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Predicting kindergartners' end of year spelling ability from their reading, alphabetic, vocabulary, and phonological awareness skills, and prior literacy experiences

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Abstract

The purpose of this paper is to examine the role of home literacy, parental education and demographic factors in addition to conventional literacy skills at the beginning and end of kindergarten in predicting end of kindergarten spelling achievement. The present study involved 9 schools and 29 classrooms serving an economically and ethnically diverse population (n = 288). Students spelled three types of words: sight words, decodable real words, and decodable pseudowords; conventional and invented spellings are reported. Results from a three step hierarchical regression indicated the variables accounted for 66% of the variance in spelling scores, and the single strongest spring predictor was a one-minute letter-sound fluency test. Implications for instruction and for identifying students at risk for future spelling and reading difficulties are discussed.

Over 40 years of research has focused on early reading development (e.g., National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). Relative to this extensive research base, knowledge about how early spelling develops has received less attention (Joshi & Aaron, 2005), which is disturbing because poor spellers typically remain poor spellers (Juel, 1988). Poor spelling impedes the writing process and the inability to spell and write to communicate one's ideas limits participation in content area curriculum and limits future job opportunities (Graham, 1999). Frequently poor spellers are also poor readers, perhaps because, as Ehri (2000) noted, spelling and reading develop synergistically and reciprocally. Early spelling can therefore play an important diagnostic role in identifying inaccurate letter-sound or word representations to target for early intervention. Recently, the National

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Early Literacy Panel (NELP, 2009) confirmed that invented spelling, assessed prior to formal reading instruction, is a strong predictor of later decoding ability (average correlation of .60). In fact, the NELP reported that the magnitude of the correlations between invented spelling increased from .49 at the end of kindergarten to .63 in first or second grade. This finding is notable because, typically, researchers find that the greater the amount of time between the initial assessment and the outcome, the weaker the correlation. Furthermore, invented spelling was shown to be an important predictor of response to early literacy interventions (Al Otaiba & Fuchs, 2002).

Connections between Spelling and Reading Development

Researchers historically had theorized that students' spelling develops in stages that parallel reading development (Adams, 1990; Ehri, 2000; Moats, 2000). According to the stage theory of spelling development, students progress from preliterate to alphabetic spellers as they master letter-sound correspondence. Next, they learn about within-word orthographic patterns (e.g., CVC spellings), and subsequently, about complex syllable patterns (e.g., the long /e/ sound may be represented by several possible spellings) and derivational patterns. Nevertheless, research is beginning to converge on the idea that spelling develops not in such discrete stages, but rather develops as students learn to connect their knowledge about the alphabet, phonology, orthography, and morphology across time with increasing efficiency (e.g., Treiman & Bourassa, 2000). Specifically researchers have shown that these connections develop through what has been termed the overlapping waves model (Siegler, 1996; Rittle-Johnson & Siegler, 1999). Students have been shown to learn to spell using a variety of strategies based upon their knowledge about alphabetics and word reading, literacy experiences, and exposure to words. It is this overlapping waves theory, supported by research demonstrating relatively increasing correlations among invented spelling and measures of phonological awareness and reading in the primary grades, that provides a theoretical framework for the present study.

The NELP report (Lonigan eat al.,. 2009), which synthesized the results of the existing research (18 studies and over 2,600 children) in predicting spelling performance of kindergarteners, first, and second graders, provides strong support for the overlapping waves theory of spelling development. The NELP reported strong to moderate correlations between spelling and various reading skills ranging from .54 for alphabetic knowledge and decoding, .43 for concepts of print, .40 for phonological awareness, to .36 for oral language and writing. Additionally, early spelling strongly predicted later spelling (average correlation of .78 for conventional and .69 for invented spelling).

These NELP findings strongly support the need for research investigating a broad array of potentially important contributions to early spelling development - including those which may occur prior to or at school entry. One recent study, conducted by Ritchey (2008) explored the concurrent relations among early spelling (real and pseudoword spelling) and a relatively wide range of alphabetic, phonological, and reading measures at the end of kindergarten in a sample of 60 students. Students were ethnically diverse, but their individual socioeconomic status was not provided. Real word spelling had moderate to strong correlations with letter-name fluency (.50), letter-sound fluency (.81), moderate

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correlations with beginning reading (Test of Early Reading Ability- Third Edition (TERA; Reid, Hresko, & Hammil, 2001 Alphabetics, Conventions, or print awareness, and Meaning, or ability to read and understand words, sentences, and paragraphs) (.53), moderate to strong correlations with phonological awareness (ranging from .58 to .64, depending on the measure). Similar correlations were found for pseudoword spelling. The correlation between spelling of real and pseudowords with CVC patterns was very strong (.92), suggesting that spelling is a unitary construct at the end of kindergarten. Ritchey also conducted a regression analysis in which concurrent TERA-3 reading and letter-sound fluency accounted for 70% of the variance in real word spelling.

