

## The Reading–Spelling Connection: Developing and Evaluating a Beginning Spelling Intervention for Children at Risk of Reading Disability

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**Abstract.** *In this article, we describe the development and evaluation of a beginning spelling intervention for young children at risk of reading disability. We first summarize the literature that supports beginning spelling as an ideal method for strategically integrating the beginning reading big ideas of phonemic awareness and alphabetic understanding. We then summarize the literature on effective instructional principles for students at risk of reading disability. Next, we describe how instructional design was applied to the development of an intervention for young children at risk of reading disability, then summarize the findings of an experimental study supporting the effectiveness of this intervention. Finally, we provide selected examples from the spelling intervention to illustrate the findings' translation into instructional practice.*

Students who struggle with beginning reading benefit from instruction that emphasizes and strengthens both phonological awareness (explicit knowledge of our language's sound system) and alphabetic understanding (knowledge of the relationship between the letters of written language and the individual sounds of

spoken language) (e.g., Adams, 1990). Recent research has extended our knowledge of phonological awareness instruction by recognizing how spelling can contribute to students' insight into our language's sound system (e.g., Ehri, 1997; O'Connor & Jenkins, 1995). Moreover, because learning to spell emphasizes decoding skills and spelling-sound knowledge, spelling can further enhance instruction in alphabetic understanding. In other words, *spelling instruction that is carefully and intentionally integrated into a beginning reading program can help students improve both spelling and reading skills.*

Though spelling is often defined as recognizing or reproducing a correct sequence of letters in an oral or written form, the literature indicates that the actual process of spelling involves the critical integration of phonological and alphabetic skills of beginning reading. According to Perfetti (1997), spelling is the encoding of linguistic forms into written forms. Spelling reflects the general principles of the writing system, the writing system design, and the specific orthography that embodies the writing system and its distinctive features (Perfetti, 1997). Described another way, spelling is a multifaceted linguistic skill that integrates and depends upon several layers of knowledge: phonological awareness of speech-sounds in words, morphological awareness, semantic knowledge, and orthographic knowledge of the letter sequences and patterns that are used to spell words (Moats, 1984).



Learning to spell can become a motivating contributor to a child's understanding of how print works. Adams (1990), for example, noted that children's use of spellings contributes to curiosity about print and develops enhanced understanding of phonological awareness and alphabetic understanding. Overall, spelling is an instructional tool that can help students understand the alphabetic writing system and its relationship to spoken language.

As the above conceptualizations suggest, spelling and reading are highly interrelated. Though there is still debate regarding the exact nature of the psycholinguistic process of spelling (Moats, 1995; Perfetti, 1997), spelling and reading can be viewed as "two sides of the same coin" (Perfetti, 1997, p. 28). According to Ehri (1997), "learning to read and learning to spell are one and the same, almost" (p. 237). Ehri further noted that:

People read the spellings of words. People spell the spellings of words. People read the spellings they have spelled. The lack of clear distinction between these (spelling and reading) terms raises the possibility that we have been misled by our language and that reading and spelling are more similar than we recognize (p. 238).

The apparent interrelation of spelling and reading is supported by research. In a review of reading-spelling correlational studies, Ehri (1997) reported that correlations between reading words correctly, producing correct spellings of words, and recognizing misspellings of words ranged from 0.68 to 0.86 for first through seventh grade students. The relatively high correlations across several grade levels suggests that similar processes may be measured by the tasks of spelling, word reading, and the identification of misspellings. Given this reading-spelling connection, the increased use of spelling to teach reading may be a promising approach for students who are at risk of reading disability.

The purpose of this article is to describe the development and evaluation of a beginning spelling intervention for young children at risk of reading disability. First, we summarize the literature that supports beginning spelling as an ideal means for strategically integrating phonemic awareness and alphabetic understanding into beginning reading instruction. We then summarize the literature on effective instructional principles for students at risk of reading disability. Next, we describe how instructional design principles were applied to the development of an intervention for young children at risk of reading disability and then summarize the findings of an experimental study supporting the effectiveness of this intervention. Finally, we provide selected examples from the spelling intervention that illustrate the translation of these findings into instructional practice.

## INTEGRATING PHONEMIC AWARENESS AND ALPHABETIC UNDERSTANDING THROUGH BEGINNING SPELLING

Students at risk of experiencing reading difficulties require instruction that focuses on the big ideas in beginning reading (National Reading Panel, 2000). For example, a common theme throughout empirical research is that instructional activities emphasizing the skills of phonemic awareness and alphabetic understanding make the symbolic alphabetic writing system of the English language explicit. Phonemic awareness (the ability to perceive spoken words as a sequence of sounds) and alphabetic understanding (the understanding that letters represent sounds and that whole words embody a sound structure of individual letters and sound patterns) are recognized as essential for the development of proficient reading (Adams, 1990; Carnine, Silbert, & Kame'enui, 1997; Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998).

