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ATTENTION TO ORTHOGRAPHIC AND PHONOLOGICAL WORD FORMS IN VOCABULARY INSTRUCTION FOR KINDERGARTEN ENGLISH LEARNERS

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This study examined benefits of connecting meaning, speech, and print in vocabulary learning for kindergarten English learners. Students screened eligible with limited English proficiency were randomly assigned to two instruction conditions. Both groups received direct instruction in high frequency root words. One condition featured added attention to orthographic and phonological word features. Increased attention to the spoken and printed word forms was associated with significantly greater gains in general vocabulary and word reading, and in taught-word spelling. Results suggest features of effective vocabulary instruction for young and English learner students.

Introduction

Teachers in U.S. schools provide instruction to nearly 11 million students ages 5–17 years who speak a language other than English in their home (Aud et al., 2010). English learners often enter school with limited English vocabulary knowledge that supports school learning across content areas (Proctor, Carlo, August, & Snow, 2005). English learners experience less success than native English speakers on many important school outcomes: lower reading performance than English-speaking peers (August & Shanahan, 2006); lower performance on state reading comprehension standards (Kindler, 2002); higher rates of placement in the upper grade levels in special education programs (Artiles, Rueda, Salazar, & Higareda,

2002); and lower rates of high school completion (Pachon, Tornatzky, & Torres, 2003). For many English learners, immigration status is closely linked with low socio-economic status (Alba & Holdaway, 2013) and is also associated with lower levels of vocabulary knowledge.

A broad spectrum of state and district policies attempt to address the language and literacy learning needs of English learners, yet many students do not make adequate progress in the English language skills that are linked to school success (Baker et al., 2014). Accelerating foundational English vocabulary knowledge is considered one means to reduce the gap between more and less advantaged children in the early grades (Biemiller, 2005). Research indicates that typical school experience and classroom instruction do not catch up students with limited vocabulary, including English learners (Biemiller & Boote, 2006). Researchers have designed and tested both classroom and supplemental approaches to promote early vocabulary growth for primary students.

Vocabulary Interventions and Children's Word Learning

Reviews of vocabulary interventions for native English-speaking students provide one source for information on the features of vocabulary instruction associated with successful word learning outcomes. An early review by Stahl and Fairbanks (1986) summarized studies of vocabulary instruction conducted in Grade 2 through college. They found that vocabulary instruction had a significant effect on comprehension of passages containing taught words. The instruction approaches that produced the strongest effects were methods in which the child was provided the definition and also encountered the word in context. Effective instruction also encouraged depth of processing through learning word associations and interacting with the words in written and oral contexts. Finally, effective instruction provided students with multiple exposures to the words being learned. However, the Stahl and Fairbanks (1986) review did not disaggregate findings for younger children and has methodological limitations that have been addressed by more recent research syntheses.

Two recent more rigorous meta-analyses summarize the findings for vocabulary interventions. In their meta-analysis of vocabulary interventions that included students in Grades pre-K through 12, Elleman, Lindo, Morphy, and Compton (2009) identified 37 studies meeting eligibility criteria. Although the primary focus of their review was the influence of vocabulary instruction on comprehension outcomes, 28 studies also examined vocabulary outcomes. They found that vocabulary instruction had greater overall comprehension benefits for students with reading difficulties. The interventions that featured higher levels of discussion were associated with greater vocabulary effects. Yet most of the studies were conducted in Grades 3 to 5 and offer limited specific guidance for instruction of students in early elementary grades or for English learners. Elleman et al. (2009) noted that studies often omitted details about the teaching approaches, making it difficult to detect intervention characteristics associated with vocabulary learning. In their review, Marulis and Neuman (2010) examined 67 studies of vocabulary instruction for preschool and kindergarten children. They found large effect sizes (overall effect size 0.88) for kindergarten word learning. Teacher- and experimenter-implemented interventions were most effective, and even relatively brief interventions of a week or less were associated with good word learning outcomes. The most effective interventions were characterized by explicit instruction in word meanings, with multiple exposures to the words in story contexts. Finally, they found that vocabulary gains for low SES children were lower than for middle or high SES children, and that vocabulary interventions did not close the gap in vocabulary knowledge for at-risk children. Elleman et al. (2009) and Marulis and Neuman (2010) reported negligible and moderate effects, respectively, on general vocabulary measures. Because many vocabulary studies included in these reviews did not include the English learner status of participants, it is more difficult to draw conclusions about features that optimize vocabulary learning for this large group of students who most need to expand their English vocabulary.

These major reviews indicate that, until recently, research on features of effective vocabulary instruction has focused on older elementary students, and the findings support the value of multidimensional approaches (see Baker et al., 2014; Graves, 2006; Stahl & Fairbanks, 1986). These approaches include explicitly

teaching word meanings, providing multiple exposures to reading the words, and encouraging interactive and deep processing of the word in varied sentence and text contexts (Beck & McKeown, 2007; Coyne, McCoach, & Kapp, 2007; Stahl, 1986). On the other hand, many of the approaches recommended to develop vocabulary knowledge for younger preschool or kindergarten-age children with limited word reading skills have been storybook interventions (National Reading Panel, 2000). In a series of studies, a group of researchers have examined features of effective vocabulary instruction for kindergarteners provided in storybook reading contexts. Coyne, McCoach, Loftus, Zipoli and Kapp (2009) found that extended instruction with multiple opportunities to encounter and review the target words in oral interactions led to high levels of word learning. Zipoli, Coyne, and McCoach (2011) found that systematic and semantically related review of taught words resulted in higher levels of word learning compared to embedded review or no review of taught words. Loftus, Coyne, McCoach, Zipoli, and Pullen (2010) also found that at-risk kindergarteners made greater gains in learning taught vocabulary with added instruction and practice using the words. Silverman (2007) examined the effectiveness of explicit research-based vocabulary practices that were incorporated into storybook reading contexts for kindergarten English learners. Intervention features included explicit definitions, having children say the words and identify letters in the words, and reinforcing taught words with review. The English learners acquired taught words at the same rate as the English-only students and increased in general vocabulary knowledge at a faster rate than the English-only children. These findings indicate ways in which kindergarten vocabulary learning can be promoted in an inclusive classroom context of reading storybooks aloud.

