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End-of-Kindergarten Spelling Outcomes: How Can Spelling Error Analysis Data Inform Beginning Reading Instruction?

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Abstract

In this article, the authors examined the spelling performance of 430 kindergarteners, which included a high risk sample, to determine the relations between end of kindergarten reading and spelling in a high quality language arts setting. The spelling outcomes including the spelling errors between the good and the poor readers were described, analyzed, and compared. The findings suggest that not all the children have acquired the desired standard as outlined by the Common Core State Standards. In addition, not every good reader is a good speller and that not every poor speller is a poor reader. The study shows that spelling tasks that are accompanied by spelling errors analysis provide a powerful window for making instructional sense of children's spelling errors and for individualizing spelling instructional strategies.

Keywords

spelling error analysis; spelling difficulties; beginning spellers; poor; poor readers; Common Core State Standards

Introduction

Early literacy skills of kindergarten children are strongly correlated with later literacy skills such as reading, writing, and spelling (National Early Literacy Panel, 2008). Despite these findings, limited early literacy intervention research has investigated spelling as an outcome measure in kindergarten (i.e., Ehri & Wilce, 1987; O'Connor & Jenkins, 1995; Ouellette & Sénéchal, 2008; Santoro, Coyne, & Simmons, 2006; Tangel & Blachman, 1992; Vandervelden & Siegel, 1997).

The Spelling-Reading Connection

It is important for teachers of young children (including children with reading difficulties or who are at risk for reading disabilities) to understand that the skills that promote reading also

promote spelling and vice versa. These skills include the understanding of the alphabetic principle and phonemic awareness (Ehri, 2000). The relation between phonological awareness, alphabet knowledge, and spelling is well established (Foorman & Francis, 1994; Moats, 2005/2006; National Reading Panel, 2000; Santoro et al., 2006; see Table 1 for the literacy terms related to spelling acquisition). For example, within phonological awareness, or the ability to hear and manipulate sounds in speech, the phoneme segmentation skill (i.e., that “cat” is comprised of /c/ /a/ /t/) has been discovered to be an important link between reading and spelling (Foorman & Francis, 1994).

In young children, Caravolas, Hulme, and Snowling (2001) found that 68 percent of the variance in phonological spelling accuracy is predicted at age five by phoneme isolation (telling the first sound in a word) and letter-sound knowledge. Similarly, in a sample of nearly 300 kindergarten children which included a diverse and at-risk sample, Al Otaiba et al. (2010) reported that 66% of the variance in end of kindergarten spelling was predicted by letter-sound fluency, letter and word reading, letter writing fluency, and phoneme segmentation fluency. Evidence from the meta-analyses by the National Early Literacy Panel (2008) also demonstrated that alphabet knowledge is the strongest predictor of spelling ($r = .54$). Thus, across these studies on beginning spellers, phonemic awareness and letter-sound knowledge are important precursors for the development of orthographic representations.

Despite spelling and reading being “two sides of the same coin,” spelling is essentially more difficult than reading (Ehri, 2000, p. 33). Spelling requires more precision in phoneme-grapheme or letter-sound knowledge than reading (Foorman & Francis, 1994). In addition, reading entails decoding of graphemes into phonemes while spelling entails encoding the phonemes into graphemes (Carreker, 2011). These are two different processes. Thus, readers may recognize a single sound or syllable that comprise multiple graphemes, but as spellers they may not be able to correctly reproduce from memory the multiple graphemes (and in the correct order) in writing (Ehri, 2000). Hence, without the explicit and formal spelling instruction, which teaches children to physically write the sounds they hear either through finger spelling and/or writing with a pencil and the use of multisensory tools including letter tiles and Elkonin boxes; to use capitalization and punctuation; and to generalize patterns through the use of word study (e.g., -at family of words such as *cat*, *mat*, and *sat*; see Bear, Invernizzi, Templeton, & Johnson, 2008; Carreker, 2011; Graham & Santangelo, 2014; Santoro et al., 2006; Schlagal, 2013; Uhry, 2011; Weiser & Mathes, 2011), beginning spellers may not be able to establish the awareness and memory of letter patterns or understand transcription skills necessary to become good spellers and writers. Spelling skills should therefore be explicitly taught (Carreker, 2011; Moats, 2005/2006; Treiman, 1998).