There is strong theoretical support and empirical evidence to indicate that beginning spelling provides a strategic integration of phonemic awareness and alphabetic understanding, and that teaching students how to spell reinforces both of these skills (Adams, 1990; Ehri, 1987, 1989a, 1989b, 1994; Ehri & McCormick, 1998; Moats, 1995; O'Connor & Jenkins, 1999). Kindergarten experimental and quasi-experimental studies suggest that students who received spelling instruction including both phonemic awareness and alphabetic understanding demonstrated more proficient word reading skills than students who did not receive such integrated instruction (Ehri & Wilce, 1987; O'Connor & Jenkins, 1995; Vandervelden & Siegel, 1997). Overall, these studies suggest that incorporating spelling into beginning reading instruction improved reading achievement. The following sections describe more specifically how beginning spelling instruction reinforces both phonemic awareness and alphabetic understanding.

## PHONEMIC AWARENESS

To spell, a child must possess some degree of phonemic awareness, specifically, a burgeoning awareness that a word is made up of segments of sound (Tangel & Blachman, 1992). Students must segment and identify the sounds in a word to successfully spell it. For example, to spell the word *mud*, students must first be able to segment the word into the individual speech-sounds, or phonemes, /mmm/ - /uuu/ - /d/.

The way a child spells words demonstrates what a child knows about how sounds form words. For example, spelling "huint" or "hent" for the word *hunt* demonstrates more sophisticated phonemic understanding than spelling "h," "hmstv," or "hit" for *hunt*. Therefore, a child's evolving understanding of the phonemic



structure of language is actively reinforced when phonetic spellings are attempted (e.g., Ball & Blachman, 1991; Ehri, 1987; Moats, 1995; Tangel & Blachman, 1992).

Beginning spelling instruction reinforces children's skill at segmenting words. According to Ehri and Wilce (1987), phonemic segmentation instruction contributed to superior word reading abilities of children who received spelling instruction. Other studies have found that phonemic segmentation training contributes to word reading acquisition, especially when phonemic awareness is taught in conjunction with alphabet letters (Bradley & Bryant, 1983; Hatcher, Hulme, & Ellis, 1994).

### ALPHABETIC UNDERSTANDING

Acquiring an understanding of the alphabetic code—an understanding that words are composed of individual letters (graphemes)—and “the use of grapheme-phoneme relations to read words” (Ehri, 1991, p. 387) is critical to beginning reading. Beginning spelling emphasizes letter-sound knowledge by requiring children to identify and write letters that correspond to a word's sounds. Due to the intrinsic link between letters and sounds in the spelling process, spelling can help beginning readers learn the alphabetic writing system (Ehri & Wilce, 1987; Perfetti, 1997).

Spelling instruction strengthens alphabetic understanding by emphasizing the names of letters, the sounds they most frequently symbolize, and how to group letters to form graphemes. Both Ehri and Wilce (1987) and Vandervelden and Siegel (1997) found that practicing letter-sound correspondences in isolation did not contribute to word reading abilities. Rather, emphasis on letter-sound correspondences in spelling appeared to increase children's word reading abilities. O'Connor and Jenkins (1995) also discussed how spelling made the alphabetic principle more concrete for students with disabilities.

To spell a word, a student must produce the correct letter sequence in oral or written form. Recent research has highlighted the importance of physically representing the letters of words through writing when students learn the spellings of words (Berninger, 1999; Cunningham & Stanovich, 1990; Edwards, 2003). Cunningham and Stanovich (1990) and Berninger (1999), for example, have recognized that explicit instruction in writing letters with a pencil contributes to a more solid representation of letter knowledge in memory.

### MEMORY

Spelling instruction requires children to use phonemic awareness and alphabetic understanding both to spell and read words to confirm whether they are spelled correctly (Ehri & Wilce, 1987). When children decode a word, they form and store associations between

some of the letters in a word's spelling and some of the sounds in the word's pronunciation. If children encounter the word again, they retrieve the stored associations from memory to read the word. In other words, the process of spelling words in beginning reading instruction provides an instructional redundancy that may contribute to more fluent and automatic word identification skills (Perfetti, 1997; Trieman, 1993, 1998). Ehri's research (e.g., 1983, 1987, 1989a, 1989b; Ehri & Wilce, 1987) suggests that memory plays a critical role in spelling's relation to word reading. As students increase their knowledge of the spelling system, and as they develop facility with phonological recoding, their ability to identify words improves. Thus, increased word reading accuracy is due to reinforced connections between spellings and words in memory (Ehri, 1989a).

