is that there is more consistency in the letter-to-sound mapping in Spanish than in English (Defior, Martos, & Cary, 2002; Defior & Serrano, 2007, 2011; Seymour, Aro, & Erskine, 2003). In Spanish, along with phoneme awareness, syllable awareness has been found to play a strong role in reading (Herrera & Defior, 2005). Despite these differences, research across languages shows that children develop sensitivity to syllables first, followed by onsets and rimes, and finally, phonemes (e.g., Jimenez & Ortiz, 2000; Treiman & Zucowski, 1991). However, due to differences in phonological structure and orthography, the patterns of relationships between PA and word-recognition skills vary across languages. Whereas in Spanish the most salient unit of speech processing is the syllable, because most of the words are open-syllable words, in English the most salient units of speech processing are the phoneme and the intrasyllabic levels because most of the words are closed-syllable words (CVC, CVCC; Bruck, Genesee, & Caravolas, 1997). Thus, Spanish-speaking children show higher syllable but lower phoneme and rime awareness than English-speaking children (Bruck et al., 1997; Clinton, Quiñones, & Christo, 2011; Denton, Hasbrouck, Weaver, & Riccio, 2000). However, due to the high consistency in the letter-to-sound mapping in Spanish to decode words, the focus on syllables rather than phonemes is disadvantageous for Spanish-speaking children (Goodwin, August, & Calderon, 2015; Jiménez, González, Monzó, & Hernández-Valle, 2009). Therefore, the ability to segment words into their phonemes becomes a critical predictor of reading acquisition in Spanish (Denton et al., 2000).

### ***The importance of vocabulary and MA***

Although poor reading is, in most cases, rooted in poor phonological awareness, a broader range of language skills explains the reading challenges of a large number of children from low SES (Torgesen, 2002). In addition to poor phonological awareness, many children from low SES enter kindergarten knowing significantly fewer words than their peers (Beck, McKeown, & Kucan, 2013; Biemiller, 2012; Hart & Risley, 1995, 2003) because of limited exposure to rich oral language. In a study by Hart & Risley (2003), preschoolers from low SES had been exposed to thirty million fewer words than those from medium to high SES. This explains why some kindergarteners arrive to school as much as two years behind others (Hart & Risley, 2003). These gaps have also been found among preschoolers in five Latin American countries (e.g., Schady, 2012; Schady et al., 2015). Vocabulary knowledge is the strongest

predictor of reading and academic success (see National Early Literacy Panel [NELP], 2008). Large oral vocabulary facilitates word decoding (Al Otaiba, Kosanovich, & Torgesen, 2012; Skebo et al., 2013) and reading comprehension (Cain, 2016; Quinn, Wagner, Petscher, & Lopez, 2015). In Grade 4 and beyond, when children shift from learning to read to reading to learn, vocabulary plays a prominent role in reading comprehension (Chall, 1983); however, it is critical to intervene in vocabulary deficits early (Ramirez, Walton, & Roberts, 2013). Without intervention, the gap between children with poor and rich vocabulary widens exponentially throughout schooling (Biemiller, 2012; Duff, Tomblin, & Catts, 2015; Stanovich, 1986), suggesting that the more words a child knows, the easier it is to learn new ones, and the fewer words known, the harder it is to learn new word meanings. This may explain why children who start kindergarten with poor vocabulary knowledge learn on average 32% fewer root words than their peers throughout the primary grades, as found by Biemiller (2005). The gap would be probably larger if we consider all the derivations of these root words.

Effective vocabulary intervention takes into account explicit and systematic teaching of words (Biemiller, 2012; Biemiller & Boote, 2006) through a meaningful context such as interactive read-alouds (Biemiller & Boote, 2006; Snell, Hindman, & Wasik, 2015). Prior to developing reading skills, children learn vocabulary and understand the meaning of words by listening to the oral discourse that surrounds them. Reading aloud to kindergarteners is an effective way of enriching vocabulary and conceptual knowledge, but only if the meanings of new words are explicitly taught (Biemiller & Boote, 2006).

Another important consideration is how many and which words should be taught. According to Beck, McKeown, and Kucan (2013), students learn approximately 2,000 to 3,000 words (including root words and their derivations) a year, from which about 400 should be taught directly. For 183 days of instruction, this corresponds to about two words per day. In a regular school day, however, students, particularly those with low vocabulary, encounter more than two unknown words. Thus, strategic selection of words for direct instruction is required.

In addition to learning new vocabulary through explicit and systematic instruction, children need to learn how to be effective independent word learners. This can be achieved through the teaching of metalinguistic skills (e.g., morphological awareness; Nagy, 2007; Ramirez et al., 2013). Although a strong association of morphological awareness with phonological awareness (Carlisle & Nomanbhoy, 1993; Cunningham & Carroll,

2015; Law & Ghesquière, 2017) and with vocabulary (Berninger, Abbott, Nagy, & Carlisle, 2010; Ramirez et al., 2013) has been noted, it has also been observed that morphological awareness makes a significant, independent contribution to reading (e.g., Apel & Lawrence, 2011; Casalis & Colé, 2009; Deacon & Kirby, 2004) across several languages.

Early interventions targeting morphological awareness have shown that, although all children benefit from this intervention, it is the ones with lower vocabulary levels who benefit the most (Apel & Diehm, 2013; Ramirez et al., 2013) and that effective morphological awareness interventions are integrated with the teaching of other literacy skills (Bowers, Kirby, & Deacon, 2010). The effectiveness of morphological awareness interventions in kindergarten has been examined in typologically diverse languages such as Norwegian (Lyster, 2002), English (Apel & Diehm, 2013; Ramirez et al., 2013), French (Casalis & Colé, 2009), Chinese (Wang & McBride, 2017), and Spanish-Speaking English Language Learners (Zoski & Erickson, 2017). To our knowledge, no studies have examined the effectiveness of morphological awareness interventions among monolingual Spanish kindergarteners.