Gaps in Vocabulary Instruction for English Learners

The general reviews offer limited information on features of vocabulary instruction that are most effective for both young kindergarten children and for English learners. And while certain types of storybook interventions may help young children develop vocabulary, it may be more difficult for English learners to acquire vocabulary knowledge in story contexts. Learning vocab-

ulary from context is likely when the listener is familiar with at least 95% of the running words in the text (Liu & Nation, 1985), reducing incidental learning for English learners with limited English vocabulary. One approach to identifying teaching practices that help young children develop vocabulary is to examine the relationships between classroom teacher practices and children's vocabulary knowledge. In a correlational study, Silverman and Crandell (2010) examined features of preschool and kindergarten classroom vocabulary instruction and teacher practices that were associated with vocabulary growth for children with higher and lower initial vocabulary knowledge. Silverman and Crandell found that teachers used many of the practices that had been found effective in multidimensional instruction for older children, such as analyzing the words, contextualizing words, and defining or explaining. They found that practices associated with vocabulary learning outcomes for younger children included acting out and illustrating the words. Finally, they found that attention to spelling, phonics, and writing practice had positive effects on both a general age-normed receptive vocabulary measure and a researcher-designed proximal measure of learning target words. Silverman and Crandell's (2010) findings for the value of attention to word spellings in vocabulary instruction for young children are supported by several lines of research.

As Ehri (1997) clarified, reading and spelling are almost one and the same: people read word spellings they write, and they read the spellings they have written. Vocabulary instruction that includes having children read and spell the words thus draws upon English learner strengths in these skills. Reviews of studies indicate that English learners develop word reading and spelling skills equivalent to native-language speakers (Lesaux, Koda, Siegel, & Shanahan, 2006). Drawing attention to word spellings may help English learners form connections between word meanings and pronunciations, which may be more transient word features for language learners. Spellings are more concrete than phonemes and may better support word learning (Nelson, Balass, & Perfetti, 2005). Many kindergarten beginning readers with phoneme segmentation skills may be poised developmentally to form these orthographic representations that warrant drawing upon in vocabulary learning (see Ehri & Wilce, 1987).

Teachers have difficulty finding time for vocabulary instruction. For example, in their review of early childhood vocabulary practices, Christ and Wang (2011) found that multi-method theme-based approaches effectively narrowed the gap in vocabulary knowledge but were also the most time- and labor-intensive. Many preschool and kindergarten teachers have limited preparation in effective methods to build vocabulary knowledge (Neuman & Dwyer, 2009; Wasik, 2010), including the type of dedicated and complex vocabulary instruction that Christ and Wang (2011) found to build semantic connections in coordination with other aspects of classroom instruction. Approaches that feature simple spelling, writing, and phonics activities that support vocabulary learning for young children may be integrated easily into kindergarten literacy instruction that now often includes children learning to read. Because the syntheses on vocabulary interventions indicate that single interventions do not significantly catch up children with limited vocabulary knowledge, many children will require multiple and sustained approaches to close the knowledge gap. These lines of research may inform efficient teaching practices that improve vocabulary learning.

Connecting Meaning, Speech, and Print in Vocabulary Learning

Many recommended vocabulary interventions for school-age children are designed to build depth of word knowledge, most often understood to mean semantic depth. We suggest that depth be considered more broadly to include knowledge of the phonological and orthographic dimensions of the word. This understanding of depth is supported by Ehri's connectionist theory (2005) that knowledge of the written word strengthens connections between the word meaning and pronunciation, and supports retrieval of the word from memory. The value of including these features to enhance vocabulary learning is demonstrated in recent studies by Ehri and Rosenthal: (a) exposing students to the written spellings of unfamiliar vocabulary words (Ehri & Rosenthal, 2007; Rosenthal & Ehri, 2008), an instructional feature Silverman and Crandall (2010) also found to be associated with vocabulary learning for kindergarten children; and (b) having students pronounce new words aloud when they encounter them in print (Rosenthal & Ehri, 2011). Spellings help students

build connections between the pronunciations of the words and the meanings, and develop strong memory representations. Pronouncing the words also helps students form strong orthographic and phonological memory connections for words that help students retrieve the word meaning. Although these studies were conducted with older second and fifth graders, spelling has been mentioned in descriptions of several quasi-experimental studies of vocabulary instruction for younger students (Juel & Deffes, 2004; Silverman, 2007). The value of including an oral or written spelling feature in kindergarten vocabulary instruction is often overlooked. There may be several reasons for this omission. It may seem that kindergarten children's beginning spelling skills are too limited to draw upon when teaching vocabulary. Further, the value of knowing how to spell a word may not be apparent when teaching the word meaning. Finally, when there is limited classroom time for vocabulary instruction, it may not seem worthwhile to also try to teach students the spellings of the words being taught. However, as Ehri and Rosenthal (2007) noted, spelling may help clarify phonemes, especially for English learners, and thereby help develop precise memory forms for the words. And, importantly, whereas multidimensional vocabulary instruction requires skill and training to implement, spelling and decoding (both activities usually require pronouncing the word) can be easily implemented by non-teacher school staff who may often supplement instruction for at-risk and English language learner (EL) students.

We report a randomized experiment with EL kindergarteners to test the benefits of added attention to orthographic and phonological word features in an explicit supplemental vocabulary intervention. We hypothesized that drawing attention to these features would support vocabulary learning, word reading, and spelling.

Method

Students

RECRUITMENT

Seven urban, public elementary schools in the Northwest with relatively high proportions of ELs were invited and agreed to

participate in the study. Schools had enrollments averaging 17% receiving bilingual services (range: 7 to 23%), 69% eligible for free or reduced lunch (range: 34 to 88%), 79% minority status (range: 53 to 96%), and 15% receiving special education services (range: 7 to 23%).

CONSENTS

All 20 kindergarten classroom teachers at participating sites sent home consents to all students in their classroom known to have a home language other than English (see forthcoming Eligibility for further details). Blank consent forms in English, as well as translated versions in the child's home language, were provided to teachers. Of the 123 parent consents received, 4 (3%) declined participation. Of the remaining 119 students, one student was dropped prior to randomization due to lack of sufficient numbers of EL students within their classroom (a minimum of two students per classroom was required for randomization), and two students moved prior to screening. Thus, 116 students from 19 classrooms were available for study eligibility screening.