### PRINCIPLES OF EFFECTIVE INSTRUCTION FOR STUDENTS AT RISK OF READING DISABILITY

The preceding section described how beginning spelling strategically integrates two critical components of early literacy, phonemic awareness, and alphabetic understanding. However, simply including beginning spelling instruction in early literacy intervention is insufficient. Such intervention needs to be designed, developed, and delivered with careful attention to validated principles of effective instruction (Coyne, Kame'enui, & Simmons, 2001). In other words, for students at risk of experiencing reading difficulties, *how* we teach is equally as important as *what* we teach.

There is extensive literature investigating instructional practices for students with learning disabilities and young children at risk of academic failure. Instructional principles have emerged that are common across effective interventions and consistently produce the strongest effects on student learning (Gersten, 1985, 1998; Kame'enui, Carnine, Dixon, Simmons, & Coyne, 2002; O'Connor, 2000; Swanson & Hoskyn, 1998; Vaughn, Gersten, & Chard, 2000, 2001). The following section outlines three instructional principles supported by a large body of converging intervention research: conspicuous instruction, instructional scaffolding, and opportunities for practice with high-quality feedback.

These principles are especially important for students with reading disability and students at risk of reading failure. These students require the highest-quality instruction to gain access to the complex combination of concepts, skills, and strategies needed to become successful readers.

### CONSPICUOUS INSTRUCTION

Although some students are able to infer intuitively the skills and strategies necessary for successful learning, many students (especially those with disabilities) are



not able to discover effective or efficient strategies. In a sense, the tools that expert learners rely on to solve problems and achieve desired academic outcomes are effectively hidden from students experiencing learning difficulties. The role of instruction, therefore, is to let these students "in on the secret" of academic success by making essential learning skills and strategies conspicuous.

Conspicuous instruction is direct and explicit. Concepts, skills, and strategies are broken down and taught systematically in carefully sequenced steps. Teachers use clear and consistent language to reduce confusion and prevent misunderstanding. Conspicuous instruction is intended to present information in a manner that is easy to understand and completely unambiguous. In this way, learners struggle less with acquiring skills and strategies and can instead focus their energies on applying them in more authentic learning situations.

A primary characteristic of conspicuous instruction is extensive teacher modeling. At every stage in the learning process, teachers repeatedly explain and demonstrate skills before asking students to perform them independently. Models of proficient performance provide students with examples of successful skill and strategy use. For example, if students were learning the phonemic awareness skill of oral segmentation, teachers would model segmenting words into individual phonemes before requiring students to do so. Moreover, teachers would verbalize their actions to draw attention to the segmentation process. These types of "thinking aloud" procedures make proficient learners' usually silent cognitive processes obvious to students at the beginning stages of skill acquisition.

### INSTRUCTIONAL SCAFFOLDING

In a building project, scaffolds provide considerable external support at the outset of construction and then are removed in stages as internal structures become stronger and better able to function independently. It is the same with instruction: instructional scaffolding describes the support provided by teachers and materials during the learning process. Students with intensive needs require substantial support during early learning. As students progress, these supports are gradually withdrawn and students begin to apply skills and strategies independently. Carefully scaffolded instruction is essential to successful learning for those with disabilities or at risk of academic failure.

Control of task difficulty is a critical component of instructional scaffolding (Swanson & Hoskyn, 1998; Vaughn, Gersten, & Chard, 2000). For example, teachers should introduce concepts and skills systematically in increasing levels of difficulty. To return to the example of oral segmenting, it is easier for students to isolate the first sound than to completely segment the word. Scaffolded instruction would mirror this progression. Other ways in which task difficulty can be scaffolded include selecting and sequencing instructional exam-

ples to reinforce previously learned material. Example selection should also illustrate the complete range of applications for which a skill is relevant.

Material scaffolds also support learning. Graphic organizers, procedural facilitators, and concrete manipulatives are visual prompts that support learners as they internalize skills and strategies. For example, when learning to segment words, boxes representing individual phonemes help students visualize the sound structure of language. Additionally, markers or letter tiles can provide concrete representations of phonemes. As students become more adept at applying segmentation skills, these material prompts should progressively and systematically fade.