Consistent research findings make it undisputable that prevention through early intervention is more effective than remediation beyond the primary grades; what is not so clear is what skills should be targeted, particularly for Spanish monolingual speakers, as there is a dearth of research examining this issue in this population. Most early intervention studies have focused on phonological awareness (Suggate, 2016), whereas others have focused on aspects of oral language such as vocabulary, listening comprehension, inference generation, and narrative skills (e.g., Bowyer-Crane et al., 2008), either in isolation or integrated. Only recently, some studies have focused on morphological awareness (Casalis & Colé, 2009; Ramirez et al., 2013; Wang & McBride, 2017; Zoski & Erickson, 2017). To sum, there is emerging but still insufficient research examining the impact of comprehensive early interventions (e.g., PA + Vocabulary + MA) on language and literacy skills, particularly in languages other than English.

The ultimate goal of literacy instruction is to prepare readers who are successful at comprehending written material. To achieve this, both good general language comprehension and effective (accurate and rapid) word reading skills are required (see Simple View of Reading in Gough, 1996; Hoover & Gough, 1990). According to this, early intervention to prevent later reading difficulties in at-risk groups should consider key skills that capture both dimensions of reading. The independent

contribution of vocabulary, decoding, phonological awareness, and morphological awareness to reading suggests that it is important to consider all of them when planning an early intervention.

### **The current study**

As reading research has pointed out, early literacy intervention is more effective than later remediation and is key in preventing reading difficulties. Explicit instruction is critical for children at risk of reading difficulties, and a broad range of literacy-related language skills need to be targeted when working with children from low SES. With these considerations in mind, the current study examined the effectiveness of two school-based interventions: (a) phonological awareness and phonics and (b) phonological awareness + vocabulary + morphological awareness, on early language and literacy development of kindergarteners from low SES background. The main purpose is to identify what skill or combination of skills would yield stronger effects in this group of monolingual, Spanish-speaking kindergarteners about whom little is known. Drawing on the insights from the above-reviewed literature, it was predicted that the children in the combined intervention would show the greatest growth on target skills that underline reading development (PA, vocabulary, MA, and letter-sound knowledge).

## **Method**

### **Sample**

Participants were monolingual Spanish-speaking children who met the following criteria: (a) they had no known history of neurological or hearing problems (teacher report), (b) they had not learned to read (teacher report and pretest data), and (c) their families had middle to low academic level (school records). The sample was composed of 129 kindergarten children from six classrooms located at four marginal urban schools in Mendoza, Argentina (*Mean age* = 66.2 months [5.5 years], *SD* = 0.4).

### **Design**

To assess the impact of two types of classroom intervention programs on early literacy outcomes, we used a pretest–posttest quasi-experimental design with repeated measures. Children were assessed on PA abilities, letter-name and sound knowledge, morphological awareness and vocabulary knowledge before and after

the intervention. Children's level of parental education and socioeconomic status were evaluated.

### **Random assignment**

Given that the intervention programs were delivered by the classroom teachers, students from the same class could not be randomly assigned to different conditions. However, classes were randomly assigned to one of the following conditions: (a) intervention on phonological awareness and vocabulary (PA training + direct vocabulary teaching + morphological awareness), (b) intervention on phonological awareness and basic phonics, and (c) control. Two classes were randomly assigned to each condition. Two classes from the same school had different teachers and were part of different conditions, but one class attended school during the morning and one during the afternoon.

The school selection was based on the following criteria: (a) neither grapheme nor phonemic instruction were introduced in the kindergarten class, and (b) the majority of the children who attended this school were from neighborhoods where nearly all families have low incomes and parental education is low, with the parents on average having less than nine years of schooling (according to school records). The sample size was sufficiently large to ensure more than 10 participants per cell, which was the conservative standard used in Troia's (1999) review.

### **Dependent variables**

All of the subjects were assessed using the following tasks: (a) Letter Name and Sound Knowledge (raw scores), (b) Phonological Awareness Tasks: Initial Phoneme, Initial Syllable, and Final Syllable Identification (raw scores), (c) Morphological Awareness, and (d) Vocabulary: Test de Vocabulario en Imágenes Peabody-TVIP (standard scores) experimental vocabulary out of context, experimental vocabulary in context (raw scores). The response of each participant was registered on an individual protocol designed for data collection.

### **Intervention**

The intervention started after the pretest and lasted three months. The programs were delivered by the classroom teachers, who received specific training with scripted instructions on the lessons to be imparted each week. After modeling every activity in front of the class, the teacher coached the students, who manipulated their own individual materials. To check for

fidelity of implementation, the chief researcher observed one lesson per week throughout the intervention. Teachers were aware that observations would take place once a week, but they did not know in advance which day. Accuracy and consistency of implementation was assessed with a checklist detailing (a) expected length of the lesson, (b) activities delivered according to the script, (c) availability of the materials detailed in the script, (d) expected use of the materials, (e) student engagement, (f) expected modeling of activities, and (g) ability to deliver the lesson. A score from 1 to 4 was given to each variable as follows: 1 = Deficient, 2 = Basic, 3 = Good, 4 = Very good.

### ***The phonological awareness intervention program***

Adapted from the program used by Blachman, Ball, Black, and Tangel (2000), it consisted of 22 lessons for the PA-only condition and 14 lessons for the PA + Vocabulary condition of 30 min each relayed by the teacher to the entire class. Every lesson included three exercises. The main component was *phoneme segmentation*. It consisted of one task of the set of “Say-It-and-Move-It” or the Elkonin card activities adapted from Blachman et al. (2000). Each task required the children to break two- and three-grapheme words by positioning a marker for every sound they pronounced. The second exercise included a *linguistic game* to foster one of the following abilities: rhyme awareness, sound categorization, or sound blending. To develop rhyme and initial sound categorization, the program included a series of oddity tasks that required the children to select the picture whose name did not match the corresponding sound of the other three picture names. Sound blending required the children to listen to a series of separately articulated sounds from a “puppet” or the teacher, and to say aloud the complete word that the teacher was trying to pronounce. The *letter name and sound knowledge* activity involved providing the name and sound of four vowels (a, e, i, o) and five consonants (m, s, t, l, p), while the children accomplish one of the following tasks: to select and hold up the letter matching the speech sound articulated by the teacher, to say the first sound of a drawing and put the drawing inside a bag with the correct letter, and to complete letter–sound bingo games.