Benchmarks for Spelling Accomplishments at the End of Kindergarten

The recently developed *Common Core State Standards* (CCSS, 2015) have provided teachers, special educators, and interventionists with a set a benchmarks for the accomplishments of children at every grade level and across grades. Specifically, the following CCSS (2015) illustrate skills for spelling (and writing) that the CCSS suggest should be mastered by the end of kindergarten:

- Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- Capitalize the first word in a sentence and the pronoun *I*.
- Recognize and name end punctuation.
- Write a letter or letters for most consonant and short-vowel sounds (phonemes).
- Spell simple words phonetically, drawing on knowledge of sound-letter relationships.

It profits teachers to understand the foundation of English orthography and the developmental progression of beginning spelling, in order to meet these benchmarks.

Systematic Foundation to Spelling in the English Language

English is an alphabetic orthography. It is frequently misconceived to be an irregular and random orthography owing to its rich history behind the formation of Modern English, which has its roots in Anglo Saxon, Norman French, Latin, and Greek languages (Joshi, Carreker, Treiman, & Moats, 2008/2009; Moats, 2005/2006).

The origins of the English orthography give rise to the features and organization of the 3-layered spelling system: alphabetic, pattern, and meaning (Bear et al., 2008; Invernizzi & Hayes, 2004). The alphabetic layer, which originated from the Anglo-Saxon language, features a regular phoneme-grapheme correspondence (e.g., *bad*, *crash*, and *sting*). The pattern layer, which originated from the Norman French influence, overlies the alphabetic layer. The pattern later may not have a single grapheme for the phoneme (e.g., *-ape* in *cape* which is comprised of a vowel, consonant, and silent *-e* forming a long vowel) and may vary in pronunciations (e.g., *-ea* vowel digraph in *bread*, *great*, *meat*, and *clean*; Bear et al., 2008). The meaning layer derived from the Latin and Greek languages, represents the meaning of the word. It comprises Greek/Latin stems, prefixes, and suffixes (Moats 2005/2006). Examples of words with Greek influence are *autograph* and *autobiography*; words with Latin influence are *heal* and *healthy*, which have varying pronunciations but constant spellings.

Thus, the English orthography is more orderly than it appears (Carreker, 2011; Schlagal, 2013). It has reliable patterns and rules that can be taught and mastered. This systematic foundation can be used to inform spelling instruction (Bear et al., 2008; Invernizzi & Hayes, 2004). Understanding the pattern of the English orthography provides students with a system for pattern generalization from a small cluster of words to a larger number of words (Schlagal, 2013). Given that 87% of the English orthography is regular, students need not resort to rote memorization and visual memory of words when learning to spell (Carreker, 2011; Joshi et al., 2008/2009). The remaining words can be spelled correctly when the history, origins, and meaning of the words are taken into consideration (Bear et al., 2008; Moats, 2005/2006). Teachers who understand the 3 layers/structures of the English spelling will be equipped to align their instructional planning, assessment, and intervention activities.

Developmental Progression of Spelling

Studies on spelling development have generally found that children move through phases or stages, but the development is gradual and incremental and strategies may even overlap as the children's repertoire of strategies increase over time (Sharp, Sinatra, & Reynolds, 2008). Thus, spelling development is not discrete nor exact (Carreker, 2011). Broadly, children move from the phonemic representations (phoneme-grapheme correspondence) to orthographic representations (patterns) and finally, morphemic representations (meanings) of words (Schlagal, 2013).

At the beginning of the writing experience, pre-schoolers write by marking or scribbling using gross and linear visual features such as dot, circles, and shapes (Puranik & Lonigan, 2011). Then they represent an entire word with just one letter. Interestingly, preschoolers between 3 and 4 years old tend to write longer letters for larger objects and fewer letters for smaller objects (Pollo, Kessler, & Treiman, 2009; Zhang & Treiman, 2015). These researchers argued that prior to their understanding of print the children use meaning making process to connect the relation between the size of the objects and the length of the letters. Thus, the writing products are not randomly derived.

Subsequently, children move on to representing more graphemes for the phonemes in words using letter names to spell (e.g., from *b* to *bt* or *bet* for *beat*; Gentry, 2005; Treiman, 1998). Children typically learn to spell the initial consonant first, then the final consonant, and last, the medial short vowel (e.g., Bear et al., 2008; Coker, 2013; Dixon, Stuart, & Masterson, 2002; Gentry, 2005; Morris, Bloodgood, Lomax, & Perney, 2003; Ouelette & Sénéchal, 2008; Santoro et al., 2006).