### OPPORTUNITIES FOR PRACTICE WITH HIGH-QUALITY FEEDBACK

To apply proficiently newly acquired skills and strategies, students with disabilities and at risk for academic failure need multiple practice opportunities with immediate high-quality feedback. Providing instruction in small interactive groups is an effective way to maximize this type of mediated practice (Elbaum, Vaughn, Hughes, & Moody, 2000). Small group instruction allows students to be continuously and actively engaged in learning. For example, in whole-class instruction, individual students have few, if any, opportunities to interact with the teacher. On the other hand, a small group provides students frequent practice, and encouraging unison group responses further increases practice opportunities.

In small group instruction, teachers can also provide immediate, individualized feedback. A key feature of instructional feedback is error correction. Correcting errors when first made makes it much less likely that they will become internalized and repeated. For example, if a student incorrectly segmented a word, the teacher could model the accurate response, give the student another opportunity to segment the word, and return to the missed word later in the lesson to reinforce the skill. This type of ongoing, guided practice provides learners with the support and feedback they need to become fluent with critical learning skills and strategies.

### LINKING RESEARCH TO PRACTICE: DEVELOPING AND EVALUATING A BEGINNING SPELLING INTERVENTION

We recently completed a longitudinal program of research investigating ways to optimize early literacy instruction and intervention for students at risk of reading disability (Simmons, Kame'enui, Stoolmiller, Coyne, & Harn, 2003; Simmons et al., in press). As part of this larger program of research, we developed a beginning spelling intervention to supplement and



TABLE 1

Principles Supporting Beginning Spelling as a Strategic Integration of Phonemic Awareness and Alphabetic Understanding

<i>Research Principle</i>	<i>Application</i>
<i>Phonemic Awareness</i>	The spelling intervention was designed to support students' ability to apprehend and work with the individual sounds in speech. Beginning lessons required students to isolate initial sounds in spoken words (e.g., what is the first sound in <i>map</i> ?) while later lessons required students to isolate final and medial sounds (e.g., What is the last/middle sounds in <i>map</i> ?). Eventually, students segmented words completely into individual phonemes (e.g., Tell me all the sounds in <i>map</i> ).
<i>Alphabetic Understanding</i>	
Letter-sound correspondences	The spelling intervention systematically introduced and reviewed letter-sounds (e.g., <i>M</i> makes the sound /mmm/). During lessons, students chose or wrote letters that corresponded with sounds or phonemes (e.g., Choose/write the letter that makes the sound /mmm/).
Letter-writing	Teachers explicitly taught students how to write letters by modeling how to form letters, having students trace and copy letters through the use of arrow cues, and having students write newly learned letters from memory.
Letter names	The spelling lesson also reinforced letter names. Activities were designed to support and strengthen the connections between letter-sounds, letter formation, and letter-names (e.g., Write the letter that makes the sound /mmm/. What is the name of the letter you wrote?).
<i>Strategic Integration of Phonemic Awareness and Alphabetic Understanding</i>	The spelling intervention was designed so that students were given extended opportunities to apply and integrate phonemic awareness and alphabetic understanding skills within the same activity (e.g., What is the first sound in <i>sun</i> ? Now write the letter that matches the first sound in <i>sun</i> ).

reinforce kindergarten instruction in phonemic awareness and alphabetic understanding.

We integrated principles from the research into beginning spelling and effective instruction. To make the linkage between the research principles and their application more transparent, we outline these connections in the following two tables. Table 1 summarizes the research principles gleaned from the beginning spelling literature and how they informed our development of the intervention. Table 2 summarizes our application of the research principles synthesized from the literature on effective instructional practices for students with learning disabilities and at risk of academic failure.

TABLE 2

Principles of Effective Instruction for Students at Risk of Reading Disability

<i>Research Principle</i>	<i>Application</i>
<i>Conspicuous Instruction</i>	
Explicit teaching	All beginning spelling concepts and skills were taught directly in a series of carefully sequenced steps. Teachers used clear and consistent language and provided full and complete explanations of new content.
Extensive teacher modeling	Teachers explained and demonstrated beginning spelling skills and strategies multiple times before asking students to perform them independently. Teachers also used "think aloud" procedures to verbalize the step-by-step processes that expert learners use to successfully apply beginning spelling skills.
<i>Instructional Scaffolding</i>	
Control of task difficulty	Skills were introduced systematically, progressing from easier to more difficult tasks (e.g., from identifying and writing the first sounds in words to segmenting and spelling whole words). Instructional examples were carefully selected to reinforce and build on previously learned material (e.g., target words included only taught letter-sound correspondences, example sets reinforced the most recently introduced letters and selectively reviewed previously mastered letters).
Material scaffolds	Material scaffolds such as three-square strips and letter tiles provided concrete representations of sounds and letters. Prompts were faded over time.
<i>Opportunities to Practice with High-quality Feedback</i>	
Small group instruction	Instruction provided in small groups of three to five students promoted teacher-student interactions and maximized opportunities to respond.
Error correction	Teachers corrected individual student errors by modeling the correct response and giving students opportunities for immediate practice (e.g., the sounds in <i>mud</i> are /mmm/-/u/-/d/. What are the sounds in <i>mud</i> ?). Teachers returned to missed words multiple times later in the lesson to provide delayed and varied practice.