### ***The vocabulary intervention program***

The program consisted of 24 lessons of 30 min each. Teachers delivered the lessons to the whole class. Teaching of explicit vocabulary focused on general academic vocabulary, function words, and morphological awareness. The teachers and the chief researcher, in agreement, selected the words. Selected words were

introduced through repeated storybook reading followed by direct definitions of the terms and playful linguistic activities. We chose six storybooks taking into account the topics of the classroom curriculum. Approximately 12 words were selected for every story: four general academic words (e.g., *quitar–take out, tercero–third*), four function words (e.g., *por–for, después–after*) and four morphological complex words (e.g., *zapatero–shoemaker, costurera–seamstress*). A total of 72 words were directly taught throughout the 24 lessons. The words selected had to be not too common, not too rare, represent mature or more accurate description of familiar concepts, and be useful across different contexts and content areas (Beck et al., 2013).

Every two weeks, teachers introduced a new story and 12 new words for direct instruction, taught over four lessons (two per week). The first of the four lessons consisted of introduction of the book, the first complete storybook reading and the direct teaching of the first four words in the context of the story. The second lesson consisted of a second reading of the story, a review of the first four words meanings in different contexts, and the direct teaching of the four following words. The third lesson included a third reading of the story, a review of the previous eight target words, and the direct teaching of the rest of the words. The fourth lesson consisted of follow-up activities for each target word. Teaching explicit vocabulary occurred as follows: (a) direct definitions of the terms either with synonymous or simple words to comprehend the word in the context of the story, (b) use of the word in contexts different from that of the story, (c) saying aloud the new words, (d) follow-up playful linguistic activities to enhance the use and the comprehension of the novel words involving concrete experiences, acting out, and discussion (e.g., putting small objects on the table, or on the chair, after reading *The Daisy on the Moon–La Margarita sobre la Luna*).

### ***The standard curriculum followed by the control group***

In the schools where the study took place, it is not the goal of the regular curriculum instruction for kindergarteners to learn to read and write. Literacy activities goals consisted of (a) listening and discussing stories, (b) recognizing and reading their own name and those of their classmates, (c) writing their own name, (d) listening to information about specific topics to enhance information regarding that topic, (e) saying aloud stories or daily life anecdotes to the teacher as

she writes, (f) writing spontaneously (conventional or unconventional writing). There was no instruction on phonological or morphological awareness, and no systematic and explicit vocabulary instruction. All vocabulary learning was incidental through the activities described above.

## Measures

### Vocabulary

Children's vocabulary was assessed using the test *Vocabulario en Imágenes Peabody* (Dunn, Padilla, Lugo, & Dunn, 1986) and two experimental measures adapted from Biemiller and Boote (2006). The first experimental measure assessed proximal vocabulary in the context of a sentence and the second assessed proximal vocabulary out of context.

#### *Test de Vocabulario en Imágenes Peabody (TVIP).*

The Spanish Test de Vocabulario en Imágenes Peabody requires children to point to one of four word illustrations on a page after the researcher said aloud the target vocabulary item. Words were presented in 12-word sets. A ceiling was reached when eight or more items were missed in a 12-item set. According to the manual, internal consistency reliability based on the Spearman-Brown formula was .93 for 5-year-old children (Dunn et al., 1986). Scores can range 0–125.

**Vocabulary in context.** The researcher read aloud two sentences that included the target word followed by two yes–no questions. The correct answer for one of the questions was no, and for the other was yes. The children crossed out the happy face for the corresponding item on their worksheet if they thought that the answer was yes, and the sad face if they thought the answer was no. To be awarded a point for each word, the child needed to answer correctly both questions (this reduces the chance level to 25%). The task is composed of eight items. Scores range from 0 to 8. The median internal consistency reliability of this measure was 0.71.

**Receptive vocabulary out of context.** It requires the child to cross out one of four word illustrations on a page that best represented the word said out loud by the researcher. The task is composed of 15 items and has an internal consistency reliability of 0.76.

### Phonological awareness

We administered a set of three tasks to assess the different sizes of phonological units while holding

constant the task demand, as well as sound blending and phoneme segmentation tasks.

The Initial Sound Identity Task, the Initial Syllable Identity Task, and the Final Syllable/Rime Identity Task (Signorini & Borzone, 2003) are composed of 10 items each, and each item consists of three drawings presented on a chart (one in the upper part and two in the lower part of the chart). The Initial Sound Identity and Syllable Identity tasks require participants to identify which one of the two drawings located in the lower part of the chart start with the same sound or syllable as the drawing located in the upper part of the chart. The Syllable/Rime Identity Task asks the subject to identify which one of the two drawings located in the lower part of the chart end with the same syllable as the drawing in the upper part of the chart. During the Sound Blending Task (Woodcock & Muñoz-Sandoval, 1996), the subject listens to a series of syllables or phonemes and then is asked to blend the sounds into a word. This task has a median internal consistency reliability of 0.86 in ages 5 to 19. The Phoneme Segmentation Task (Manrique & Gramigna, 1985) requires the children to segment one-, two-, and three-phoneme words into their corresponding phonemes. The child is asked to move a marker for each phoneme the word has. The task consists of 42 items presented randomly from each of three conditions: 14 single-phoneme words, 14 two-phoneme words, and 14 three-phoneme words. The maximum score was 42.