In addition to the contributions language and early literacy skills make to spelling, there is converging evidence about the important role early literacy experiences in homes and preschools play in supporting reading skill development (for a review, see Whitehurst & Lonigan, 1998). Typically, children who live in poverty, including many from minority backgrounds, have impoverished language skills and fewer home literacy experiences than students from middle and higher socioeconomic backgrounds. Frequently their mothers' have had relatively less education. These early differences negatively impact childrens' skills at school-entry. It is important to learn more about whether these experiences are tempered through formal early literacy instruction, particularly among children who live in poverty who are more likely to have difficulties reading, spelling, and writing (Hecht, Burgess, Torgesen, Wagner, & Rashotte, 2000; Nicholson, 1997; NELP, 2009; Snow, et al, 1998).

The present study extends Ritchey's (2008) and other research (e.g., results of NELP, 2008) related to important contributors to spelling that can serve as reliable and stable indicators for identifying spelling development and for identifying children at risk for future spelling difficulties in several unique ways. We used a variety of measures of conventional literacy constructs and administered these assessments prior to and after kindergarten instruction. We recruited a diverse (i.e., ethnicity, SES) pool of students in a district using an explicit and systematic core reading program, and we collected parental and home literacy information as well as socioeconomic status. Specifically, we addressed two research questions:

1. What are the relations among conventional language and literacy skills (i.e., phonological awareness, alphabetics, letter writing, and word reading) and spelling at the end of kindergarten?
2. To what extent is end of year spelling predicted by students' home literacy, parental education and demographic factors as well their initial and concurrent conventional language and literacy skills?

Method

Participants and Instructional Setting

Participants in the current study were 288 kindergarteners and their 29 teachers, who were part of a larger NICHD-supported study of response to early literacy classroom instruction. In all 9 schools, kindergarten was full-day and reading instruction occurred for 90-minutes daily. One school used *Reading Mastery* (Engelmann & Bruner, 2002)) and the remaining

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schools used Open Court *Imagine It!* (Bereiter et al., 2002). Both these reading curricula systematically and explicitly provide code-focused instruction targeting phonological and phonemic awareness as well as phonemic decoding, but neither targets spelling instruction. Although the larger study involved a randomized control trial described elsewhere (Al Otaiba et al., in review) and did find that students in the treatment condition outperformed students in the contrast condition on letter-sound and word reading, there were no significant differences in spelling performance between conditions on spelling scores; therefore data in the present study represents students in both conditions.

The mean age of the present sample at the time of fall testing was 5.18 years (SD = .33) and 54.2% were male. Notably, 61% of students were from minority racial backgrounds and 52.6% received free and reduced price lunch (FARL). The mean IQ (assessed using the Kaufman Brief Intelligence Test; Kaufman & Kaufman, 2004) of the sample was 96.25 (SD = 11.22). About 7% of the sample had been retained in kindergarten. On average, these students were absent for six school days across the kindergarten year. Students schools identified as having a developmental delay or a sensory impairment who participated in the larger study were excluded from the present study. Table 1 shows the parental education, home literacy experiences, and preschool experiences of the sample.

Measures

Home literacy—In fall, students' parents completed a questionnaire about their education, their child's home literacy environment (e.g., the amount of time they read to their child), and their child's preschool history. Previous work using these measures has demonstrated significant correlations between them and children's phonological, language, and reading skills (e.g., Torgesen et al., 1999).

Word reading—We assessed word reading in fall and in spring using the Letter-Word Identification subtest of the widely-used, standardized, norm-referenced *Woodcock Johnson-III Tests of Achievement* (*WJ-III*; Woodock, McGrew & Mather, 2001). This subtest consists of 76 increasingly difficult items, which progress from identification of letters to real words. Testing is discontinued after 6 consecutive incorrect items and test authors report reliability of .91; concurrent validity with the *WJ-III* Passage Comprehension subtest is high (.79).

Alphabetics—In fall, the *Dynamic Indicators of Basic Early Literacy Skill*s (*DIBELS*) (Good & Kaminski, 2002) Letter Naming Fluency (LNF) task was used to assess a students' ability to name letters. For this task, the examiner presented an array of upper and lower case letters in random order and asked students to name as many letters as they could in one minute. The examiner told students that if they did not know a letter, he or she would provide it. Alternate-form reliability is .99.