ELIGIBILITY

We employed a three-pronged determination of eligibility to ensure that participating students would in fact be low enough in English language proficiency to benefit from a supplemental reading intervention. First, students were initially identified by their classroom teachers as having a home language other than English, even if this was not noted in school records. Second, upon receiving parental consent to participate in the study (on which we asked parents to report home language), scores from the Washington English Language Proficiency Assessment (WELPA; CTB/McGraw-Hill, 2006) were collected from the school district. Any student with consent who scored at Level 1 (Beginning) or 2 (Intermediate) of the four score levels on this test was considered eligible, irrespective of our other pretest measures. Because psychometric information about the WELPA was not made available to us, we computed simple point-biserial Pearson correlations between the WELPA lower two levels and our general vocabulary assessment (see Student Assessments), and found these to be modestly correlated, at $r = 0.54$ at pretest and 0.41 at posttest. Our final criterion was that any student who had not

been tested on the WELPA by study onset (i.e., if parents refused district testing, or if students had registered late) but who scored at or below the 50th percentile on our general vocabulary pretest was considered eligible.

SCREENING AND RANDOM ASSIGNMENT

Of the 116 consented students available for screening, 37 had not been assessed on the WELPA state test due either to registering late in the school year (they would be tested the subsequent spring) or due to parents' refusal to allow testing. Of these 37 students, 9 scored too high (resulting in one classroom being dropped due to no available students) and 2 scored too low (i.e., could not complete the training items on our individually administered general vocabulary measure). After screening was complete, $N = 105$ students from 18 classrooms across the seven school sites were available for random assignment. Students were randomly assigned, within classroom, to one of the two treatment conditions, with $N = 52$ students in the explicit vocabulary condition (EV), and $N = 53$ in the explicit vocabulary with added spelling (EV-S) condition.

ATTRITION AND FINAL SAMPLE SIZE

Attrition included five students (5%) who moved during the study: three in the EV condition and two in the EV-S condition. The final sample thus included $N = 100$ students ($N = 49$ EV, $N = 51$ EV-S) from 18 classrooms across seven schools, with at least two students per classroom, and at least one student per condition in each classroom. The sample averaged $M = 5.51$ years old ($SD = 0.31$; range: 5.06 to 6.21) at pretest. Demographic characteristics for each condition are provided in Table 1. Within the sample, there were a total of 17 home languages reported by parents; Spanish represented 29% of the sample's languages.

Paraeducator Tutors

All tutors were recruited from their school communities on the basis of their interest in working with children, prior tutoring and school volunteer experience, and scheduling flexibility. Tutors were assigned to students based on classroom schedules, tutor schedules, and number of eligible students at sites. All tutors were

TABLE 1 Student Demographic Characteristics

Characteristic	EV-S (n = 51)		EV (n = 49)		Combined	
	N	(%)	N	(%)	N	(%)
Female	27	(53%)	19	(39%)	46	(46%)
Receives EL Services	39	(76%)	38	(78%)	77	(77%)
Home Language						
SE Asian (9 languages)	19	(37%)	18	(37%)	37	(37%)
African (5 languages)	15	(29%)	16	(33%)	31	(31%)
Spanish	16	(31%)	13	(27%)	29	(29%)
Arabic	1	(2%)	1	(2%)	2	(2%)
Ukrainian	0	(0%)	1	(2%)	1	(1%)

required to have state background checks and fingerprinting, and all were trained and monitored for adherence to treatment protocols.

There were 14 tutors who participated in the study (1–3 tutors per school). Each tutor was assigned to only one site, and each was trained to implement both treatment conditions. The tutors were mostly female (94%), White (71%), and educated (57% had a bachelor's degree and all had some college) but varied in age (14% were 18–24 years old, 42% were 25–44, and 42% were 45 or older). Prior to participating in the study, many tutors had previous K–2 reading tutoring experience (71%), and half had specific tutoring experience with EL students.

Treatment Procedures

Children in both conditions received individual instruction outside their classroom for 15 min per day, four days per week, for an average of 14 weeks. The two conditions were designed to examine the value of added written spelling and pronunciations in teaching word meanings. The instruction and materials for both conditions were drawn from an early vocabulary intervention (Nelson & Vadasy, 2007) that has been evaluated extensively (Nelson, Vadasy, & Sanders, 2011; Vadasy, Nelson, & Sanders, 2013; Vadasy, Sanders, & Nelson, 2015). The original scope and sequence of the vocabulary intervention was designed to introduce high frequency root words that would support decoding practice through a set of activities and word sequence matched to typical kindergarten letter-sound instruction. Selection of the original word corpus is described in Vadasy et al. (2015). In the present study, the EV instruction included a subset of the original intervention activities and root words. We selected words for this study with particular attention to words identified in the Common Core State Standards (National Governors Association, Council of Chief State School Officers, 2010) Measurement and Counting Math Standards for the primary grades (e.g., *add, thin, long, last, list, end, less, next, even, size, more*), and words included in vocabulary lists for kindergarten science and math content. We chose a subset of features from the original intervention identified as characteristics of effective vocabulary interventions: explicit definition of each word plus exam-

ples of the word used in sentence contexts; repeated exposure to the printed word in multiple contexts; and discussion of the word generated by scripted prompts (Stahl & Fairbanks, 1986). The EV-S condition included multiple practice opportunities to write the word, spell it aloud, and read and pronounce the written word. All activities were designed to be easily and accurately implemented by non-teacher tutors who might be assigned by schools to supplement vocabulary instruction for low-skilled students. In the basic EV condition, a set of five activities was used to teach the meaning of a new target word. In the EV-S condition, written spelling practice (which included word reading and pronouncing) was integrated into the five major lesson activities.

The basic activities for both groups included: explicitly defining the target word in a child-friendly definition; hearing the word read aloud by the tutor in a familiar sentence context, paired with an illustration and student practice using the word in a sentence; and tutor and student reading the word in both sentence and story contexts with appropriate tutor scaffolding. At four points in the lesson, students in the EV-S condition were instructed to spell/write the word on grid paper, with the tutor scaffolding phoneme segmenting as needed. EV-S students also practiced spelling three previously taught words from dictation in a review at the end of each lesson. To equalize instruction time, students in EV group were read two prompts at the end of the lesson to use the word in a sentence context. Tutors scaffolded this language use as needed, helping students begin a sentence, turn a response into a complete sentence, or extend a sentence ("Say a little more").