Beginning spellers tend misspell complex words with consonant clusters (i.e., consonant-vowel-consonant-consonant [CVCC] words such as *sink*, *limp* and *went* and consonant-consonant-vowel-consonant [CCVC] words such as *plug*). The first consonant in the CVCC words and second consonant in the CCVC words are frequently omitted (Cassar & Treiman, 2004; Read, 1975; Treiman 1991; 2000). Thus, *limp* may be spelled as *lip*, *went* as *wet*, and *plug* as *pug*. Difficulties with nasal clusters are also typical of young spellers (e.g., *and* is spelled as *ad*; *sand* is spelled as *sad*; Bahr, Siliman, & Berninger, 2012). These researchers view these misspellings as systematic errors with linguistic underpinnings.

Gentry (2005) described the trajectory of spelling development and quality as progressing in stages. Stage 0 (Nonalphabetic) is the minimal accomplishment at the beginning of kindergarten. At this stage, children possess little awareness of print and would scribble approximated letter forms. Developmental spelling is not yet evident at this stage. At Stage 1 (Prealphabetic), which is the minimal accomplishment in mid-kindergarten, children's writing products are pre-communicative and may appear as random strings of letters. Children do not match sounds of the word or may use letters from their own name (e.g., *dog* is spelled as *amsas* as the letters appear in the child's name "Sam").

Stage 2 (Semi-phonetic), which corresponds with the CCSS standards for the end of kindergarten, indicates the children's ability to spell semi phonetically. For example, *boat* might be spelled as *bt* in an abbreviated manner depicting the speller's focus on prominent

consonant sounds. Stage 3 (Phonetic), which corresponds to the middle of Grade 1, reflects the speller's growing awareness that spelling requires representing sounds in the word (even if they can not represent each one accurately). For example, motor may be spelled as *motr*. Stage 4 (Transitional), which is the minimal accomplishment by the end of Grade 1, depicts the speller's knowledge of consolidated alphabetic writing. For example, *type* is spelled as *tipe*. The last stage is the Correct Stage, in which all sounds are correctly represented.

Spelling Error Analysis

Studies on young children's spelling errors have shown that spelling outcomesⁱ and spelling errors provide diagnostic windows into children's knowledge of the sound system (Bear et al., 2008; Kessler & Treiman, 2003; Sharp et al., 2008; Stage & Wagner, 1992; Tangel & Blachman, 1992).

Children typically use their letter-name knowledge, especially letters with salient phonemic cues to spell words correctly or vice versa. For example, children may produce spellings like *crt* to represent the word "cart." Conversely, children with (or at risk for) reading disabilities lack the sensitivity to the phonemic properties in letter names, which in turn impedes their spelling ability. Thus, "cart" might be spelled with only a single phoneme (e.g., *c* or *k*).

Nearly two decades ago, the Committee on the Prevention of Reading Difficulties in Young Children (Snow, Burns, & Griffin, 1998) suggested that it is important to use errors that children make to diagnose their understanding of the spelling-sound correspondence for designing instruction and intervention. This clarion call has gained increasing support (e.g., Bear et al., 2008; Invernizzi & Hayes, 2004; Joshi et al., 2008/2009; Sharp et al., 2008; Uhry, 2011).

Because children are capable of picking up patterns of spelling (Kessler & Treiman, 2003), effective early interventions can ameliorate spelling difficulties (Berninger et al., 1998; Santoro et al., 2006; Weiser & Mathes, 2011). Researchers have continued to explore how spelling error analysis can provide teachers with a lens for making accurate data-based individualized instructional planning based on their students' spelling difficulties (e.g., Fuchs, Allinder, Hamlett, & Fuchs, 1990; Gentry, 2005; Lemons, Kearns, & Davidson, 2014) such as the provision of specific letter-sound correspondences, alphabetic knowledge, and phonemic awareness training (e.g., Carreker, 2011; Lombardino, Bedford, Fortier, Carter, & Brandi, 1997; Santoro et al., 2006).

Scoring Metrics for Beginning Spelling

There are several scales for measuring the qualitative changes in how beginning spellers understand the pattern and conventions of English spelling (e.g., Bear et al., 2008; Hosp, Hosp, & Howell, 2007; Ritchey, Coker, & McCraw, 2010). The scoring metrics by Bear et al. (2008) classifies the students' spelling errors according to five developmental stages: emergent, letter name-alphabetic, within-word pattern, syllables and affixes, and derivational relations. Within each stage, the spelling quality is classified into three sub-stages: early,

ⁱWe defined spelling outcome as the spelling performance of the children in terms of grapheme(s) spelled correct and is quantified by the partial/full credit awarded in relation to the conventional spelling (see Caravolas et al., 2001; Simmons et al., 2007).

middle, or late and within these sub-classifications, the features of the linguistic structure are mapped out (e.g., if the word *bed* is spelled correctly, the letter *b* is mapped to the initial consonant column within the late emergent stage; the letter *d* is mapped to the final consonant column within the early letter name-alphabetic stage; the letter *e* is mapped to the short vowels column within the middle letter name alphabetic stage).