In spring, students' letter-sound fluency was assessed using the *AIMSweb Letter-Sound Fluency (LSF)* (reference?) subtest. In this task, the examiner presented an array of 10 rows of 10 lowercase letters and asked students to name as many letter sounds as they could in one minute. Testing was discontinued if the child could not produce any correct sounds in the first 10 letters. Alternate form reliability is .90.

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Vocabulary—In both fall and spring, to assess students' expressive vocabulary, we selected the Picture Vocabulary (PV) subtest of the *WJ-III* (Woodcock, McGrew, & Mather, 2001). In this subtest, students named pictured objects, which increased in difficulty. Testing was discontinued after 6 consecutive incorrect items. According the WJ-III test authors, reliability of this subtest is .77.

Phonological and phonemic awareness—We assessed students' phonological and phonemic awareness in fall and in spring using the Blending Words and Elision subtests of the *Comprehensive Test of Phonological Processing* (*CTOPP*; Wagner, Torgesen, & Rashotte, 1999). The CTOPP is an individually administered, standardized, norm-referenced assessment of phonological processing. The Blending Words subtest requires students to blend orally presented words to create compound words, syllables, onset-rimes, and finally, phonemes. For example, students orally presented with /c/ /at/ are required to respond /cat/. The Elision subtest assesses student's ability to delete a word, syllable, phoneme, or phonemes from orally presented words. For example, students presented “baseball” are asked to say “baseball without base.” The correct response then is “ball.” Test-retest reliability is .88 for both subtests.

In spring, we also used a timed, criterion-referenced segmentation assessment from the DIBELS) Good & Kaminski, 2002), Phoneme Segmentation Fluency (PSF). This test measures how many phonemes a student can segment in one minute when orally presented words that contain 2-5 phonemes. The test began with a practice item; the examiner said “I can say the sounds in ‘mop’. The sounds in ‘mop’ are /m/ /o/ /p/.” Then the examiner presented the student with other words. Because partial scoring is allowed, students earned a point for each correct phoneme. Test authors reported alternate-form reliabilities of .60–.88.

Letter writing fluency (LWF)—To assess students' ability to write all the letters in the alphabet, we used a task developed by Berninger and Fuller (1992) that has been found to be reliable in a number of studies. For this task, an RA asked children to write all the letters in the alphabet in order, using lowercase letters. The directions were: *We're going to play a game to show me how well and quickly you can write your ABC's. First, you will write the lowercase or small ABC's as fast and carefully as you can. Don't try to erase any of your mistakes, just cross them out and go on. When I say “ready, begin”, you will write the letters. Keep writing until I say stop. Ready, begin*. After 1 minute, the RA told the students: “*Stop and put down your pencils*”. Berninger and Fuller allowed one point for each correctly formed and sequenced letter. We modified their scoring, given that our students were relatively newer to writing than their participants and we awarded .5 for letters that were written in upper case, cursive or reversed, and a 0 only for letters written out of order or that were ineligible or not written. The possible range of scores was 0 to 26;

Spelling—To assess students' ability to spell, we used a reliable and valid untimed spelling task used in prior early literacy studies (Byrne & Fielding-Barnsley, 1993; Byrne et al., 2006; Liberman, Rubin, & Duques, & Carlisle, 1985). The task includes words that were decodable (real and psuedowrd) and decodable. RAs introduced the spelling task by pointing to the answer sheet and saying, *“I would like you to spell some words. Some are real and some are made-up words. If you don't know how to spell a word, sound it out and do your*

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best. First I am going to say the word, then I will use it in a sentence, and then I will say the word more time. Remember to write the word next to the correct number on your answer sheet. Ready, begin." Then the RA read each word, read the sentence with the word, and then repeated the spelling word (e.g., "dog". "I took my dog to the park." "dog"). The pseudowords were repeated three times (e.g., *Next word* "ig" "ig" "ig"). We applied an invented spelling scoring rubric (following Tangel and Blachman's (1992) conventions) and subsequently the range of raw scores was from 0 to 60. Scores on each type of spelling word were strongly related. Specifically, scores on decodable words and pseudowords were significantly correlated, $r(288) = .75$, $p < .01$, as were scores on decodable words and sight words, $r(288) = .77$, $p < .01$. Scores on sight words and pseudowords were also strongly related, $r(288) = .69$, $p < .01$.

Procedures

For the larger study, data from parents were collected in fall; reading, alphabetic skills, vocabulary, and phonological assessments were individually administered by Research Assistants (RAs) in fall and spring. Tasks were administered in the same order for each child. These RAs included certified teachers and graduate students majoring in special education and school psychology. All received extensive training to administer assessments by the first author. The spelling and writing measures that are particular to the present study were group-administered by RAs in late spring, two weeks prior the spring assessments were collected for the larger study.