### Letter-name and sound knowledge

Twenty-five uppercase letters were presented individually in random order on individual cards, and children were asked to say the name, the sound, and a word that starts with the letter sound. One point was scored for each correct answer. The three activities were scored separately.

### Socioeconomic status

This is a combined measure of the parents' occupation and education (Instituto Nacional de Estadísticas y Censos [National Institute of Census and Statistics], 2008). We obtained information about parents' occupation and education from the school records. Three categories were distinguished: (a) low (incomplete high school and employee); (b) middle (incomplete college and dependent professional); and (c) high (complete college and independent professional or entrepreneur).

**Level of parental education.** This is a combined measure of the average of school attendance years of both

parents. The average values were classified into the three following categories: low (average value lower than high school), middle (average value equivalent to high school diploma), and high (average value equivalent to at least some years in college). We obtained the parents educational level from the school records.

### Procedures

The pretest took place at the beginning of the academic year and lasted a month. The tasks were administered to every child over two 20-min sessions on two different days and the task order was randomized across subjects within each assessment session. Pretest measures of children's vocabulary, word recognition skills, writing, listening comprehension, and PA abilities were given to the children individually. The tests were administered in a quiet space by graduate students who received a 4-hr training.

The intervention started after the pretest and lasted three months. The first posttesting took place at the end of the academic year and lasted a month.

## Results

### Fidelity of implementation

The seven dimensions assessing fidelity of implementation show minimal variability. Dimensions 1, 2 and 3

**Table 1.** Means and standard deviations for the variables assessing fidelity of implementation.

Variable	Mean	SD	N
Expected length of the lesson	4	0	28
Activities delivered according to the script	4	0	28
Availability of materials	4	0	28
Expected use of materials	3.9	0.1	28
Student engagement	3.8	0.4	28
Expected modeling of activities	3.8	0.3	28
Ability to deliver the lesson	3.7	0.4	28

show no variability; the four teachers achieved the highest category, Very Good (see Table 1).

### Descriptive statistics

Descriptive analyses revealed that the three groups were equivalent at the pretest for all the variables assessed (see Table 2).

### Analysis of variance

We separately ran nine general linear ANOVAS models with repeated measures to assess the effect of the intervention program on vocabulary, phonological awareness ability, and letter name and sound knowledge. For all cases, a two-factor partially nested design was applied. The between-subjects factor was condition ( $A = 3$ ) and the within-subject was time ( $B = 2$ ), and subjects ( $C = 129$ ). Subject was nested with condition, as well as entered as a random variable. An alpha level of 0.05 was used to run all statistical tests.

### Effects on vocabulary

The first ANOVA showed significant effect for time ( $F[1, 115] = 11.7, p < 0.000$ ), condition ( $F[2, 115] = 3.4, p < 0.03$ ) and a significant time x condition interaction on the TVIP scores ( $F[2, 115] = 7.2, p < 0.001$ ). Although we did not observe significant differences between the pretest and the posttest assessments in either the control group or the PA group, the children who were in the combined condition (PA + vocabulary) showed a significant gain on PPTV scores between the pretest and the posttest,  $t(129) = 5.3, p < 0.000$  (two-tailed). Root mean square standardized effects (RMSSE; calculated as the mean difference between children in the two groups by the pooled within-cell error term of the model-root mean square error) for the posttest difference was 1.06. At posttest, children in the combined condition (PA+Vocabulary) showed a greater

**Table 2.** Means and standard deviations for the TVIP, Word Reading, Vocabulary in Context, Vocabulary Out of Context, Letter Name–Sound Knowledge, and PA abilities by condition group.

Condition	Age	TVIP	Receptive Vocabulary	Vocabulary in Context	Letter Name and Sound Knowledge	Sound Blending	Syllable Identity	Sound Identity	Rime Identity	
Control	Media	101,82	11,22	10,62	11,22	14,49	454,79	7,69	6,89	7,58
	SD	14,21	4,11	2,26	4,11	13,15	8,50	2,06	1,69	1,75
	N	39	40	35	40	38	39	39	39	39
PA	Media	104,55	9,38	10,06	9,38	11,55	451,05	8,10	7,55	8,21
	SD	14,69	2,65	2,47	2,65	13,04	15,23	2,15	2,44	2,42
	N	38	36	32	36	38	38	38	38	38
PA+Voc	Media	103,08	9,56	9,35	9,56	12,60	449,87	7,08	6,53	7,12
	SD	18,36	5,08	3,05	5,08	15,8	16,23	2,29	2,09	2,55
	N	46	44	39	44	47	47	47	47	47
Total	Media	103,13	10,06	9,99	10,06	12,87	451,78	7,58	6,95	7,60
	SD	15,93	4,20	2,67	4,20	14,14	13,97	2,20	2,12	2,31
	N	123	120	106	120	124	124	124	124	124



TVIP score mean than that of the children in the PA group,  $t(129) = 2.5$ ,  $p = 0.007$  (two-tailed), and that of the children in the control group,  $t(129) = 4.1$ ,  $p < 0.002$  (two-tailed), see Table 3 and Figure 1(a).

**Effects on receptive vocabulary out of context.** There was a significant effect for *time* ( $F[1, 81] = 57.02$ ,  $p < 0.0001$ ), *condition* ( $F[2, 81] = 148.5$ ,  $p < 0.0001$ ) and a significant *time x condition* interaction ( $F[2, 81] = 2.9$ ,  $p = 0.05$ ). Whereas no differences were observed between the pretest and the posttest in the control and the PA only groups, the children in the PA+Vocabulary interventions showed a significant increase in *Receptive Vocabulary Out of Context* after receiving the intervention. The difference between the pretest and posttest was highly significant,  $t(120) = 6.2$ ,  $p < 0.000$  (two-tailed). The RMSSE was 1.4 (Figure 1b).