Ritchey and colleagues (2010) compared four spelling metrics for scoring the spelling performance of beginning spellers: total words correct, correct letter sequence, correct sounds, and phonological coding. For the correct/incorrect scoring metric, children are awarded 1 for correct spelling (*cat*); 0 for incorrect spelling (*kat*). Correct letter sequence, which has mostly been used with second grade students and above (Ritchey et al., 2010), is an outgrowth from the curriculum-based measurement movement (Hosp et al., 2007). It measures the total number of correct letter sequences. Scoring is done by counting each correct sequence indicated by a caret (^). For example, for the word *cat*, the total possible points is 4 (i.e., ^c^a^t^); if it is spelled *cot*, 2 points are awarded (i.e., ^co^t^). Correct sounds metric assesses the phonological features of words spelled. One point is awarded for each phoneme correctly represented regardless of the orthographic correctness of the phoneme represented (e.g., *cat* and *kat* are both assigned 3 points).

As for the phonological coding metric there are several variations (e.g., Caravolas Hulme, & Snowling, 2001; Tangel & Blachman, 1992), but they share common features. Caravolas et al.'s phonological coding ranged from 0 to 4; graphemes that represent phonemes are awarded regardless of its orthographic accuracy. The Developmental Spelling Test that was developed by Tangel and Blachman (1992) is a widely employed phonological coding metric (e.g., Al Otaiba et al., 2010; Al Otaiba et al., 2015; Ouellette & Sénéchal, 2008; Ouellette, Sénéchal, & Haley, 2013; Simmons et al., 2007) to assess the phonological representations of words spelled. It is sensitive to beginning spellers' developmental trajectory in terms of their understanding of phonological and orthographic structures (Ritchey et al., 2010). The range for each score is between 0 and 6. For the word *cat*, a score of 0 indicates that there is no letter-sound connection in the word spelled (e.g., *aru*); a score of 1 is given for phonologically correct letter representation (e.g., *smt*); a score of 2 is given for initial sound represented by the letter (e.g., *cif*); a score of 3 is given for initial and additional phoneme correctly spelled (e.g., *ct*, *cap*, and *cot*); a score of 4 is given for all the phonemes represented (e.g., *cad*); a score of 5 is given for all phonemes with conventional letters (e.g., *chrey* for *tree*); a score of 6 is given for correct spelling (e.g., *cat*). See Table 2 for details on the phonological coding rubric.

Additionally, researchers have also been interested in understanding how beginning spellers represent initial, final, and medial graphemes, including consonant blends (e.g., Bear et al., 2008; Dixon, Stuart, & Masteron, 2002; Morris et al., 2003; Stage & Wagner, 1992; Treiman et al., 1993; Uhry, 1999). Specifically, this micro- or within-word level of coding could be important for capturing beginning spellers' ability to meet the CCSS standards.

Context and Purpose of the Current Study

The current study is part of a larger project funded by the National Institute of Child Health and Human Development, and involved kindergarten teachers in 10 schools serving many

children whose demographics indicate risk for reading difficulties (Al Otaiba et al., 2011). The aim of the larger project was to train teachers to improve Tier 1 by individualizing classroom early literacy instruction based on student data, which was conducted within a Response to Intervention (RTI) framework. Schools were recruited to represent a sample of high needs schools, many of which received Title 1 and Reading First Funding, with the help of the district reading specialist in a midsized city in north Florida. As was common in the district, a very small proportion of children were English language learners.

During the year prior to the current study, these schools had been originally assigned to treatment or a wait-list control condition in the prior year of the project. Between two to five teachers agreed to participate at each school and all of their students were recruited for the study. A majority of teachers were (70.5%) were Caucasian, (22.7%) were African American, and the remainder were Hispanic. Most held bachelor's degrees (77.3%) and the rest held graduate degrees. Al Otaiba and colleagues (2011) demonstrated that teachers in the ISI-K condition provided significantly more individualized instruction and that their students outperformed controls on an end-of-year composite of reading skills ($ES = .52$).

During the current study, all teachers received professional development (i.e., those who had been in treatment or in the wait list control that prior year. All students whose parents consented participated; there were no exclusionary criteria. The professional development was Individualized Student Instruction for Kindergarteners (ISI-K; Connor, Morrison, Fishman, Schatschneider, & Underwood, 2007), which includes (a) web-based software that enables teachers to manage their instruction and graph students' assessed word reading and vocabulary growth, (b) ongoing, monthly professional development, and (c) bi-weekly in-class support. All 10 schools used Open Court Reading, which is an explicit and systematic core reading program (Bereiter et al., 2002). Classroom instruction was assessed using videotaped classroom observations (see Al Otaiba et al., 2011, to determine that treatment was implemented with fidelity and that the overall quality of instruction was effective.