For the LWF and spelling measures, inter-scorer agreement was established by a three-step process. First the author created a scoring rubric for the two measures. The rubric for the LWF task related mostly to penmanship and letter formation. A score of 0 indicated a letter was missing, incorrect, or not recognizable; a score of .5 indicated a letter was recognizable but poorly formed or reversed; a score of 1.0 indicated a letter was well formed.

The spelling rubric indicated each word and used Tangel and Blachman (1992) to create phonetic rules. The possible scores per word ranged from 0 to 6. A 0 indicated a random string of letters or no response; 1 was a single phonetically related letter (e.g., for "dog" student wrote an "o" or a "g"); 2 was a correct first letter followed by other unrelated letters (e.g., "dib" or "d, random letters, and a "g"); 3 was more than one phoneme that was phonetically correct (e.g., :do"); 4 was all letters represented and phonetically correct (e.g., "dawg"); 5 was all letters represented and phonetically correct and the student made an attempt to mark a long vowel (e.g., for the word "blue" if the student wrote "blew" or "bloo"; 6 was the word was spelled correctly (e.g., "dog").

Two RAs were trained by the first author to use the rubric; once they reached 100% agreement, they individually scored 15% of the entire data set. For the letter writing fluency score, inter-rater reliability was 99% and Cohen's kappa was .98; for spelling, inter-rater reliability was 94.75% and Cohen's kappa was .92.

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Results

Relations among conventional language and literacy skills and spelling at the end of kindergarten

Students' scores on the 14 target spelling words were aggregated to form a single spelling score. Because there were 14 target words and each word was rated from 0-6, the maximum possible score on this outcome was 84 (M = 51.41, SD = 20.18). Table 2 shows students' assessed performance for spelling and on all other measures. Given that this was a diverse sample with a majority of students receiving FARL, it is notable that, on average, students were soundly within the national norms for vocabulary and letter-word reading, and that they increased their reading skills relative to national norms from fall to spring (98.55 to 106.71). In addition, students' fall and spring LNF and spring PSF scores were above grade level benchmarks. Figure 1 demonstrates the proportion of students scoring a 0 to a 6 on each word.

Table 3 summarizes the concurrent correlations among spring spelling and letter writing fluency, phonological awareness, alphabetics, and word reading (ranging from .41 to .65) and the correlations from fall to spring (ranging from .50 to .57). The strongest concurrent correlation was between spring letter-sound fluency and spelling (.65); whereas the strongest correlation between spelling among the fall measures was with word reading and letter-naming fluency (each .57).

Prediction of end of year spelling

We used a three-step hierarchical regression to investigate whether students' initial skills (i.e., phonological awareness, alphabetic knowledge, and reading) could predict their end-of-year spelling proficiency better than their gender, race, and prior literacy experiences alone, and in turn, whether concurrent measures of these same variables would predict spelling performance over and above that of the initial assessments. In the first step, students' parental education, home literacy experiences, socioeconomic status, gender, race, and preschool history were entered into the model. In the second step, students' phonological awareness, alphabetic, and reading skills as assessed in the fall were entered. In the third and final step, students' concurrent (i.e., spring) scores on the same measures from the fall as well as their letter writing fluency scores were entered. Table 4 shows the standardized regression coefficients predicting end-of-year spelling achievement.

Step 1 of the regression accounted for 20.3% of the variance in spelling scores, $F_{\Delta}(6, 247) = 10.516$, $p < .001$. The main effects of preschool attendance, amount of time per week spent reading at home, and socioeconomic status (as indicated by whether the student received free or reduced lunch) were significant, $\beta = .135$, $t(247) = 2.278$, $p < .05$; $\beta = .168$, $t(247) = 2.869$, $p < .05$; and $\beta = -.316$, $t(247) = -4.550$, $p < .001$, respectively. The negative t-value for the effect of FARL indicated that receiving free or reduced lunch was associated with lower spelling performance. Gender, race, and parental education were not significantly related to spelling performance (ps > .11).