At the beginning of each lesson for both groups, the tutor reminded the student of the previously taught word and asked the student to tell the meaning. Table 2 outlines the steps used in each treatment. The lesson books used with both groups of students provided clear orthographic representations of the words for decoding/reading and spelling. Students in the EV condition decoded or read aloud each TW eight times, and spelled the target word (TW) one time orally during the lesson. Students in the EV-S condition decoded or read aloud the TW 11 times (including at each added spelling opportunity), and wrote and spelled aloud the TW 3 times during the lesson and two more times in

TABLE 2 Basic Instruction Steps for EV and EV-S Treatments

EV Instruction	EV-S Instruction
Word Blending and Spelling (3 min)	
1. Tutor says and points to Target Word (TW) (student repeats TW).	Same Steps 1–4 plus
2. Tell meaning of word (read definition).	5. Dictate TW. Student write, spell and say TW.
3. Model blending TW, student repeats (point to letters).	
4. Student practice blending and reading 9 words (model if needed).	
5. Have student say, spell TW (point to letters), and repeat TW.	
Word Meaning and Sentence Reading (2 min)	
1. Tutor reads TW definition and sentence. Student listens.	Same Steps 1–3 plus
2. Prompt student to say more about TW: "What can you tell me about ——?"	4. Dictate TW. Student write, spell, say TW.
3. Repeat and help expand student responses: "What do you know about ——? Tell me more." "Can you think of words that mean the same/opposite? (help student to use complete sentences).	

TABLE 2 Basic Instruction Steps for EV and EV-S Treatments (*Continued*)

EV Instruction	EV-S Instruction
Passage Reading (4 min)	Same Steps 1–4
1. Ask student to tell the meaning of the TW before starting to read.	
2. Tutor reads passage (point to words).	
3. Tutor and student read passage together (point to words).	
4. Tutor and student read passage again to build fluency.	
Sentence Completion (3 min)	Same step 1 plus
1. Tutor and student read 3 word choices together (point to words). For each sentence: Tutor reads sentence to student with correct word filled in. Tutor and student reread sentence together with correct word filled in.	2. Dictate TW. Student write, spell, say TW.
Say a Sentence (3 min)	Spelling Review (3 min)
Tutor reads 2 sentence prompts. Repeat/rephrase student responses and help expand. "Tell me more." "Can you think of words that mean same/opposite. Help student respond in complete sentence.	Dictate 3 previous TWs. Student tells each meaning, writes, spells, says TW.

the following lessons in review, for a total of five added written spellings per word.

TRAINING AND FIDELITY

The first author conducted a one-hour initial training for tutors that included modeling each of the teaching activities for both conditions, and discussion of strategies to support student oral and written responses. Tutors were also introduced to specific strategies to support and scaffold student responses based on students' developing levels of English proficiency (e.g., how to praise and expand upon one-word responses from less skilled students early in the year, and how to elicit and scaffold longer and complete sentence responses). After the intervention commenced, staff conducted formal on-site observations to monitor fidelity, and provided follow up on-site coaching for each tutor during the first two weeks of the instruction.

During observations, a yes/no checklist of 22 tutoring components matching the treatment instruction were recorded: Fifteen of these components were common to both treatments, two were unique to the EV condition, and five were unique to the EV-S condition. The total percentage correct was then entered and tabulated for each observation, based on the appropriate criteria for the students' treatment condition assignment. During the first week of the study, inter-observer reliability was established using simultaneous observations of 15 unique tutor-student pairs (based on five tutors across two of the seven research sites). Paired observation correlations were $r = 0.95$ for components across both treatments, 0.99 ($N = 6$) for the EV treatment, and 0.93 ($N = 9$) for the EV-S treatment.

For the duration of the study all tutors were observed weekly, averaging 24 observations each, for a grand total of 336 observations (170 EV and 166 EV-S). Across the 14 tutors, mean fidelity was high and nearly identical (within rounding) across treatments, averaging 97% for each condition ($SD = 3\%$; range: 91% to 100%). There was no contamination among conditions observed, and there was no significant difference between conditions within tutors on fidelity ratings (paired *t*-test $p > 0.05$).

STUDENT ATTENDANCE

Throughout the intervention, tutors recorded attendance for each child they tutored. Across conditions, the observed student mean attendance for both treatments was identical, at 51.06 days out of 54 possible ($SD = 2.31$, range = 41 to 54 days).

Student Assessments

Students were pre-tested in late fall (October) and post-tested in early winter (January), approximately four months apart, during the first half of their kindergarten year on general vocabulary, word reading, and spelling, as well as two experimenter-developed measures of taught-word learning. For each test wave, students were tested individually in English by trained testers unaware of experimental treatment assignment. Identical test forms for measures were used at both test points. Norm-referenced standard scores were used for analyses of the three general skill measures (based on a normative population $M = 100$ and $SD = 15$); for the two experimenter-developed measures, we report percentage correct.

General vocabulary was assessed using the norm-referenced Peabody Picture Vocabulary Test-IIIA (PPVT-IIIA; Dunn & Dunn, 2006). For this test, children select a picture that best illustrates the meaning of an orally presented stimulus word and testing is discontinued after the student misses 8 out of 12 items within a grade level set; the maximum number of words is 204. Test manual split-half reliability is 0.76 for five year olds and 0.80 for six year olds. In prior research with EL kindergarteners, sample reliabilities (Cronbach's alpha) for this measure were > .90 (Nelson et al., 2011; Vadasy et al., 2015).

General word reading was measured using the mean of norm-referenced standard scores from the Woodcock Reading Mastery Test-Revised/Normative Update (WRMT-R/NU; Woodcock, 1987/1998) Word Attack and Word Identification subtests. The Word Attack test includes 45 nonwords that follow typical English orthographic rules and which steadily increase in difficulty. Students are asked to read each nonword and testing is discontinued after six consecutive incorrect responses. The Word Identification test includes 106 words that increase in difficulty, and test-

ing is discontinued after six consecutive incorrect responses. Test manual split-half reliability for kindergartners is 0.94 for Word Attack and 0.98 for Word Identification. In prior research with EL kindergarteners, sample reliabilities for both of these measures (Cronbach's alpha) were >.90 (Nelson et al., 2011; Vadasy et al., 2015).