The purpose of the current study was to determine the relations between end of kindergarten reading and spelling scores in a high risk sample of students whose teachers had been trained to individualize instruction using reading and vocabulary data and who were observed to provide high quality language arts instruction. Note that spelling assessment was not a part of the data collected for that larger study. We wished to describe, analyze, and compare the spelling outcomes including the spelling errors at the end of kindergarten in good versus poor readers. We hoped that an understanding of spelling errors and their relation to reading in good and poor readers could inform future efforts to intensify and individual interventions to improve reading and spelling, which could have important implications for both research and teaching. To that end, we examined not only whether students spelled a word correctly, but we also applied an invented spelling rubric used in prior research (Tangel & Blachman, 1992) and a micro-analysis adapted from Stage and Wagner (1992) by the first author to examine whether students could represent letters or blends correctly and in appropriate order, or only represented some salient letters not in the correct order, or omitted letters completely. We had three specific research questions:

1. What is the variability in the end-of-kindergarten spelling outcomes?

2. What are the spelling outcomes and spelling errors of students who are poor readers?
3. Are poor spellers also always poor readers?

Method

Participants

The participants in the current study were drawn from the larger study and included 430 kindergarten children (54% male) including those who qualified for special education from 10 schools ($n = 31$ classrooms). No consent students were excluded. The mean age of our participants was 5.55 years ($SD = .34$); roughly half were male (54.4%); the ethnic backgrounds were as follows: Black (57.2%), White (32.65%), and Asian/Mixed/Other (10.2%). More than half (58%) of the children were qualified to receive free or reduced price lunch based on the US federal criteria. Further, our sample included children already identified with speech impairment (SI) and/or language impairment (LI; 6.57 %), specific learning disabilities (SLD; 1.4%), and developmental delay (1.6%). These demographics are a reflection of recruitment for the larger study, in which we intentionally recruited schools where a large proportion of children were at risk for reading difficulties based on the judgment of the district reading specialist.

Measures

Spelling—We implemented a group-administered brief spelling measure had been used in prior research within the Learning Disability Center Grant projects (Bryne et al., 2007) and included 10 words; six decodable real words (*dog, man, plug, went, limp, tree*) and four decodable pseudowords (*ig, sut, frot, and yilt*). Two members of the research team were present for testing. The total scores possible ranged from 0 to 60.

Word reading—We assessed students' word reading skills individually using the WJ-III Letter Word Identification (Woodcock et al., 2001) subtest. Trained examiners who were part of the research team asked students to identify letters in large type and then to read words in arrays of about eight per page. The subtest consists of 76 increasingly difficult words. Testing is discontinued after six consecutive incorrect items. Interrater reliability is high for this age group ($r = .91$); concurrent intercorrelations with the WJ-III Word Attack and Passage Comprehension subtests are .80 and .79, respectively.

To categorize poor readers, we used a standard score of below 85 on word reading assessed in the spring of kindergarten using the Letter-Word Identification subtest of Woodcock Johnson-III Tests of Achievement (WJ-III; Woodcock et al., 2001). This categorization represents one standard deviation below a nationally normed sample.

Spelling Error Coding Procedures

In current study, we analyzed a corpus totaling 4,300 words from 430 children who were each, as mentioned earlier, given 10 words to spell. First, participants' spelling errors were scored using Tangel and Blachman's (1992) invented spelling rubric. Rather than scoring correct/incorrect, for spelling error analysis, we used their phonological coding rubric (see

Table 2) because it is strongly related to phonological awareness abilities and it is most sensitive to kindergarteners' spelling development over time (Ritchey et al., 2010). The spelling proficiency for each word was measured using a 7-point scale ranging between 0 (random strings) and 6 (conventional spelling). The range for the all the words spelled is between 0 and 60 ($M = 34.13$, $SD = 13.46$). The correlation of the spelling scores between the decodable words and pseudowords was $r = .75$. The percent of inter-rater agreement between the first author and two trained graduate research assistants (RA) was calculated on the entire dataset ($n = 4,300$ words) and was above 90% and Cohen's kappa was in the range of .76 to .90.