Step 2, which consisted of the set of fall conventional literacy assessments, accounted for an additional 27.2% of unique variance in spelling scores, $F_{\Delta}(6, 241) = 20.823$, $p < .001$,

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indicating that students' initial phonological, alphabetic knowledge, and reading skills better predicted spelling performance than gender, race, and prior literacy experiences alone. Thus, a total of 47.5% of the variance in end of year spelling could be predicted at the beginning of the kindergarten year. Phonological awareness was indicated by two measures in this step, namely, the CTOPP Elision and Blending Words subtests. Specifically, students' performance on the elision subtest was significant, β = .134, $t(241) = 2.011$, $p < .05$, and their ability to blend words was also significant, β = .167, $t(241) = 2.444$, $p < .05$. Alphabetic knowledge was indicated by letter-naming fluency and letter-sound fluency. Students' ability to name letters was significantly related to end-of-year spelling, β = .241, $t(241) = 3.415$, $p < .01$, while letter-sound fluency was not ($p = .50$), presumably because most kindergarteners had not learned many letter sounds so early in the year. Letter and word reading skills, assessed using the WJ-III Letter-Word subtest also approached significance, β = .140, $t(241) = 1.903$, $p = .058$. Students' vocabulary in the fall was not significantly related to end-of-year spelling performance ($p = .67$).

Finally, Step 3, which incorporated spring assessments into the model, accounted for an additional 18% of unique variance; thus in combination with the first two steps, we accounted for 65.6% of the variance in end of year spelling performance, $F_{\Delta}(8, 233) = 15.226$, $p < .001$, indicating that concurrent measures of phonological awareness, alphabetic knowledge, reading, and letter writing fluency contributed to prediction of spelling performance above and beyond that of students' literacy backgrounds and initial literacy skills. Three measures of phonological awareness were entered in this step: CTOPP Elision and Blending Words did not reach significance (ps > .14), but Phoneme Segmentation Fluency (DIBELS) was significantly related to spelling performance, β = .145, $t(233) = 3.217$, $p < .01$. Of the alphabetic skills indicators, letter-naming fluency was not significant ($p = .70$), but letter-sound fluency was significant and the single best predictor of spelling performance, β = .248, $t(233) = 4.101$, $p < .001$. Letter and word reading was also significantly related to end-of-year spelling performance, β = .227, $t(233) = 3.274$, $p < .01$. Lastly, students' letter writing fluency significantly contributed to prediction of spelling performance, β = .153, $t(233) = 3.334$, $p < .01$.

Discussion

In the present study, we examined the relations among initial and end of year conventional language and literacy skills and spelling at the end of kindergarten. We also examined the extent to which end of year spelling was predicted by students' home literacy, parental education and demographic factors as well their initial and concurrent conventional language and literacy skills. It is noteworthy that despite the relatively high proportion of students who received free lunch and who were from minority backgrounds, on average, we found that students' phonological awareness, alphabetic, and reading skills were at grade level or above. Thus, even if students from at-risk homes had come into school with relatively weak skills, they seemed to have benefited greatly from instruction. Indeed, the sample mean word reading standard scores improved from a 97 to a 107, indicating that their word reading was improving relative to national norms. However, these students varied considerably in their ability to spell words at the end of kindergarten. Because we used a rubric to represent students' invented spelling, rather than only using conventional spelling

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(i.e., right/wrong), we were able to learn more about the variability in how students' spelled words phonetically and orthographically at the end of kindergarten.

As seen in Figure 1, 70% of students could produce the conventional spelling of “dog” correctly, and over half correctly spelled “man”, “ig”, “sut” and the sight word “blue”. By contrast, very few students correctly produced the conventional spellings for “said”, “limp” or “yilt”. Even in spelling difficult words such as “yilt”, only about 15% of the sample scored a zero (indicating that no letters were correctly represented by any related phoneme). Further, a relatively small number of students scored a one or two, indicating that they spelled only a single phonetically related letter (e.g., for “dog” student wrote an “o” or a “g”) or a correct first letter followed by other unrelated letters (e.g., “d” followed by random letters). For most decodable words with a blend, the most common score was a three, indicating more than one phoneme was phonetically correct, but not all letters were represented correctly. This pattern was very different, however, for words like “come”, for which most students did represent all letters phonetically correctly. Students' spelling proficiency across decodable real words and decodable pseudowords as well as sight words was highly correlated (*rs* > .*69*), which is consistent with Ritchey's (2008) findings and suggests that early spelling is a unitary construct.

Not surprisingly, the concurrent correlations among end of year spelling and conventional language and literacy skills were slightly larger in magnitude than assessments at the beginning of the year. Thus, our findings appear consistent with the overlapping waves theory (Rittle-Johnson & Siegler, 1999; Siegler, 1996), which would suggest kindergartners were beginning to use their knowledge of phonology, letter-sounds, and word reading to spell words. The strongest concurrent correlations were with LSF (r = .65) and letter-word reading (r = .62), followed by blending (r = .56), letter-naming (.54), and elision (.53); moderate correlations were found with letter writing fluency and PSF (respective rs = .46 and .41). Fall correlations with spelling ranked in strength from LNF and letter-word reading (r*s* = .57), LSF and blending (r*s* = .52), and elision (r = .50). The magnitudes of these correlations are largely consistent with those reported by the NELP (2009). Ritchey (2008) reported a stronger correlation between LSF and spelling, (.81) than we found, which could be due to differences between study samples or the specific measures used.