**Effects on vocabulary in context.** There was a significant effect of *condition* ( $F[2, 82] = 4.9$ ,  $p = 0.009$ ) and a significant *time x condition* interaction ( $F[2, 82] = 12.7$ ,  $p < 0.0001$ ). Follow-up analyses of the interaction revealed that the group who received the combined intervention (PA + Vocabulary) was the only one that showed a significant growth in Vocabulary in Context from pretest to posttest,  $t(119) = 5.6$ ,  $p < 0.000$  (two-tailed). The RMSSE for this interaction was 1.4. At posttest, the group who received the combined intervention showed greater scores than the control group,  $t(119) = 3.5$ ,  $p < 0.01$  (two-tailed) and the PA group,  $t(119) = 5.4$ ,  $p < 0.000$  (two-tailed). See Table 3 and Figure 1(c).

#### Effects on initial syllable identity

There was a significant interaction effect between *time* and *condition* on *initial syllable identity* ( $F[2, 117] = 3$ ,  $p = 0.05$ ). Although there were not significant differences for the control group between pretest and posttest, the two treatment groups showed higher posttest score means than pretest score means. The group that received PA intervention scored significantly higher at posttest than at pretest,  $t(125) = 2.3$ ,  $p = 0.02$  (two-tailed). The RMSSE difference was 0.5. In the same manner, the group that received the combined intervention (PA + Vocabulary) scored higher at the posttest than at the pretest,  $t(125) = 3.4$ ,  $p < 0.002$  (two-tailed). At posttest there were not significant differences between the two treatment groups. See Table 3 and Figure 2(a).

#### Effects on initial sound identity

There was a significant *time x condition* interaction ( $F[2, 117] = 4.0$ ,  $p = 0.02$ ). The two intervention groups showed significant differences between the pretest and

the posttest (see Table 2). The control group did not show significant differences between the pretest and the posttest. At posttest, the control group showed a lower score than the combined intervention group,  $t(125) = 3.2$ ,  $p < 0.006$  (two-tailed). The RMSSE effect size for the posttest difference was 0.7. See Table 3 and Figure 2(b).

#### Effects on rhyme identity

The ANOVA revealed significant interaction effects of *time* on *rhyme identity* ( $F[2, 117] = 15.6$ ,  $p < 0.0001$ ). The group of children that received the combined intervention showed higher scores at posttest than at pretest,  $t(125) = 3.2$ ,  $p < 0.000$  (two-tailed). The RMSSE difference was 0.6. The group who received the PA intervention also scored significantly higher at the posttest than at the pretest,  $t(125) = 2$ ,  $p = 0.05$  (two-tailed). The RMSSE for this interaction was 0.4. The two intervention groups did not differ at posttest. See Table 3 and Figure 2(c).

#### Effects on phoneme segmentation

There was a significant effect of *time* ( $F[2, 117] = 15.6$ ,  $p < 0.0001$ ) and a significant *time x condition* interaction ( $F[2, 117] = 12.5$ ,  $p < 0.0001$ ). The two intervention groups scored significantly higher at the posttest than at the pretest. The control group did not show significant differences between the pretest and the posttest. At posttest, the combined intervention group showed greater scores than the control group,  $t(124) = 5.0$ ,  $p < 0.000$  (two-tailed). The RMSSE for the difference was 1.2. See Table 3 and Figure 2(d).

#### Effects on letter-name sound knowledge

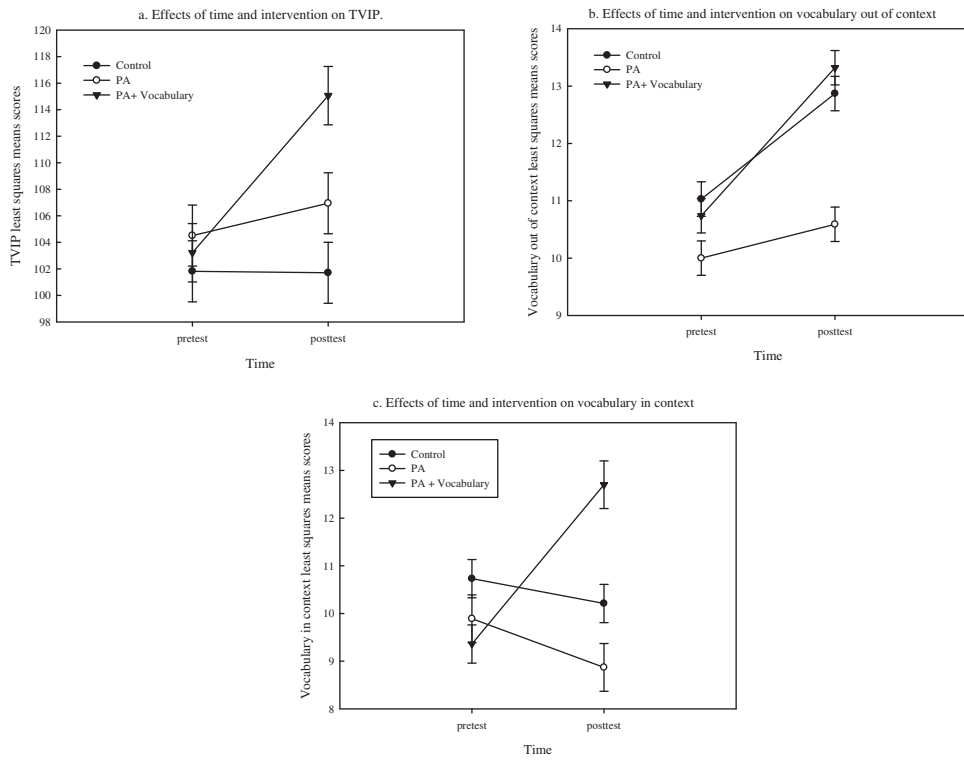
There was a significant effect of *time* ( $F[1, 116] = 82.4$ ,  $p < 0.0001$ ), *condition* ( $F[2, 116] = 4.6$ ,  $p = 0.01$ ), and a significant *time x condition* interaction ( $F[2, 116] = 18.9$ ,  $p < 0.0001$ ). The control group did not show differences between the pretest ( $M = 2.2$ ,  $SE = 0.7$ ) and the posttest ( $M = 2.3$ ,  $SE = 0.7$ ). By contrast, the PA group showed significant growth from pretest to posttest,  $t(124) = 7.5$ ,  $p < 0.000$  (two-tailed). The RMSSE was 1.7. Likewise, the PA + Vocabulary group showed significant growth from pretest to posttest,  $t(124) = 9.5$ ,  $p < 0.000$  (two-tailed). The RMSSE for the difference was 1.7. At posttest, the control group showed a significantly lower score than the groups that received the intervention, both the PA group,  $t(124) = 4.8$ ,  $p < 0.000$  (two-tailed) and the CF+PA group,  $t(124) = 5.3$ ,  $p < 0.000$  (two-tailed). There were no differences between the two interventions at posttest. See Table 3 and Figure 3(a).