Second, a micro-analysis using a scoring method adapted from Stage and Wagner (1992) by the first author was completed to learn how students' spelled the initial, medial, and final phonemes (and initial and final blends) within the same corpus of 10 words. The range of each letter spelled based on the micro-scores was from 0 to 1; totaling a range from 0 to 35 with a mean of 21.41). One point was awarded for correct letters or blends in the correct position, 0.5 for correct letter in wrong positions or for phonetically related letters, and 0 points for omissions. Interrater reliability between the first author and the trained RAs for this micro-level coding was calculated for 20% of the data. The percent agreement was above 90% and Cohen's kappa was also above .90.

Results

Variability in the End-of-Kindergarten Spelling Outcomes

The following are proportions of children who obtained the full points for words spelled: *dog* (71%), *man* (52%), *sut* (47%), *ig* (40%), *plug* (26%), *tree* (26%), *frot* (18%), *went* (11%), *yilt* (10%), and *limp* (9%). The consonant-vowel-consonant (CVC) words such as *dog*, *man*, and *sut*, and consonant-vowel (CV) words (i.e., *ig*) were the easiest for the kindergarteners to spell. The spelling performance of the poor and good readers is presented in Table 3.

Next, we analyzed the micro-level accuracy of spellings (initial, final, and medial phonemes; with possible scores ranging from 0, or incorrect to a 1, or correct) using a two-way within-subject analysis of variance (excluding *ig* and *tree* because these two words did not meet the initial, medial, and final word structure). Figure 1 indicates the proportion of participants who spelled the words, consonants (initial and final), medial vowels, blends, and nasals correctly. There was statistically reliable position effect; $F(2, 858) = 226.121$, $p < .001$. Using a Bonferroni-based procedure with adjusted $p = .01$, a multiple comparison test was conducted. The participants performed reliably better on initial consonants ($M = .78$; $SD = .41$) than final consonants ($M = .73$; $SD = .42$), and they were better on final consonants ($M = .73$, $SD = .42$) than medial vowels ($M = .57$, $SD = .47$).

Spelling Outcomes and Spelling Errors of Students Who are Poor Readers

There were 17 poor readers in the sample, who scored < 85 on the WJ-III Letter Word Identification. The types of spelling errors among this group of participants revealed that most of the students had some knowledge of grapheme-phoneme correspondence. There

were significant and large correlations between the WJ-III Letter Word Identification and scores on the three coding rubrics (i.e., correct/incorrect, scores on Tangel and Blachman's 1992 coding rubric, scores on the micro-level coding rubric). The correlations ranged from $r = .64$ to $.66$, $ps < .01$. There were also significant and large correlations between all three coding types with correlations ranging from $r = .88$ to $.98$ (see Table 4 for the specific correlations between WJ-III Letter Word Identification and the three coding rubrics).

Are Poor Spellers Also Poor Readers?

We operationalized poor spellers as students with z-scores below -1 on the standard scoring of correct/incorrect on the 10-word spelling task. There were 71 participants who were poor spellers. However, not all poor spellers were also poor readers. Twenty-seven poor spellers scored at or above 100 on the WJ-III Letter Word Identification subtest, 33 scored between 85 and 99, and 11 scored as poor readers (less than 85 on the WJ-III Letter Word Identification subtest).

Discussion

Our first research question addressed variability in end of kindergarten spelling errors in a sample of well-taught albeit high-risk students. There was a clear pattern of results in that high frequency decodable words such as *dog* and *man* and other CVC words were easily spelled by most participants. However, even though these are high frequency words that appear frequently in books, 125 students of the 430 students (29%) did not spell *dog* correctly; similarly, 206 students of the 430 students (48%) did not correctly spell *man*. For the decodable pseudoword *sut*, 60% of the participants could not spell the word, which suggests that not all the children have acquired the desired standard as outlined by the CCSS (2015) that kindergarten children are expected to have mastered the spelling phonetically simple words that have simple phoneme-grapheme correspondence based on their knowledge of the sound letter relationships. An implication is that spelling errors on high frequency CVC words may indicate a lack of awareness and a need for more explicit and individualized spelling instruction.

Words with consonant clusters were difficult on average for the participants to spell as only about 10% of them responded correctly. Students frequently omitted consonant clusters, especially the 2nd consonant of initial consonant clusters and the 1st consonant of final consonant clusters. This finding converges with existing research (e.g., Bahr et al., 2012; Cassar & Treiman, 2004; Read, 1975; Treiman, 1991; 2000).

Based on our analysis on the micro-level accuracy of spellings (initial, final, and medial phonemes; with possible scores ranging from 0, or incorrect to a 1, our findings show that there was a position effects; the participants' performance was statistically better at spelling initial consonants than the final consonants, and in turn the participants performed better in spelling the final consonants than the medial vowels. This finding extends prior studies (Dixon et al., 2002; Morris et al., 2003; Stage & Wagner, 1992; Treiman et al., 1993; Uhry, 1999), but does so in the context of well implemented classroom literacy instruction.