We directly compared the extent to which end of year spelling was predicted by students' home literacy, parental education and demographic factors as well their initial and concurrent conventional language and literacy skills through a three-step hierarchical regression analysis. Thus our study uniquely addressed the need to better understand whether spelling skill is associated with home literacy experiences prior to kindergarten or to variables such as parental education within a diverse population of students. This is important because parental education and socioeconomic status have been linked to differences in oral language proficiency and reading readiness skills (e.g., Hart & Risley, 1995; NELP, 2009). These factors accounted for over 20% of the variance in spelling.

Overall we were able to account for 65.6% of the variance in spelling, which is slightly less than the 70% that Ritchey (2008) reported. In our sample, once we accounted for kindergartners' conventional literacy skills at the start of kindergarten, the effect of

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socioeconomic status and home experiences decreased. This finding could be because children in the present study were provided explicit and systematic reading instruction. However, another explanation could be that young children who entered school with more proficient oral language and reading skills developed better spelling than children with weaker initial skills (Scarborough, 2001)

Limitations and future directions

As with any research, there are important limitations to our study that lead to directions for future research. First, it is important to qualify our findings because we had no spelling pretest data. Thus, future research is needed to address this limitation and to determine whether students who entered school with the weakest language and literacy skills also lagged behind their peers in spelling.

Second, our findings may not generalize to other curriculum programs that have less explicit reading instruction, which is important in light of at least one prior larger-scale investigation that examined the efficacy of reading kindergarten curricula (Foorman et al., 2003). Foorman et al.'s multi-year study involved three cohorts and over 4,800 students who attended struggling schools; teachers were provided professional development. Foorman and colleagues examined the extent to which kindergarten reading curricula supported the teaching of connections between phonemic awareness and letter-sound knowledge explicitly and systematically. They also examined whether more or less phonemic awareness in the kindergarten literacy curriculum affected growth in kindergarten literacy skills and first-grade reading and spelling outcomes. Similar to our study findings, Foorman et al. reported that those curricula (e.g., Open Court, which was used in the schools which participated in our study) that explicitly linked phonemic awareness and the alphabetic principle in kindergarten led to reading performance that was at the national average. By contrast, Foorman et al. reported that students' spelling performance was poor and group means for spelling ranged from the 16th to the 25th percentile. They found spelling was not directly addressed in these curricula and even though it was targeted through professional development, relatively little spelling instruction occurred.

Third, it will be important to examine the instructional context and to describe the amounts, types, and quality of reading, spelling, and writing instruction students received. Although all children received the same core reading program, children clearly could have had more exposure or instruction for some words than others, which was not controlled for in this study. Understanding the instructional context is important in light of NRP (2000) and NELP (2009) findings emphasizing that explicitly teaching phonemic awareness and letter-sound awareness improves reading and spelling outcomes. We have collected, but not yet analyzed, videotapes of instruction from a larger sample with an additional cohort of 500 students. In doing so, we will also be able to account for the nested nature of the data by using hierarchical linear modeling, which will be a stronger data analytic procedure than the hierarchical regression used in the present study.

Finally, we acknowledge the need to learn how spelling continues to develop longitudinally relative to national norms. We plan to follow students in our sample longitudinally to describe their reading, spelling, and writing development. We will also use a standardized

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spelling assessment for the purpose of comparing our sample to national norms and to determine, across time, which students are and are not on grade level for reading and spelling.

Implications for practice

Despite these limitations, findings from the present study provide several important instructional implications for teaching young children who have or at risk for reading and spelling difficulties. First, our finding that young children produced a large variation in spellings supports the notion that early spelling errors provide an important diagnostic window of understanding about how children strategically use letters and sounds and how well they remember irregular words. Thus, early spelling should play a role in screening and progress monitoring students with or at risk for learning disabilities. Similarly, early spelling.assessment data can inform instruction by helping teachers group children for word study and tailor their instruction based on what strategies they know and do not know.