## Participants

We evaluated the effects of our spelling intervention within the context of a large-scale experimental study with kindergarten children identified as at risk of experiencing reading difficulties (Simmons et al., in press). Children were considered to be at risk based on their performance on letter naming and phonological awareness tasks measured in the fall of kindergarten (Good, Simmons, & Kame'enui, 2001; Torgesen, 2000). To participate in the study, students were screened on the letter



naming fluency (LNF) and onset recognition fluency (OnRF) measures (Kaminski & Good, 1996) and selected for participation based on the following criteria: (a) they scored at or below the 25th percentile in the district on both measures (i.e., less than 11 on OnRF and less than 6 on LNF), and (b) their performance was confirmed by kindergarten teachers as being at risk of reading difficulty. Students were excluded if they (a) had severe hearing or visual acuity problems, or (b) were determined by school personnel to have significantly limited English proficiency. All participating kindergartners were then administered the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981) to determine their baseline level of receptive vocabulary knowledge.

Overall, 116 students from seven elementary schools in the Pacific Northwest were identified to participate in the study. All seven schools received Title I funding, and the percentage of free- and reduced-lunch services ranged from 32 to 63 percent. Schools ranged in overall enrollment from 319 to 683, and time allocated for kindergarten in all schools was 2.5 hours per day. Participating kindergarten children were primarily white ( $n = 94$ ; 83.93 percent) and Latino/Hispanic ( $n = 15$ ; 13.39 percent). Two of the participating children were black/African American, and one did not specify a race or ethnicity. Fifty-eight percent of the samples were male ( $n = 65$ ). The mean age for students in the fall was 5 years 7 months with the range from 5 years 0 months to 6 years 9 months.

## Procedures

In November of kindergarten, participating children were randomly assigned to one of three instructional groups, two experimental groups and one comparison group. Both experimental groups received a base intervention that focused on increasing beginning reading skills (e.g., orally blending and segmenting phonemes, learning letter-sound correspondences, reading short decodable words) through instruction designed with careful attention to principles of effective instruction. One of the experimental groups received the spelling intervention; the other received instruction focused on building vocabulary and reading comprehension through a storybook read aloud approach. The comparison group received commercial reading program's sounds and letters module that included a similar emphasis on developing beginning reading skills. Children in all groups received 108, 30-minute intervention sessions between November and May. Instruction for all three groups was implemented during an extended day kindergarten program and did not interrupt regular classroom instruction. Because of the young age of the children and the intensity of the intervention, group size was limited to five children.

Both treatment groups received interventions with two 15-minute instructional components. The first component was the same for both and emphasized phonological awareness and alphabetic understanding (PA-AU). The scope and sequence of the PA-AU lessons progressed through identifying first sounds, last sounds, blending, segmenting, combined blending and segmenting, and reading simple CVC words.

During phonological awareness activities, students listened to and isolated first, last, and medial sounds, segmented words presented orally into individual phonemes (e.g., *Tell me all the sounds you hear in this word. Mud. /mmm/-huu/-d/*), and verbally produced a target word after listening to the word spoken in a slow, stretched-out manner (e.g., *"I'll say a word slowly, and you say it fast. Ssssaaddd. What word? Sad."*). Alphabetic understanding activities included identifying letter names and sounds as well as word reading. When preparing for sentence-reading activities at the end of the curriculum, children were also explicitly taught how to read some irregular words like *the*, *a*, and *was*. PA-AU lessons at the end of the curriculum emphasized reading sentences that contained VC and CVC words.