General spelling was measured using norm-referenced standard scores from the Wide Range Achievement Test-4 (WRAT-4; Wilkinson & Robertson, 2006) Spelling subtest, which requires writing the child's first name, writing 13 dictated letters, and spelling 42 dictated, increasingly difficult words. Testing is discontinued after 10 consecutive errors. Test manual internal consistency reliability coefficient for kindergarteners is 0.94. In prior research with EL kindergarteners, sample reliabilities for this measure (Cronbach's alpha) were >.80 (Nelson et al., 2011; Vadasy et al., 2015).

Taught word learning was assessed using experimenter-developed measures of *reading vocabulary* and *spelling*. The *taught word reading vocabulary* is a 25-item curriculum-based measure comprising target words that had been randomly sampled from the corpus of 54 taught words. The mean instructional lesson of the words selected for this measure is 28.96 (*SD* = 16.48, range: Lessons 3 to 54). For each item, the student is asked to match a given meaning to a word. The meaning is read aloud by the tester. The student must read and choose from among three words: one target and two distractors. Students have 3 sec to respond to each item. All items are administered, and each item is scored dichotomously, for a maximum of 25 points possible. Sample-based Cronbach's alphas were .21 and .72 at pretest and posttest, respectively. The low internal consistency at pretest was most likely due to successful guessing (item difficulties ranged from 0.24 to 0.44 and averaged 0.33, representing chance levels given the three-option response format) especially in light of the low language proficiency levels represented by the sample.

The *taught word spelling* measure was also a 25-item curriculum-based measure comprising target words that had been randomly sampled from the corpus of 54 words taught during instruction. Ten of the 25 sampled words overlapped with the words in the taught-word reading vocabulary measure, but item presentation for spelling was randomly sorted separately from the

sorting for the vocabulary measure. The mean instructional lesson of the words selected for this measure is 27.72 ($SD = 16.99$, range: Lesson 1 to 52), similar to that of the taught-word reading vocabulary measure. Each target word was dictated by the tester, and the child was asked to write as much of the word as they could. If the student could not spell the word, they were asked to draw a line. Five sec pauses were used between items. We applied an 8-point developmental scoring rubric (Kroese, Hynd, Knight, Hiemenz, & Hall, 2000) that was based on the earlier Tangel and Blachman (1992) scale. Student responses are rated for representing phonemes with orthographically acceptable letters, with credit for representing the correct number of syllables. Kroese et al. (2000) earlier reported excellent scoring reliabilities (0.99). Items were scored from 0 (random string of letters) to 7 (entire word correctly spelled), for a maximum possible score of 175 points. Sample internal consistencies (Cronbach's alpha) were .97 and .98 at pretest and posttest, respectively.

Analysis Plan

Due to the multiple nesting structures present in the research design, a multilevel, hierarchical modeling approach was adopted. All models were estimated with maximum likelihood in *HLM7*. All analyses were conducted using either norm-referenced standard scores (for the three general skill measures) or percentage correct (for the two taught word measures). Specifically, we employed three-level models in which student gains (Level 1) were nested within tutors (Level 2), nested within schools (Level 3). All treatment effects were tested at the individual level since students were the unit of randomization. For each gain outcome, we conducted a series of four models in a fashion similar to sequential regression. Model 1 estimated gains, adjusted for tutor and school membership, to determine whether growth across both experimental conditions was significantly different from zero (intercept-only models). To evaluate the second research question, Model 2 estimated treatment effects on gains (at the student level). Model 3 tested adjusted treatment effects, after controlling for pretest, as well as for potential interactions between treatment and pretest. We did not incorporate student attendance or tutor fidelity into

our models since both of these variables had extraordinarily high means with little variance (for both treatments).

For ease of interpretation as well as computation of the interactions, experimental condition was effect coded ($+1$ = EV-S and -1 = EV) and approximate effect sizes (denoted d^*) were computed for treatment differences as twice the coefficient estimate (twice due to effect coding of conditions) divided by the square root of the sum of the variance component estimates (i.e., approximate standard deviation). In other words, the effect size for condition may be interpreted as the approximate distance in gains between treatments in standard deviations.

Results

Sample Descriptives

Disaggregated (unadjusted) student assessment means and standard deviations for pretests, posttests, and gains for each condition are provided in Table 3; zero-order correlations for each condition are provided in Table 4, which also include treatment-related variables (student attendance and tutor fidelity). Based on the means of the norm-referenced measures, at pretest the sample averaged in the 14th percentile in vocabulary, 32nd percentile in word reading, and 23rd percentile in spelling. By posttest, the sample averaged in the 20th, 62nd, and 46th percentiles, respectively.

Pretests

As a check on potential differences between the two conditions prior to treatment, we compared groups on each pretest measure using basic two-group *t*-tests; results showed no significant differences on any measure (all ps > 0.05). The same results were found when data were analyzed using multilevel modeling (i.e., after adjusting for tutor and school membership).

TABLE 3 Disaggregated Student Descriptive Statistics

Measure	EV-S (n = 51)						EV (n = 49)					
	Pretest		Posttest		Gain		Pretest		Posttest		Gain	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
General Vocabulary	76.35	(17.81)	86.45	(15.03)	10.10	(12.44)	71.84	(17.60)	76.67	(14.64)	4.84	(12.86)
General Word Reading	93.79	(7.97)	107.37	(10.18)	13.58	(8.13)	92.97	(6.39)	103.28	(10.58)	10.31	(8.76)
General Spelling	86.82	(14.28)	100.08	(11.68)	13.25	(10.31)	81.96	(14.55)	96.24	(10.80)	14.29	(11.47)
Target Word Learning												
Reading Vocab (%)	34.51	(10.73)	46.20	(20.32)	11.69	(20.92)	31.76	(9.88)	39.43	(14.24)	7.67	(17.41)
Spelling (%)	5.02	(9.75)	38.10	(28.96)	33.08	(25.28)	3.13	(9.90)	26.36	(25.19)	23.23	(22.30)

Note. General Vocabulary = standard score of Peabody Picture Vocabulary Test-IIIA; General Word Reading = mean of standard scores from Word Attack and Word Identification subtests of Woodcock Reading Mastery Test-Revised/Normative Update; General Spelling = standard score of Spelling subtest of Wide Range Achievement Test-4; Taught Word Reading Vocab = percent correct on dichotomously scored 25-item curriculum-based measure of taught word reading vocabulary; Taught Word Spelling = percent correct on 7-point developmental scoring of 25-item curriculum-based measure of taught word spelling.