Another related implication for students at risk for learning disabilities, is that LSF, which may be administered as an ongoing curriculum-based progress monitoring measure, may be an important screener for early spelling difficulty. Notably, we found that the relationship between LSF and spelling grew stronger from fall to spring, while the relation between LNF and spelling diminished. This is consistent with at least one other longitudinal study conducted by McBride-Chang (1999) that used a set of reading related skills that was similar to those used in the present study (including letter-naming, letter-sound knowledge, phonological awareness, spelling, and reading), but she followed students longitudinally from kindergarten to the end of first grade. She reported that concurrent correlations between invented spelling and letter-sound knowledge were relatively stronger (and had an increasingly stronger correlation across time) than those between spelling and letter-name knowledge (which showed a decreasing trend). This is likely because letter-naming is an earlier skill than letter-sound correspondence, although letter name knowledge predicts letter sound knowledge (Evans, Bell, Shaw, Moretti, & Page, 2006).

Finally, Aristotle once said “What we have to learn to do, we learn by doing.” A substantial number of students in the present study, even among those who read at grade level, had not learned to spell. An obvious implication for their future primary grade teachers is the need to provide spelling instruction and to help students learn about spelling through practicing spelling. Although we have not yet determined the amount of spelling or writing instruction students in the present study received, other researchers have found that during the early primary grades the amount of time focused specifically on teaching spelling is minimal (e.g., Juel & Minden-Cupp, 2000) and often focuses on drill practice to memorize words (Scott, 2000). In sharp contrast, findings from the present study, consistent with the overlapping waves theory, suggests children need spelling instruction that shows them how to use their increasingly refined understanding of the English language and its alphabetic principle and syllable structure.

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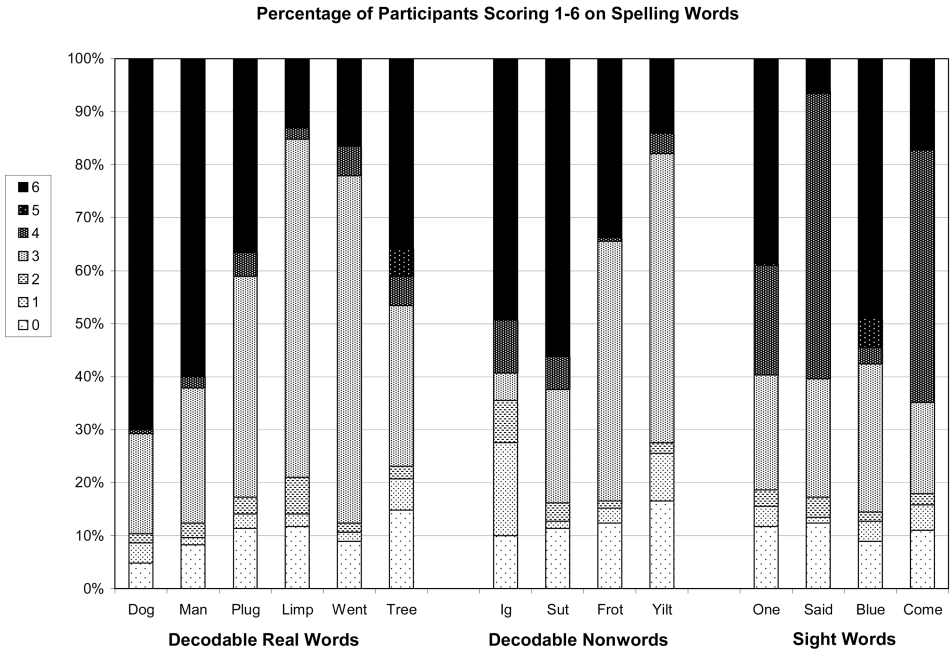

Figure 1.

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Table 1
Parental Education and Home Literacy Survey Data

Variable	n	%
Parental Education		
Some high school	21	7.3
High school	31	10.8
Some college	88	30.6
Four year college	86	29.9
Graduate degree	35	12.2
Not reported	27	9.4
Parent-to-Child Reading Time Per Week		
None	7	2.4
About 10 minutes	87	30.2
Between 15-30	151	52.4
Over 30 minutes	18	6.3
Not reported	25	8.5
Child's Pre-School Attendance		
Attended	235	81.6
Did not attend	30	10.4
Not reported	23	8.0

Note: Total number of children: 288.

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Table 2

Student Fall and Spring Spelling, Reading, Alphabetic Knowledge, Vocabulary, Phonological Awareness, and Letter Writing Fluency Scores