The second instructional component for the first treatment group focused on building vocabulary and reading comprehension through a storybook read aloud. The second instructional component for the other treatment group extended the PA-AU's emphasis on phonological awareness and alphabetic skills through the use of writing and spelling. Lessons in the second component also followed the scope and skill sequence outlined for the PA-AU lessons where phonological and alphabetic skills were extended through the use of spelling activities. For example, if students were learning first and last sounds, they would listen to the teacher say a CVC word, isolate the first and last sounds, and move the correct letter tiles into a three-square strip (Henderson, 1990). In addition to practicing spelling with letter tiles, many of the spelling activities required students to write on an activity sheet with a pencil or write on a white board with a marker. Throughout the writing/spelling instructional component, memory of letter names and sounds was continually reinforced through dictations where students would write the dictated letter or write the letter that corresponded to the dictated sound.

The example presented in Figure 1 is taken from the beginning lessons of the spelling intervention. At first glance, this activity does not appear to be what we usually think of as spelling. However, it represents the beginning stages of the development of spelling skills. To spell, students must segment a word presented orally into individual sounds or phonemes and then write the letters that correspond to those phonemes in the correct order. In this activity, students identify or segment the initial sound in words and then write the letter for this sound. In a sense, students are learning to "spell" the beginning sounds of words in this activity, a skill that is a direct precursor to more recognizable and complete spelling.





"This is sun. The first sound in sun is /sssss/." (The teacher displays three letter tiles)

p s f

"I'm going to write the letter that matches this picture's first sound. (Teacher points to the letter s.) s says /sssss/ like the /sssss/ in sun so I'm going to write the letter s. I start at the dot and write the letter." (Teacher models writing the letter s)



"Now you write s like the /sssss/ in sun. Start at the dot and write the letter." (Students practice writing the letter s.) "Great job writing s!"

(The teacher models two more examples using the same instructional format.)

FIGURE 1 Beginning spelling activity: Initial sound spelling

This activity requires students to apply and integrate both phonemic awareness and alphabetic understanding skills. For students to be able to identify the first sound of words, they must demonstrate awareness that words are made up of individual phonemes and then be able to segment or isolate the initial phonemes of words. To complete this activity, students must also possess alphabetic understanding. They must understand that sounds have a one-to-one correspondence with letters and be able to identify the unique letters that match the first sounds in words. Finally, students must physically represent these letters through writing, which strengthens representations in memory.

The activity also reflects principles of effective instruction. First, the instruction is conspicuous. The teacher presents the strategy for identifying and writing the first sounds in words explicitly and directly in discrete steps using clear and unambiguous language. The strategy is also modeled (performed while verbalizing key actions) multiple times before asking students to demonstrate skills independently.

The instruction also is scaffolded. The difficulty of the task is carefully controlled because this activity is presented to learners at the initial stages of learning. Students are only required to segment beginning sounds in words, which is an easier skill than segmenting final or medial sounds (or segmenting entire words). The activity uses only the small pool of letter-sounds that have already been introduced to students. Moreover, students choose the correct letter from three examples rather than having to produce the letter from memory. The activity also includes material scaffolds such as

pictures, starting dots, and ruled lines to guide letter formation.

Finally, the activity provides students with several opportunities to practice identifying and writing beginning sounds in words. This practice occurs not only within this current activity but also across future activities. Because instruction takes place in small groups, the teacher can correct errors immediately and provide carefully structured and individualized feedback.

The example presented in Figure 2 is taken from a later lesson of the spelling intervention. This activity is more recognizable as conventional spelling although, again, it reflects a direct developmental progression from the first activity. In this activity, students segment all of the sounds in three phoneme words and then write the letters that correspond to the sounds.

In this activity, students apply and integrate more advanced phonemic awareness and alphabetic understanding skills. Students must be able to completely segment a word into individual phonemes, a skill that represents a highly developed stage of phonemic awareness. Additionally, students must be able to write the letters that correspond with each sound. This activity represents a higher level of complexity and requires students to write the complete sequence of letters in the correct order from memory.

This activity continues to reflect the same principles of effective instruction. Many of the instructional scaffolds have been withdrawn or faded because this activity is presented to learners at a more advanced stage of learning. For example, the teacher does not model or demonstrate the skills because this has already been demonstrated in an earlier lesson. Moreover, the teacher





"Now it's your turn. This is seal. What is the first sound in seal?" (Students answer /ssss/) (Teacher displays three letter tiles)

s m p

"You're going to write the letter that matches this picture's first sound. What letter says /ssss/ like the /ssss/ in seal?" (Students point and answer s.) That's right! The letter s says /ssss/ like the /ssss/ in seal.

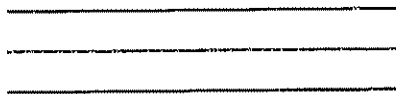


Now it's your turn to write s like the /ssss/ in seal. Start at the dot and write the letter." (Students write the letter s.) "Great job writing s!"