TABLE 4 Disaggregated Zero-order Correlations by Experimental Condition

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
Treatment-related																	
1. Student Attendance	—	0.04	0.19	−0.12	0.26	−0.02	−0.07	0.04	0.07	0.01	0.26	−0.04	−0.22	0.17	**−0.33**	0.22	−0.02
2. Tutor Fidelity	0.03	—	−0.01	−0.02	−0.08	0.01	−0.03	0.19	0.13	0.13	−0.10	0.02	0.23	0.17	0.22	−0.09	0.04
Pretest																	
3. General Vocabulary	0.06	−0.05	—	**0.32**	**0.35**	0.03	**0.29**	**0.70**	0.22	0.07	**0.33**	0.14	**−.58**	0.03	**−.37**	0.25	0.03
4. General Word Reading	0.07	0.07	**0.42**	—	**0.48**	0.02	**0.85**	**0.28**	**0.56**	**0.41**	**0.55**	**0.45**	−0.12	−0.05	−0.22	**0.44**	0.13
5. General Spelling	0.22	−0.10	**0.34**	**0.60**	—	0.02	**0.50**	**0.29**	**0.65**	**0.63**	**0.53**	**0.38**	−0.14	**0.44**	**−0.68**	**0.42**	0.21
6. Taught Word Reading Vocab%	−0.08	0.11	0.23	**0.40**	0.16	—	−0.01	0.01	0.08	0.04	−0.01	0.26	−0.03	0.09	0.02	**−0.58**	**0.29**
7. Taught Word Spelling%	−0.03	−0.04	**0.32**	**0.77**	**0.64**	**0.32**	—	**0.28**	**0.56**	**0.40**	**0.70**	**0.47**	−0.08	0.06	−0.25	**0.58**	0.09
Posttest																	
8. General Vocabulary	0.24	0.14	**0.73**	**0.45**	**0.41**	0.18	**0.31**	—	**0.39**	0.26	**0.41**	0.20	0.19	0.27	−0.13	**0.33**	0.10
9. General Word Reading	−0.04	−0.02	**0.39**	**0.62**	**0.64**	0.14	**0.69**	**0.43**	—	**0.71**	**0.50**	**0.71**	0.15	**0.80**	−0.16	**0.36**	**0.55**
10. General Spelling	0.13	0.14	0.25	**0.53**	**0.70**	**0.36**	**0.58**	**0.31**	**0.62**	—	**0.35**	**0.63**	0.20	**0.56**	0.15	0.26	**0.53**
11. Taught Word Reading Vocab%	0.09	0.10	**0.41**	**0.65**	**0.64**	0.21	**0.76**	**0.44**	**0.76**	**0.63**	—	**0.32**	0.01	0.21	**−0.34**	**0.82**	0.05
12. Taught Word Spelling%	0.02	−0.10	**0.36**	**0.34**	**0.41**	0.17	**0.52**	**0.35**	**0.71**	**0.58**	**0.73**	—	0.03	**0.53**	0.11	**0.58**	**0.92**
Pretest-Posttest Gain																	
13. General Vocabulary	0.20	0.24	**−0.56**	−0.05	0.01	−0.12	−0.09	0.17	−0.03	0.01	−0.06	−0.09	—	0.27	**0.36**	0.03	0.07
14. General Word Reading	−0.12	−0.10	0.08	−0.20	0.21	−0.22	0.12	0.10	**0.64**	0.26	**0.31**	**0.56**	0.01	—	−0.03	0.12	**0.58**
15. General Spelling	−0.17	**0.30**	−0.18	−0.24	**−0.59**	0.19	−0.23	−0.21	−0.17	0.16	−0.17	0.10	0.00	0.01	—	**−0.29**	0.23
16. Taught Word Reading Vocab%	0.13	0.04	**0.28**	**0.43**	**0.54**	**−0.31**	**0.57**	**0.33**	**0.66**	**0.42**	**0.87**	**0.32**	0.00	**0.41**	−0.27	—	−0.13
17. Taught Word Spelling%	0.04	−0.10	**0.29**	0.10	0.22	0.07	0.21	**0.28**	**0.55**	**0.44**	**0.54**	**0.94**	−0.07	**0.59**	0.20	**0.49**	—

Note. EV-S condition (*n* = 51 students) given in lower diagonal, EV condition (*n* = 49 students) given in upper diagonal; Student Attendance = number of days student was tutored; Tutor Fidelity = mean tutor fidelity percentage; General Vocabulary = standard score of Peabody Picture Vocabulary Test-IIIA; General Word Reading = mean of standard scores from Word Attack and Word Identification subtests of Woodcock Reading Mastery Test-Revised/Normative Update; General Spelling = standard score of Spelling subtest of Wide Range Achievement Test-4; Taught Word Reading Vocab = percent correct on dichotomously scored 25-item curriculum-based measure of taught word reading vocabulary; Taught Word Spelling = percent correct on 7-point developmental scoring of 25-item curriculum-based measure of taught word spelling. Pearson's *r* reported; correlations in boldface are significant at the 0.05, 2-tailed level.

TABLE 5 Estimated Intraclass Correlations across Experimental Conditions

Measure	Pretest		Posttest		Gains	
	Tutors	Schools	Tutors	Schools	Tutors	Schools
General Vocabulary	0.00	0.04	0.00	0.05	0.04	0.00
General Word Reading	0.00	0.00	0.00	0.00	0.00	0.04
General Spelling	0.00	0.00	0.03	0.00	**0.23**	0.00
Target Word Learning						
Reading Vocab (%)	0.00	0.00	0.00	0.00	0.00	0.00
Spelling (%)	0.00	0.00	**0.10**	0.00	**0.16**	0.01

Note. $N = 100$ students within 14 tutors, within 7 schools. Intraclass correlations (ICCs) = proportion of variance in scores accounted for by nesting unit. ICCs computed from 3-level variance component maximum-likelihood estimates; boldfaced ICCs are significantly different from zero. General Vocabulary = standard score of Peabody Picture Vocabulary Test-IIIA; General Word Reading = mean of standard scores from Word Attack and Word Identification subtests of Woodcock Reading Mastery Test-Revised/Normative Update; General Spelling = standard score of Spelling subtest of Wide Range Achievement Test-4; Taught Word Reading Vocab = percent correct on dichotomously scored 25-item curriculum-based measure of taught word reading vocabulary; Taught Word Spelling = percent correct on 7-point developmental scoring of 25-item curriculum-based measure of taught word spelling.