**Table 3.** Least square means, standard errors (in parentheses), *t* and *F*\* values for pretests and posttests of each condition for TVIP, Vocabulary Out of Context, Vocabulary in Context, Letter Name and Sound Knowledge, Initial Syllable Identity, Initial Sound Identity, Rhyme Identity, Phoneme Segmentation, and Morphological Awareness.

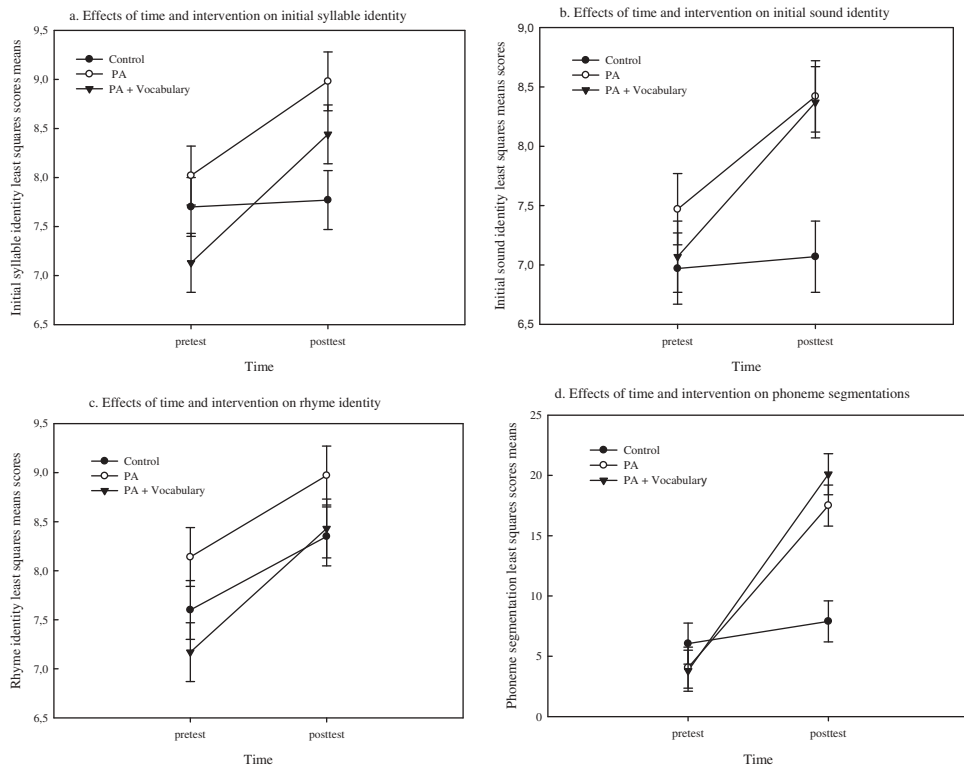
Measure	Control				PA				PA + Vocabulary							
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest		<i>t</i>	<i>F</i> *		
	<i>C</i>	<i>PA</i>	<i>t</i>	<i>F</i> *	<i>C</i>	<i>PA</i>	<i>t</i>	<i>F</i> *	<i>C</i>	<i>PA</i>	<i>t</i>	<i>F</i> *				
TVIP	101	104	0.7	0.2	101.71 (2.3)	101.82 (2.3)	0.04	0.00	104.51(2.4)	106.95 (2.4)	0.22	0.22	103.22 (2.2)	115.06 (2.2)	5.3***	1.06
Vocabulary Out of Context	11.0	9.6	3.2**	0.7	12.87 (0.3)	11.03 (0.3)	4.57**	1.05	9.68 (0.3)	10.59 (0.3)	0.81	0.81	10.74 (0.3)	13.32 (0.3)	6.2***	1.4
Vocabulary in Context	10.7	9.8	1.1	0.3	10.21 (0.4)	10.73 (0.4)	0.78	0.23	9.89 (0.5)	8.87 (0.5)	0.49	0.49	9.36 (0.4)	12.7 (0.5)	5.66***	1.4
Letter Name-Sound Knowledge	7.7	8.0	0.7	0.1	2.35 (0.7)	2.20 (0.7)	0.05	0.82	2.07 (0.7)	7.23 (0.7)	1.7	1.7	2.06 (0.6)	7.17 (0.6)	9.53***	1.7
Initial Syllable Identity	6.9	7.4	1.0	0.2	7.77 (0.3)	7.70 (0.3)	0.19	0.04	8.02 (0.3)	8.98 (0.3)	0.52	0.52	7.13 (0.3)	8.44 (0.3)	3.44***	0.77
Initial Sound Identity	7.6	8.1	1.0	0.3	7.07 (0.3)	6.97 (0.3)	0.22	0.05	7.47 (0.3)	8.42 (0.3)	0.52	0.52	7.07 (0.3)	8.37 (0.3)	2.88**	0.98
Rhyme Identity	6.0	4.0	0.7	0.1	8.35 (0.3)	7.60 (0.3)	1.82	0.41	8.14 (0.3)	8.97 (0.3)	0.44	0.44	7.17 (0.3)	8.43 (0.3)	3.20**	0.69
Phoneme Segmentation	10.6	10	0.5	0.1	7.9 (1.7)	6.05 (1.7)	0.87	0.19	4.06 (1.7)	17.5 (1.7)	0.97	0.97	3.8 (1.7)	20.1 (1.7)	7.83***	1.68
Morphological Awareness	10.6	10	0.5	0.1	11.89 (0.5)	10.69 (0.5)	1.67	0.42	10.32 (0.5)	12.15 (0.5)	0.64	0.64	10.57 (0.5)	13.0(0.5)	3.78***	0.90