In addition, our findings add uniquely to the literature in that some poor spellers were relatively good readers. Thus, poor spellers may not always be poor readers. This is because reading encompasses graphemes-phonemes correspondence while spelling encompasses phoneme-grapheme correspondence. In terms of encoding or spelling, a single sound may be represented by more than one grapheme (Carreker, 2011), which requires more précised letter-sound knowledge.

We also found that 18 kindergarten children spelled with random strings for all 10 words. The WJ-III Letter Word Identification scores for these kindergarten children were between 74–107 standard scores. These random strings are letters (which may include undecipherable scribbles or in some cases, nothing was written) that bear no relation to the letters of the target words. This finding is similar to studies on preschoolers' early writing (Puranik & Lonigan, 2011).

That poor spellers may not also be poor readers has an implication for teachers, indicating the importance of using spelling data and error analyses to individualize spelling instructional strategies. Since spelling requires more precision in phoneme-grapheme knowledge (Foorman & Francis, 1994), spelling may not only be difficult for poor readers but also for the average and good readers.

Limitations and Directions for Future Research

This is a preliminary study on spelling outcome and spelling errors on participants who had received high-quality Tier 1 instruction, and notably only 17 out of 430 children scored below a standard score of 85 at the end of kindergarten. Some important limitations include that data for this study were collected from one school district; thus, the findings may not relate to other school districts or to other less explicit core reading programs.

It is noteworthy that 9 out of the 17 poor readers also had additional special education classifications (e.g., Specific Learning Disability, Speech, Language, Limited English Proficiency, Developmental Delay), additional research with this special needs population is warranted. In addition, future research using more sophisticated statistical methods, such as SEM techniques are needed to identify how much of classroom instruction (e.g., individualized instruction, code-based instruction, meaning-based instruction, spelling, and writing) and children's letter-writing knowledge, letter-name knowledge, letter-sound knowledge, and phonological awareness contribute to spelling outcomes. Finally, we did not administer curriculum-based writing tasks which also assess spelling. Future research is needed to develop sensitive curriculum-based measures that represent reliable and valid general outcome measures with benchmarks for the purpose of screening and identifying poor spellers (and poor readers) to inform data-based individualization of intensive early literacy interventions.

Implications for Practice

Sensitive spelling tasks and spelling error analysis are important for the early identification and remediation of children in need of reading and spelling intervention. Spelling error analysis provides a window of information about young children's phonological, orthographic, and morphological knowledge and fosters a better understanding about

learning disabilities. However, our findings suggest that not every good reader is a good speller and that not every poor speller is a poor reader. Furthermore, at least a third of our students would not have met the CCSS for end of kindergarten because they could not correctly and consistently spell simple words like dog. However, a very small minority were unable to represent any letter sounds at all. This finding suggests caution in similarly high needs schools about whether the CCSS are realistic for all children to achieve. Our findings do suggest that, when accompanied by spelling error analysis, these simple spelling tasks can provide powerful teachable opportunities because the spelling errors provide a window into young children's phonological and orthographic knowledge. For example, data from spelling tests can guide teachers in more accurately targeting a child's spelling stage for instruction (and grouping in more homogenous formats, in providing center or other practice opportunities at a child's independent spelling stage, and in identifying children for more intensive small group instruction who are not picking up letter sound correspondence, capitalization, punctuation or other transcription skills.

A possible scenario for data-based individualized instructional planning could be that if most of the children in the class have already begun to use the initial and final consonants in spelling a regular short CVC word with one-to-one correspondence, but several children are scribbling or using random letters and/or numbers, the teacher would know that these children's instructional level is at the different level from the rest of the class. The teacher can use these children's spelling data to group them for instruction focusing on letter knowledge, phonemic awareness, and mapping the letter-sound correspondence. The teacher could use proven multisensory approaches comprising letter tiles, Elkonin boxes and/or writing out the letters by first modelling the spelling procedure to the children and then providing sufficient repeated practice for the children to enforce the information into memory (e.g., Uhry, 2011). The children who have already grasped the concept of the initial and final consonant can then learn how to spell the medial vowels using word study such as word sorts (Bear et al., 2008). If several children are spelling *bk* for *back* and *ft* for *feet* (Uhry, 2011), the teacher may want to focus on phoneme segmentation using letter tiles and writing out the medial vowels for this group of children.