Pretest-Posttest Gains

INTRACLASS CORRELATIONS

Table 5 displays intraclass correlations (ICCs) for tutors and schools computed using variance components estimates from un-conditional three-level models. ICCs may be interpreted either as the proportion of variance accounted for by the nesting unit or as the correlation between any two randomly drawn scores within a nesting unit. Although most ICCs at pretest and posttest were close to zero, ICCs for gains in spelling outcomes were nonzero for tutors in particular. Hence, a multilevel modeling approach is an appropriate analysis to control for dependencies in these data.

MODEL 1: GAINS ONLY

Results from our gains models are provided in Table 6. As can be readily seen, children in both treatments made sig-nificant gains from pretest to posttest on all outcomes. For the experimenter-developed measures, model-implied gains were 10% and 29% for reading vocabulary and spelling, respectively. For the norm-referenced tests, the model-implied gain of 7.57 points for general vocabulary translates to a gain of 0.50 stan-dard deviations; gains of 12.29 and 14.26 points on general word reading and spelling, respectively, indicate gains of 0.82 and 0.95 standard deviations.

MODEL 2: DIRECT TREATMENT EFFECTS

Results from our treatment effects models reported in Table 7, which included condition as an effect-coded predictor ($+1$ = EV-S, -1 = EV), showed significant treatment differences favoring the EV-S condition on pretest-posttest gains in general vocabulary (5.46 standard points), general word reading (3.30 standard points), and taught-word spelling (10.96%), with modest-sized effects of $d^* = 0.44$, 0.39, and 0.47, respectively. No significant differences between the two treatments were found for general spelling or taught-word reading vocabulary ($d^* = -0.04$ and 0.21, respectively).

MODEL 3: ADJUSTED TREATMENT EFFECTS

When pretest and treatment-by-pretest interaction terms were entered into the models, there was no substantive change in

TABLE 6 Model Results for Pretest-Posttest Gains across Experimental Conditions

Fixed Effects	General Vocab Coeff	General Word Reading Coeff	General Spelling Coeff	Taught Reading Vocab% Coeff	Taught Spelling% Coeff
Mean Pre-Post Gain	7.57**	12.29***	14.26***	9.71**	28.64***
Random Effects	*Var*	*Var*	*Var*	*Var*	*Var*
Tutors	5.76	0.02	26.30***	0.49	91.56*
Schools	0.03	2.61	0.05	0.04	3.80
Residual	157.94	69.70	90.22	367.98	483.06

Note. $N = 100$ students within 14 tutors, within 7 schools. Maximum likelihood-based estimates for 3-level models reported. General Vocabulary = standard score of Peabody Picture Vocabulary Test-IIIA; General Word Reading = mean of standard scores from Word Attack and Word Identification subtests of Woodcock Reading Mastery Test-Revised/Normative Update; General Spelling = standard score of Spelling subtest of Wide Range Achievement Test-4; Taught Word Reading Vocab = percent correct on dichotomously scored 25-item curriculum-based measure of taught word reading vocabulary; Taught Word Spelling = percent correct on 7-point developmental scoring of 25-item curriculum-based measure of taught word spelling.

*$p < 0.001$, **$p < 0.01$, ***$p < 0.05$.

TABLE 7 Model Results for Treatment Differences on Pretest-Posttest Gains

	General Vocabulary		General Word Reading		General Spelling		TW Reading Vocabulary%		TW Spelling%	
Fixed Effects	Coeff	d*	Coeff	d*	Coeff	d*	Coeff	d*	Coeff	d*
Mean Pre-Post Gain	7.54**		12.28***		14.26***		9.67**		28.48***	
Condition (1 = EV-S)	2.73*	0.44	1.65*	0.39	−0.21	−0.04	2.01	0.21	5.48*	0.47
Random Effects	*Var*		*Var*		*Var*		*Var*		*Var*	
Tutors	8.85		0.02		26.11***		0.47		106.85**	
Schools	0.03		2.77		0.05		0.04		1.06	
Residual	148.00		66.83		90.24		363.97		445.60	

Note. N = 100 students within 14 tutors, within 7 schools. Maximum likelihood-based estimates for 3-level models reported; Condition effect coded (+1 = EV-S, -1 = EV). General Vocabulary = standard score of Peabody Picture Vocabulary Test-IIIA; General Word Reading = mean of standard scores from Word Attack and Word Identification subtests of Woodcock Reading Mastery Test-Revised/Normative Update; General Spelling = standard score of Spelling subtest of Wide Range Achievement Test-4; Taught Word Reading Vocab = percent correct on dichotomously scored 25-item curriculum-based measure of taught word reading vocabulary; Taught Word Spelling = percent correct on 7-point developmental scoring of 25-item curriculum-based measure of taught word spelling.

*p < 0.001, **p < 0.01, ***p < 0.05.

treatment effects: Effects that had been significant in Model 2 continued to be significant in the presence of pretest, and vice versa. Although we found pretest to be significantly negatively predictive of gains in general vocabulary, general spelling, and taught-word reading vocabulary (i.e., children who were relatively higher skilled made relatively fewer gains in these skills), we observed no interactions between treatment and pretest on any outcome. In other words, the kindergarten EL sample's initial test scores did not moderate treatment effects.

Discussion

In this study all students received the core intervention that was characterized by explicitly defining the target high frequency vocabulary word, providing multiple exposures to the word in list and sentence contexts, practice decoding and attending to the printed letters in the word, interacting with the word in oral responses, and using the word in sentences with tutor supports. The basic instruction for both groups was originally designed to strengthen connections between the meaning and phonological decoding of each word, with only incidental spelling and pronunciation practice. Added written spelling and pronunciation opportunities were provided in the EV-S treatment.