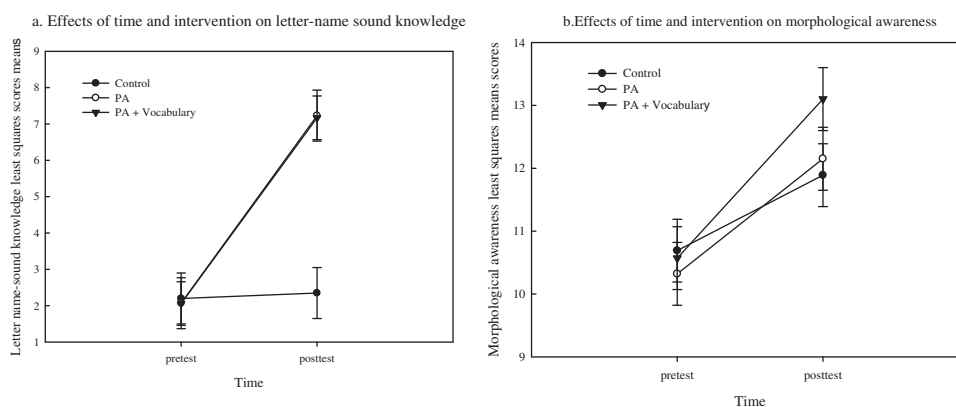
Measure	Pretest				Posttest												
	<i>C</i>		<i>PA</i>		<i>C</i>		<i>PA</i>		<i>d</i>	<i>F</i> *	<i>t</i>	<i>F</i> *					
	<i>C</i>	<i>PA</i>	<i>t</i>	<i>F</i> *	<i>C</i>	<i>PA</i>	<i>t</i>	<i>F</i> *									
TVIP	101	104	0.7	0.2	101	103	0.4	0.1	101	106	1.5	0.4	1.2	106	115	2.5*	0.7
Vocabulary out of Context	11.0	9.6	3.2**	0.7	11.0	10.7	0.7	0.1	9.6	10.5	5.5***	1.2	0.2	12.8	13.3	6.7***	1.5
Vocabulary in Context	10.7	9.8	1.1	0.3	10.7	9.3	2.1	0.4	9.8	8.8	1.8	0.3	0.9	10.2	12.7	3.5**	1.4
Letter Name-Sound Knowledge	2.2	2.0	0.1	0.0	2.2	2.0	0.1	0.04	2.0	2.0	4.8	1.6	0.7	2.3	7.1	5.3***	0.0
Initial Syllable Identity	7.7	8.0	0.7	0.1	7.7	7.1	1.4	0.3	8.0	7.7	3	0.7	0.3	7.7	8.4	1.6	0.0
Initial Sound Identity	6.9	7.4	1.0	0.2	6.9	7.0	0.8	0.2	7.4	7.0	3.2	0.7	0.7	7.0	8.3	3.2***	0.3
Rhyme Identity	7.6	8.1	1.0	0.3	7.6	7.1	0.8	0.2	8.1	8.3	1.2	0.3	0.7	8.3	8.4	0.1	0.0
Phoneme Segmentation	6.0	4.0	0.7	0.1	6.0	3.8	0.9	0.2	4.0	3.8	3.8***	0.9	1.2	7.9	20.1	5.0***	0.2
Morphological Awareness	10.6	10	0.5	0.1	10.6	10.5	0.1	0.03	10	11.8	0.3	0.09	0.4	11.8	13.1	1.7	0.3



**Figure 1.** (a) Effects of time and intervention on TVIP. (b) Effects of time and intervention on vocabulary out of context. (c) Effects of time and intervention on vocabulary in context.



**Figure 2.** (a) Effects of time and intervention on initial syllable identity. (b) Effects of time and intervention on initial sound identity. (c) Effects of time and intervention on rhyme identity. (d) Effects of time and intervention on phoneme segmentations.



**Figure 3.** (a) Effects of time and intervention on letter-name sound knowledge. (b) Effects of time and intervention on morphological awareness.

### Effects on morphological awareness

There was a main effect of *time* ( $F[1, 82] = 21.15$ ,  $p < 0.0001$ ). The two intervention groups showed a higher score mean at the posttest than that of the pretest (see Table 2). The RMSSE for the difference observed in the PA group was 0.6. The RMSSE for the difference observed in the combined intervention group was 0.9. The control group did not show significant differences between the pretest and the posttest. At the posttest there were no significant differences between the three groups. See Table 3 and Figure 3(b).