(Students practice multiple examples using the same instructional format.)

"It's your turn to spell some words. The first word is yes. Say the sounds in yes and touch a finger for each sound. (Students segment the word orally into individual sounds while touching a finger for each sound /yyy/ - /eee/ - /sss/.)

Now spell the sounds in yes. (Students write the letters y, e, s.)



"Say each sound in yes as you point to the letters you wrote. (Students respond /yyyeeesss/ while pointing to their spellings.) Now, say it fast." (Students read yes.)

"That's right you spelled yes, /yyy/-/eee/-/sss/ are the sounds in yes!"

(Students practice multiple examples using the same instructional format.)

FIGURE 2 Beginning spelling activity: Complete spelling

does not provide a pool of letters to choose from, making students produce letters from memory. Finally, material scaffolds such as pictures and starting dots have been withdrawn. This activity reflects a systematic and purposeful progression of lessons of increasing difficulty.

Overall, by the end of the spelling intervention, students were participating in "Making Words" games that involved manipulating and changing letters in words to form new words (e.g., "Change *bat* to *hat* to *ham* to *him*."). (Cunningham, 1991a, 1991b; Gaskings, Ehri, Cress, O'Hara, & Donnelly, 1997). The "Making Words" games used both letter tiles with three-square strips and white boards with markers. Table 3 contains a scope and sequence for the beginning reading and spelling intervention.

## Measures

We collected pre- and postintervention data on the following measures: DIBELS letter naming fluency and initial sound fluency (Kaminski & Good, 1996, 1998), a modified version of Tangel and Blachman's (1992, 1995) spelling measure, and the Berninger et al. (1997) letter writing dictation measure. Postintervention measures included phonemic segmentation, nonsense word reading fluency, and the Woodcock Reading Mastery Test-Revised word attack and word identification subtests (Woodcock, 1987). Overall, measures used in the study targeted phonological awareness (OnRF and phonemic segmentation fluency), alphabetic and reading skills (LNF, nonsense word fluency, word



TABLE 3  
Scope and Sequence of Beginning Reading and Spelling Intervention

<i>Lessons</i>	<i>Skill</i>	<i>Review</i>	<i>Objective</i>
1-42	Identifying first sound		Given a letter name, students will write the letter from memory. Given a word, students will write the letter that corresponds to the first sound.
43-66	Identifying last sounds; segmenting	First sounds	Given a word, students will segment the word and write the letter that corresponds to the first sound and last sound in the correct position.
67-84	Identifying medial sounds; segmenting	First sounds; last sounds	Given a word, students will segment a word and write the letters that correspond to all sounds in correct position.
85-114	Spelling	Segmenting	Given a word, students will write the letters that correspond to all sounds in correct position.
115-132	Manipulating letters and sounds to make new words	Segmenting; spelling	Given a word, students will write the letters that correspond to all sounds in correct position. Given a new word, students will change their word by erasing a letter and replacing it with another letter to form the new word.

attack and word identification subtests of the Woodcock Reading Mastery Test-Revised), spelling, and letter writing dictation. A measure of receptive language ability was also included in the study at pretest to obtain information on language ability for student profiles.

## Results

To examine the study's outcomes, we conducted planned contrasts between the treatment group that received the beginning reading/spelling intervention, the group that received the beginning reading/storybook intervention, and the comparison group that received the commercial sounds and letters module. For measures collected at both pre- and postintervention, analysis of covariance was used to assess post-test group differences using preintervention scores as the covariate to minimize the potential influence of differences in baseline scores. We first tested homogeneity of regression across groups. If no differences were detected,

the group-by-pretest interaction terms were dropped from the model and the pooled post-on-pre regression for all groups was used to adjust mean posttest differences among the groups. When post-on-pre regressions were significantly different, mean comparisons were conducted among groups at selected points in the pretest distribution. For all models, residual diagnostics were carefully scrutinized to assess the adequacy of background statistical assumptions (linearity of regression, normality and heteroscedasticity of residuals) and guard against undue distortions due to outliers or points of high influence. Given the planned contrasts, we adjusted alpha levels to minimize Type I errors using a per-comparison alpha of 0.016 for all research questions.