Pre-Post Effects

Children in both groups made significant gains from pretest to posttest on the norm-referenced measures of general vocabulary, general word reading, and general spelling. Posttest scores reflect considerable variability in skill levels, possibly due to large variability in the English learner sample. The individual tutoring sessions offered regular language interactions with an adult who encouraged and scaffolded student responses, and this aspect of the instruction may have contributed to the growth in general vocabulary. The regular individual tutoring sessions provided EL kindergarteners opportunities within brief predictable routines in which to practice and develop English language skills that support vocabulary learning. EL children who are often reticent to respond in their classrooms may have felt more confident to do so in the context of predictable routines with a familiar adult's

support. Instruction for both groups included scaffolded practice decoding the target words in lists and in sentences, and this activity drew children's attention to the individual letters and sounds in the words. This practice may have contributed to growth for both groups in general word reading and spelling.

Treatment Effects

To examine the benefits of building connections between the semantic, phonological, and orthographic word features, the students in the EV-S condition wrote, spelled aloud, and read/pronounced the TW a total of five added times, three times on the day it was taught, and reviewed in the following two lessons. Children in the EV-S instruction showed greater gains in general vocabulary, general word reading, and in proximal spelling than children in EV instruction. This attention to these three word features is related to the general vocabulary advantage for the EV-S group. As noted earlier, the effects of vocabulary interventions on general vocabulary have been limited (see Elleman et al., 2009; Marulis & Neuman, 2010). Although the 10% advantage in proximal spelling growth for EV-S children may appear modest, it should be considered in light of their emergent spelling skills and the limited attention to spelling in typical kindergarten programs. The added written spelling and reading/pronouncing practice may have contributed to the moderate general word reading advantage for the EV-S group.

WITHIN-TREATMENT EFFECTS

The added attention to word forms did not result in higher proximal word reading vocabulary for the EV-S group. We suspect that failure to detect treatment differences for proximal word reading vocabulary reflects the difficulty and limits of our custom measure. The word reading vocabulary measure required that the child be able to decode the three word choices in the test item and then be able to match the spoken word meaning given by the tester to the correct written word. Further, dichotomous scoring was used for the proximal word reading vocabulary measure, whereas the proximal spelling measure was developmentally scored and likely more sensitive to incremental learning of the orthographic features of the target words. Findings for the

treatment comparison must be qualified by the measurement approaches used in this study, a limitation that characterizes many studies of early vocabulary interventions.

Limitations

Several limitations must be noted. First, without an untreated control group, we cannot know if intervention effects are due to treatment or to classroom instruction. The gains we observed for general English vocabulary may reflect the rapid acquisition of English language that young EL children often demonstrate upon school entry (e.g., Silverman, 2007). A second limitation is that our proximal vocabulary measure is confounded with children's decoding skill, and its internal reliability was low. Our lack of a true definition measure of word meaning leaves open the question whether the orthographic knowledge advantage for the taught words demonstrated by the EV-S group also provided a semantic advantage. A definition measure that reveals the depth of children's understanding of the word meaning is needed to determine whether spelling benefits vocabulary learning for at risk kindergarten-age and for EL students. The question warrants further study because these two groups of young learners are likely to require multiple exposures to fully learn word meanings.

Instructional Implications

The features common to EV and EV-S included many found to be effective in vocabulary instruction for elementary students, including features of widely used storybook reading interventions (Coyne et al., 2009; Loftus et al., 2010; Zipoli et al., 2011). However, in most kindergarten storybook interventions, children are not directed to the printed words in the storybooks. In the many kindergarten classrooms where children are now being taught word reading skills, vocabulary learning may be reinforced when children see the words in print and their attention is drawn to the letters and sounds in the words, as in the EV and EV-S decoding practice.

In this study, attention to word spellings was beneficial for English learners being explicitly taught English vocabulary. This attention to the printed words may also enhance vocabulary

learning in storybook reading contexts for English learner and at-risk children less able to draw upon story context and syntax to learn word meanings. English learners with less early exposure to English vocabulary pronunciations and printed words may benefit from vocabulary instruction that includes attention to phonology and spellings. This attention may also benefit at-risk native speaking children with more limited early oral language and print interactions.

Findings support the value of including written spellings and pronunciations in vocabulary learning. This is of practical importance because exposure to printed words for decoding, pronouncing, and spelling is easily and quickly implemented. We observed that this practice was motivating for beginning readers eager to interact with the printed words. The improvements in general vocabulary in particular support the benefit of these simple routines. Future research should further examine the benefits of these practices with improved measurement of vocabulary knowledge. Of the measures we used, the experimenter measure of word reading vocabulary may be considered a weak proxy measure of vocabulary knowledge, indicating recognition of the word (perhaps an initial step in processing the word) but not degree of word knowledge. Further, the measure has lower than desired reliability; thus the lack of effects for this measure may be due to a relatively high error variance. Others have noted the difficulty in assessing vocabulary learning in young children (Hoffman, Teale, & Paciga, 2014). In the present study, the central question really is whether learning the orthographic features of a word, whether demonstrated with partial or complete spelling, supports learning and retrieving memory traces of the word's meaning. Definition measures require the child to articulate his or her knowledge of the word in language, a difficult task for young kindergarten-age children, and even more difficult for young English learners.

The findings we report here, and in a related study (Vadasy & Sanders, 2015) suggesting that even young kindergarten English learners benefit when vocabulary instruction includes attention to word meaning, spelling, and pronunciation, support future research on effective methods to engage children with the printed word forms. In our studies, the vocabulary interventions were effectively delivered by paraprofessional tutors. Although many of the tutors in this study had previous experience with

English learners and young children, their experience and education levels were similar to backgrounds of typical school support staff hired as assistants or tutors. One implication for practice is that these school staff may effectively extend classroom vocabulary instruction when provided with simple but carefully designed instructional scripts and training. These explicit features for teaching vocabulary might be implemented widely in contexts where tutors and paraprofessionals supplement and reinforce classroom instruction for EL children. Finally, future research on early vocabulary learning will require improved measures to assess degrees of word knowledge in young children.

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Appendix A

List of Words Taught in Both Treatments

add	pick	wink	well
on	rib	ill	when
map	thin	long	exit
damp	with	land	next
nap	dash	last	chill
nod	ship	lift	quick
pass	wish	best	safe
pack	cub	den	even
back	mud	end	ripe
boss	rush	less	size
path	tug	nest	more
dim	bank	pet	old
grin	think	rest	open
			true