## Discussion

This study examined the impact of two different interventions (PA only versus PA, vocabulary, and MA) on kindergarteners' language and literacy skills. At the end of the intervention program (24 lessons of 30 min each), children in the comprehensive intervention condition showed significant growth from pretest to posttest on all measures. Children in the PA condition showed significant growth on vocabulary out of context, letter-name sound knowledge, initial syllable identity, and rhyme identity. In other words, the intervention targeting one skill only (PA) was not as effective as the intervention targeting a more comprehensive range of skills (PA + Vocabulary + MA). After the intervention, children who received the comprehensive intervention showed an overall vocabulary knowledge advantage over children in the PA-only intervention and to the ones in the comparison group. The two intervention conditions outperformed the control group in letter-sound knowledge, initial syllable identity, sound segmentation, and rhyme identify, but there were not differences between the two conditions.

One of the most impressive and promising findings related to vocabulary is that the growth was observed,

not only on the proximal measures (those containing words that were directly taught), but also on distal measures (TVIP), which measure general vocabulary knowledge. Most previous research (e.g., Casalis & Colé, 2009; Damhuis et al., 2014) has either not examined effects on general vocabulary or if examined, no effects were found. For example, Damhuis et al. (2014) included it as a covariate, but did not directly examine effects on it. In Casalis and Colé (2009), no significant general vocabulary knowledge growth from pre- to posttest was found. However, their intervention taught either PA or MA. No combined intervention was provided and no direct teaching of vocabulary. It is possible that the disparity in results across our study and those of Casalis & Colé (2009) and Damhuis, et al. (2014) is related to the comprehensive nature of our combined intervention.

The significant growth in general vocabulary by the group in the comprehensive intervention might be explained by the inclusion of MA instruction along with explicit vocabulary instruction and PA. When children develop MA, they get better at learning words on their own, as they can apply the analytical skills learned through MA instruction to deduce the meaning of unfamiliar words. Although researchers (e.g., Carlisle & Nomanbhoy, 1993; Nagy, 2007), continuously advocate for the teaching of MA to accelerate vocabulary knowledge, this is the first study directly showing the effectiveness of MA in increasing general vocabulary knowledge among low SES Kindergarten children who are monolingual Spanish speakers.

There are similarities and differences between these findings and those by Damhuis et al. (2014). In their study, Dutch kindergarteners who received implicit vocabulary instruction, as well as those who receive explicit instruction, increased their vocabulary knowledge, although the ones in the explicit condition showed larger

gains. In our study, only the ones who received targeted, explicit, and systematic vocabulary instruction showed significant growth. It is worth noting that the children in Dambhuis et al. came from homes with high SES, who typically have larger vocabularies than children from low SES, which is the case of our sample. It is possible that the threshold of vocabulary knowledge the students in the Dutch study started with was sufficient to benefit, even from implicit vocabulary instruction.

In addition to PA, which already has been shown to be critical in early literacy interventions, other skills such as morphological awareness promise to be effective in early interventions. This was our motivation to include PA and MA in our intervention. Kindergarten intervention studies focusing on PA are common, whereas those focusing on MA are rare; most MA intervention studies have been conducted in grade 4 and beyond. This study adds to the emerging body of evidence (e.g., Casalis & Colé, 2009; Lyster, 2002; Ramirez et al., 2013) showing that even kindergarteners can benefit from morphological awareness instruction.

One of the strengths of this study is its ecological validity, as the instruction was delivered by classroom teachers with the whole class. Several prior early interventions have been conducted by researchers with small groups of children (e.g., Casalis & Colé, 2009; Damhuis et al., 2014). For these interventions to have a long-term effect, they should be delivered in a naturalistic setting by regular classroom teachers rather than researchers, as teachers' effects have been demonstrated to be one of the most important factors in students' achievement (Hattie, 2009; Nye, Konstantopoulos, & Hedges, 2004). Therefore, as recommended by Torgesen (2002), "We must work more effectively to ensure that classroom teachers acquire the skills and knowledge to teach reading to children who do not learn easily" (p. 23). The current study accomplished this by having teachers deliver the intervention in their classrooms. Moreover, fidelity treatment results indicate that there was minimal variation of implementation across different teachers, suggesting the ease of implementation and acceptability of the treatment strategies by the teachers. This in turn suggests social validity, another strength of this study.

The current study has some limitations. In one of the conditions we targeted PA only, and in the other condition we targeted PA, vocabulary, and MA. By combining MA with vocabulary, we are not able to identify clearly which of the two skills has a greater impact on the other. Although it is reasonable to expect a bidirectional association between vocabulary and MA, we cannot identify from the current study whether MA had a greater impact on vocabulary or vocabulary on MA. Future research with kindergarteners should examine this causal

relationship by including a condition targeting MA only and a condition targeting direct teaching of word meanings and examining their respective impact on MA and vocabulary. Identifying the direction of this association would provide more clear guidance for educators by suggesting whether they should emphasize MA awareness over explicit teaching of word meanings or vice versa. Another limitation of this study is the use of narrative text only to teach the vocabulary in context. Research indicates that children with poor vocabulary knowledge struggle with academic vocabulary in particular (Beck & McKeown, 2007; Nagy & Hiebert, 2011; Snow, 2010), which is found more regularly in nonfiction written material and oral contexts. Future kindergarten vocabulary intervention studies should use both fiction and nonfiction materials.

## Conclusions

Overall, results from the present study support the integration of PA, vocabulary, and MA in kindergarten interventions. As noted by the National Early Literacy Panel (2009), "an instructional focus on vocabulary during the preschool and kindergarten years is likely a necessary but insufficient approach to promoting later literacy success" (p. 78). Similarly, focusing only on PA may not provide the long-term results required for more advance literacy tasks, such as reading comprehension. When planning early language and literacy interventions, it is important to incorporate a comprehensive range of key skills, especially for kindergarteners from low SES. Results showing that only the group receiving direct vocabulary intervention obtained significant gains in vocabulary demonstrates the importance of direct, explicit, and systematic vocabulary teaching. Finally, this study also demonstrated that early intervention programs can be delivered effectively to the whole class by trained classroom teachers.

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