Given that spelling demands precision in the phoneme-grapheme correspondence (Foorman & Francis, 1994), it presents challenges to children who may be average and above average readers. Thus, spelling must be explicitly taught and carefully progress monitored (formally or informally). Explicit spelling instruction, which includes multisensory strategies for mapping phoneme to graphemes, listening for the phonemes of the words (i.e., initial, final, and medial sound), physically writing the words either through finger spelling and/or writing with a pencil, and word study for fostering pattern generalization (see Bear et al., 2008; Carreker, 2011; Santoro et al., 2006; Schlagal, 2013; Uhry, 2011; Weiser & Mathes, 2011), may help poor spellers, in general, and also good readers who are also poor spellers to focus on the specifics of the orthography and phonology of words.

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Figure 1. Proportion of participants who spelled the words, consonants (initial and final), medial vowels, blends, and nasals correctly; n = 430.

Table 1

Literacy Terms Related to Spelling Acquisition

Term	Definition
Alphabet knowledge	The ability to name the alphabetic letters with accuracy and speed.
Alphabetic principle	The awareness that the spoken language is comprised of strings of words, sequences of syllables, and phonemes.
Graphemes	Printed symbols or letters.
Phoneme	Smallest unit of the spoken language (e.g., /c/ in “cat”).
Phonological awareness	The ability to detect, manipulate, or analyze sounds in spoken language in varying complexities such as words, syllables, and phonemes.
Phonemic awareness	The awareness that the spoken language is comprised of a sequence of phonemes.
Phoneme segmentation	The ability to identify the individual phonemes in spoken language. For example, the ability to segment the word “mat” into /m/ /a/ /t/.

Table 2**Phonological Scoring Rubric for Spelling Errors**

Points	Rubric description	Skills that kindergarteners possess
0	random strings of letters or no response (“hdd” for <i>sut</i>)	There are scribbles or no response (i.e., prealphabetic stage) or the child wrote letters that do not match the sounds of words being spelled (i.e., precommunicative stage).
1	single phonetically related letter (e.g., “o” or “g” for <i>dog</i>)	Partial alphabetic writing occurs at this time; letter-sound matches are partially correct for the word spelled, which signifies the limited knowledge of the sound-letter correspondence.
2	correct first letter of the word with or without any other letters (e.g., “dac” for <i>dog</i>)	Partial alphabetic writing occurs at this time. The first letter is spelled with or without accompanying letters signifying more sensitivity to the initial sound in words.
3	more than one phonemes are represented (e.g., “do” for <i>dog</i>)	Partial alphabetic writing occurs at this time; at least two sounds are spelled signifying an increasing awareness in sound-letter correspondence.
4	all phonemes were phonetically represented (e.g., “duog” for <i>dog</i>)	Phonetic spelling occurs at this time; all the sound-letter relationships for the word are represented. At the end of kindergarten children are expected to spell the simple words (e.g., CVC words) phonetically*.
5	all phonemes with conventional letters (e.g., “chrey” for <i>tree</i>) were represented.	Consolidated alphabetic writing is evidence at this time signifying a greater awareness of phonics knowledge although the spelling may not be completely correct.
6	conventionally correct spelling (e.g., <i>dog</i>)	All letters spelled is correct. Children are more conversant in conventional spelling.

* Note: The interpretation of skills that kindergarteners should possess by the end of kindergarten is adapted from Common Core State Standards (2012) and Gentry (2004).

Table 3

Summary of the Spelling Performance of Poor and Good Readers

	Poor readers (<i>n</i> = 17)			Good readers (<i>n</i> = 306)		
	<i>M</i>	Range	<i>SD</i>	<i>M</i>	Range	<i>SD</i>
Letter Word Identification ^a	79.76	74–84	3.43	113.86	100–149	10.97
Correct/Incorrect ^b	.65	0–3	1.06	3.72	0–10	2.53
Tangel and Blachman ^b	16.47	0–38	11.17	38.08	2–60	11.51
Micro-level coding ^b	9.85	0–24	7.62	24.02	2.5–35	7.38

Note. Poor readers = less than 85 standard score on the WJ-III Letter-Word Identification; good readers = less than or equal to 100 standard score on the WJ-III Letter-Word Identification.

^a standardized score.

^b raw score.

Table 4

Correlations among WJ-III Letter Word Identification and the Coding Rubrics

	Correct/Incorrect coding	Tangel and Blachman's coding	Micro-level coding
WJ-III Letter Word Identification	.64 ^{**}	.65 ^{**}	.66 ^{**}
Correct/Incorrect coding		.91 ^{**}	.88 ^{**}
Tangel and Blachman's coding			.98 ^{**}

^{**}
P < .01