Measure	Semester	Possible Range	Min	Max	M	SD
Spelling						
Composite Score	Spring	0-84	0	82	52.45	18.99
SW	Spring	0-30	0	30	18.24	6.81
DW	Spring	0-30	0	30	19.69	7.41
PW	Spring	0-24	0	24	14.51	6.68
Reading						
LW	Fall	n/a	62	142	98.58	11.89
LW	Spring	n/a	61	142	106.84	14.03
Alphabetic						
LNF	Fall	0-110	0	107	26.94	17.02
LNF	Spring	0-110	0	110	49.70	18.15
LSF	Fall	0-100	0	54	10.47	10.91
LSF	Spring	0-100	0	83	38.64	15.46
Vocabulary						
PV	Fall	n/a	78	132	101.95	8.78
PV	Spring	n/a	70	132	101.56	8.99
Phonological						
BW	Fall	1-20	4	19	10.54	2.33
BW	Spring	1-20	3	20	12.16	2.53
EL	Fall	1-20	3	19	9.45	2.48
EL	Spring	1-20	2	18	10.32	2.81
PSF	Spring	n/a	0	72	37.24	15.76
Letter Writing	Spring	0-26	0	26	10.50	6.23

Note: Total number of children: 288. SW = Sight Words Raw Score; DW = Decodable Words Raw Score; PW = Pseudo-Words Raw Score. LW = Letter-Word Standard Score; LNF = Letter Naming Fluency Raw Score; LSF = Letter-Sound Fluency Raw Score; PV = Picture-Vocabulary Standard Score; BW = Blending Words Standard Score; EL = Elision Standard Score; PSF = Phoneme Segmentation Fluency Standard Score.

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Table 3

Zero-Order Correlations Among Constructs

Measure	Semester	SPC Spring	LW Fall	LNF Fall	LSF Fall	PV Fall	BW Fall	EL Fall	LW Spring	LNF Spring	LSF Spring	PV Spring	BW Spring	EL Spring	PSF Spring
LW	Fall	.57**	-												
LNF	Fall	.57**	.62**	-											
LSF	Fall	.52**	.62**	.71**	-										
PV	Fall	.33**	.35**	.27**	.33**	-									
BW	Fall	.52**	.60**	.45**	.50**	.34**	-								
EL	Fall	.50**	.56**	.44**	.46**	.41**	.64**	-							
LW	Spring	.62**	.76**	.42**	.43**	.37**	.60**	.58**	-						
LNF	Spring	.54**	.43**	.54**	.51**	.20**	.40**	.41**	.41**	-					
LSF	Spring	.65**	.46**	.52**	.45**	.25**	.43**	.40**	.49**	.70**	-				
PV	Spring	.31**	.37**	.24**	.33**	.67**	.36**	.42**	.34**	.25**	.26**	-			
BW	Spring	.56**	.48**	.35**	.34**	.31**	.58**	.49**	.61**	.35**	.43**	.28**	-		
EL	Spring	.53**	.51**	.31**	.38**	.47**	.60**	.67**	.59**	.36**	.45**	.43**	.61**	-	
PSF	Spring	.41**	.15*	.16**	.13*	.14*	.26**	.28**	.26**	.29**	.39**	.16**	.35**	.32**	-
LWF	Spring	.46**	.27**	.35**	.25**	.13*	.18**	.22**	.22**	.33**	.39**	.06	.26**	.27**	.31**

Note: SPC = Spelling Composite Score; LW = Letter-Word Standard Score; LNF = Letter Naming Fluency Raw Score; LSF = Letter-Sound Fluency Raw Score; PV = Picture-Vocabulary Standard Score; BW = Blending Words Standard Score; EL = Elision Standard Score; PSF = Phoneme Segmentation Fluency Standard Score; LWF = Letter Writing Fluency.

* $p < .05$.

** $p < .01$.

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Table 4
Standardized Regression Coefficients Predicting End-of-Year Spelling Achievement

Factors	Model 1	Model 2	Model 3
Demographics and Home Literacy			
Gender	-.070	-.068	-.001
Parental Education	.093	-.055	.014
Time spent reading at home	.168*	.076	.068
Preschool attendance	.135*	.078	.045
Race	-.102	-.015	.012
SES (FARL)	-	-.136*	-.106*
Initial conventional literacy skills (fall semester)			
LW		.140	.117
LNF		.241**	.148*
LSF		.049	.086
PV		.024	.002
BW		.167*	.013
EL		.134*	-.008
Concurrent conventional literacy skills (spring semester)			
LW			.227**
LNF			-.024
LSF			.248***
PV			-.034
BW			.084
EL			.062
PSF			.145**
LWF			.153**

Note: SES (FARL) = Socioeconomic Status indicated by Free or Reduced Lunch; LW = Letter-Word Standard Score; LNF = Letter Naming Fluency Raw Score; LSF = Letter-Sound Fluency Raw Score; PV = Picture-Vocabulary Standard Score; BW = Blending Words Standard Score; EL = Elision Standard Score; PSF = Phoneme Segmentation Fluency Standard Score; LWF = Letter Writing Fluency.

* $p < .05$

** $p < .01$

*** $p < .001$.