

The Effects of Professional Development in Scientifically Based Reading  
Instruction on Teacher Knowledge and Reading Outcomes

Abstract

This study examined the effects of professional development in scientifically based reading instruction on teacher knowledge and student reading outcomes. Teachers of first- and second-grade children participated in a 35 hour, three credit summer course on assessment and instruction of phonemic awareness, phonics, and fluency with subsequent coaching. Teacher knowledge pre- and post-test comparisons showed that while teachers in the experimental group initially scored lower than control teachers, they surpassed the controls on the posttest. The students of participating teachers were assessed at the beginning and end of the following school year and compared to a control group. Results indicated that the first-grade students exceeded the controls in letter name fluency, phonemic segmentation, nonsense word fluency, and oral reading. Second-grade students exceeded the controls in phonemic segmentation and phonemic decoding efficiency. The findings suggest that teachers can improve their knowledge regarding explicit reading instruction, and that this new knowledge contributes to student growth in reading.

The Effects of Professional Development in Scientifically Based Reading  
Instruction on Teacher Knowledge and Reading Outcomes

“Lower level language mastery is as essential for the literacy teacher as anatomy is for the physician” (Moats, 1995, p. 50).

Reading serves as the major conduit for all learning— both the groundwork for school and life-based knowledge. Over the past two decades, attention has focused on the importance of assuring that all children become skilled readers. Interest in the improvement of reading performance has stemmed partially from concerns regarding the large numbers of children who are having difficulty learning to read. Estimates suggest that at least 20 percent of children experience some difficulty in mastering the skills necessary for reading fluently and easily (Lyon, 1995), or about 10 million children (National Institute of Child Health and Human Development, 1998). In addition, despite increased funding and resources devoted to reading, results from a national assessment of reading achievement indicate that little progress has been made in improving the reading performance of fourth graders since 1996, with just a small increase (29 percent to 31 percent) of students performing reading tasks at or above the “Proficient” level, with no gains in reading achievement for grade 8 students over the last decade, and with a decline in the reading scores of high school seniors (National Assessment of Educational Progress, 2003). The most recent 2005 report shows that there has been little significant improvement in reading performance overall. On the scale from 0 to 500, students in grade 4 were 1 point higher and students in grade 8 were 1 point lower in 2005 than in 2003. The average scores for students in 2005 were only 2 points higher than in 1992, the first assessment year, at both grades 4 and 8. At grade 8, no state had a higher average score in 2005 than in 2003, and 7 states had lower scores and the percentage of students performing at or above *Basic* increased in 1 state and decreased in 6. In addition, 58% of African-American and Hispanic

students in Grade 4 obtained reading scores below the Basic level (U.S. Department of Education, 2005).

Vaughn et al. (2003) noted that students who struggle to learn to read in first and second grade are likely to struggle with reading their entire lives. Longitudinal research confirms that many of these early reading problems persist. Children who have inadequate literacy skills in first grade continued to struggle with reading in fourth grade (Juel, 1988) and many of the students identified as poor readers in the third grade continued to be identified as poor readers in the ninth grade (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996). What often starts out as a problem learning phoneme-grapheme relationships evolves into a more generalized problem affecting all aspects of reading. Because poor readers cannot pronounce words with ease and read fluently, they struggle to comprehend and gain conceptual knowledge (Beck & Juel, 1995; Shaywitz, Fletcher, & Shaywitz, 1994). In essence, these unresolved reading problems threaten children's entire education, as well as their futures (Hall & Moats, 1999).

#### Publications and Legislation

Recent publications and legislation have spurred increased public awareness of the nature and scope of this problem. The publications of *Preventing Reading Difficulties* (Snow, Burns, & Griffin, 1998) and the National Reading Panel report (2000) heralded a core shift in thinking about what both children need to learn and what teachers need to know about the delivery of reading instruction. Both of these publications underscored that a comprehensive approach to reading instruction is key and includes provision of instruction in five essential elements: phonemic awareness, phonics, fluency, vocabulary, and comprehension. These publications also addressed the need for and the importance of highly trained teachers who know how to help children become competent, efficient readers.