To assess practical significance and facilitate interpretation of findings, effect size indices from selected analyses are provided in Table 4 in the form of Cohen's *d*. An effect size of 1.00 means that the average child in one group scored at the 84th percentile of the other group's score distribution. In general, the higher the effect size,

TABLE 4  
Magnitude of Intervention Effects on Pre/Post and Post-Only Measures by Contrast

<i>Pre/Post and Post-Only</i>	<i>Reading/Spelling vs Reading/Storybook</i>	<i>Reading/Spelling vs Comparison (Sounds &amp; Letters Module)</i>
Onset recognition fluency	0.47	0.36
Phonemic segmentation fluency	0.36	0.59
Nonsense word fluency	0.60	0.82*
Word attack at LNF = 0, 1, 2, and 3	1.30*, 1.07*, 0.85*, 0.62*	1.40*, 1.17*, 0.95*, 0.72*
Word identification at LNF = 0, 1, and 2	1.28*, 1.02*, 0.76*	1.28*, 1.02*, 0.76*
Letter dictation fluency	0.74*	0.73*
Spelling at prespelling scores of 3, 8, and 12	2.28*, 1.46*, 0.80*	0.86*

Note. Effect sizes are reported as Cohen's *d* based on adjusted for pre score post mean differences

\**p* < 0.016 level.



the greater the difference between the two groups (Gall, Borg, & Gall, 1996). According to Cohen's convention for the importance of significance, 0.10 is a small effect, 0.30 is a moderate effect, and 0.80 is a large effect (1988). For a more comprehensive description of the analysis and results beyond effect size calculations, see Edwards (2000), Simmons et al. (2003), and Simmons et al. (in press).

## Discussion

The spelling intervention group outperformed the storybook and comparison groups on measures of spelling and letter dictation. Effect sizes were large when comparing the spelling intervention and storybook groups. Differences favoring the children who participated in the beginning reading and spelling intervention on alphabet letter knowledge and writing may be attributed to the additional practice provided to review and learn letters. Letter names were emphasized as children learned to write. In addition, identifying letter names was an integral part of spelling words. The second distinguishing instructional feature that may have contributed to differences in alphabet letter writing is the use of handwriting to spelling words. According to research by Abbott and Berninger (1993), handwriting draws on letter knowledge. In order to write a letter, a child must attach a verbal label (name) to a letter form, have an accurate, precise representation of the letter form in memory, and be able to access that letter in memory and retrieve it. Results from Berninger et al. (1997) also demonstrated that handwriting is not simply a motor process. Memory representation of letters and memory retrieval processes are crucial in the automatization of handwriting. Therefore, the additional amount of time spent in letter name instruction in handwriting and spelling activities, as well as handwriting's relation to letter knowledge, may have contributed to differences between the two interventions on the LNF and handwriting measures at posttest.

Most important is the study's implied hypothesis that the strategic integration of phonemic awareness and alphabetic understanding in the spelling intervention would result in children's improved and differential ability to read words. This hypothesis was supported. Children in the spelling intervention performed better on word attack and nonsense word reading measures, as well as on "real" word reading. Moderate to large effect sizes were seen for these word reading measures.

An obvious but essential goal of beginning reading instruction is to help children learn to read and decode words independently. At the end of the study, children in the spelling group were able to read more words when compared to the children in the other groups. While these results appear to support the reading-spelling connection, the question about the critical aspects and skills within spelling instruction remains a question

for further research. Our study reveals that beginning spelling and beginning reading instruction focus on the same skills, and therefore spelling instruction, to a great extent, is really more instruction on the same skills that are included in reading instruction. To address the question of whether spelling truly promotes reading requires a comparison of the reading and spelling performance for students who receive the same amount of time on phonemic awareness and the alphabetic principle as students who receive phonemic awareness and spelling instruction.

Two important considerations are highlighted in this study. First, spelling instruction can strategically integrate two critical aspects of beginning reading for kindergarten children at risk of reading difficulties: phonemic awareness and alphabetic understanding. The results suggest that the spelling intervention in the treatment condition yielded moderately strong effect sizes when compared to the control condition; spelling does appear to intensify beginning reading instruction and help improve student spelling skills. Second, while not explicitly examined in our research, the use of instructional design principles to guide our intervention's development directs attention to the issue of careful instructional design when teaching the interrelated skills of reading and spelling.

## CONCLUSION

In this article, we described the development and evaluation of a beginning spelling intervention for kindergarten children at risk of reading disability. Because of the intensive learning needs of these students, we looked to two separate research literatures to inform the design and development of this intervention: the literature concerned with the integration of phonological awareness and alphabetic understanding through beginning spelling and principles of effective instruction and intervention. Researchers and practitioners can improve beginning reading outcomes for students at risk of reading disability by attending to both the "what" and the "how" of instruction. We believe that supporting and extending beginning reading intervention with spelling instruction that is explicit, systematic, and intensive is one promising way to accomplish this goal.

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