Recent legislation has also emphasized the need for effective teacher preparation, as well articulation of the nation's reading goals. For example, the No Child Left Behind Act of 2001 (NCLB), the most recent reauthorization of the Elementary and Secondary Education Act, was signed by President Bush in January of 2002. NCLB affects all children in general education programs as well as students with disabilities who attend special education programs for part or all of their instruction. This law targets a comprehensive redesign of teacher preparation and in-service professional development. As with National Reading Report, appropriate reading instruction in NCLB in reading must include explicit and systematic instruction in the essential components of: phonemic awareness; phonics; vocabulary development; reading fluency, including oral reading skills; and reading comprehension strategies.

Prior to the passage of NCLB, the President outlined the following four objectives in a radio broadcast (White House, 2001): (a) assessments should be conducted to identify early reading problems in kindergarten through third grade; (b) reading problems will be corrected; (c) reading instruction will be implemented using reliable, research-based methods; and (d) every teacher will be well trained in these methods, including phonics. NCLB dramatically increased the federal role in education by requiring states, school districts, and schools to focus on the student outcomes. Schools are required to improve (with supporting data to show the improvement) students' performance in reading and math by the middle of 2014 (Yell, Katsiyannas, & Shiner, 2006). Teacher preparation programs must then ensure that teachers are well prepared to address this challenging, but shall we say, impossible, task.

### **Professional Development and Teacher Knowledge**

Clearly, teachers who are knowledgeable about instruction do play an important role in helping children learn to read, and especially children who are at risk for reading failure (Brady

& Moats, 1997). The problem becomes, however, determining exactly what content teachers do need to know to teach reading effectively. When thinking of implementation of explicit phonics instruction, do teachers need to be able to explain what a diphthong is or an allophone? Do they need to know that phonics is spelled with a ph instead of an f because it comes from a Greek combining form? Do they need to be able to count the number of phonemes in a word accurately and tap out the number of syllables? Essentially, some types of knowledge are easy to assess on tests, but the knowledge is of little value if it is not usable in instruction.

In addition, even if teachers do possess specific knowledge regarding effective literacy instruction, it is necessary to demonstrate that this increased knowledge actually improves student reading outcomes. Snow, Griffin, and Burns (2005) addressed this important question as follows : “What is lacking, and the task that remains ahead of us as a profession, is documentation that teachers who possess this sort of knowledge actually teach better and more effectively (where more effectively means students learn more and better) than those who do not” (p. 210). The answers to these questions become critical when considering what should be taught about reading instruction in teacher preparation programs.

### ***The Importance of Knowledge of Language Structure and Phonics***

The importance of teacher knowledge of the structure of language has been well documented by Moats (1994, 1995, 2003). Teachers must be prepared to deliver linguistically informed, code-based reading instruction (Moats, 1995). Moats has shown repeatedly that knowledge of language structure and understanding of language and reading development are two of the essential prerequisites (but not the only ones) for providing informed reading instruction. Because literacy is a secondary system that is dependent on oral language as the primary system, both teachers and students need to know a good deal about language (Snow et

al., 2005), including how the language works (Podhajski, 1995) at the sound, word, sentence, and text levels. For example, a teacher who understands the importance of phonological awareness as an oral language prereading skill can provide engaging, carefully sequenced instructional lessons to the children who need to increase their sensitivity to sounds in spoken words. This teacher would also be well aware of the students who already has these skills and do not require this type of instruction.

Moats (1995) explains that knowledge of language structure is critical for successful teachers for the following reasons: (a) interpreting and responding to student errors, (b) choosing the best examples of words for teaching sound-symbol relationships, (c) being able to organize and sequence information for instruction, (d) being able to use knowledge of morphology to explain spelling, and (e) being able to integrate word study into meaningful reading and writing activities. Gaining a deep understanding and knowledge of the English language structure is, however, not an easy task. Because of the complexities of English phonology, orthography, and morphology, Moats (1999) observed that the teaching of reading really is “rocket science.”

The relationships between English phonemes and graphemes can be confusing to both teachers and students alike. For example, the same grapheme can represent different phonemes (e.g., the vowel *a* can represent a number of different sounds depending on its position in a word and the letters that follow it as in *cat*, *cake*, *along*, *star*, *lawn*). In addition, the same phoneme can be spelled with different graphemes (e.g., the vowel sound *a* in *cake*, *rain*, *way*, and *weigh*).

Teachers who understand phonemes and their relationships to graphemes can apply this knowledge in the context of daily classroom interactions (Moats, 2004). If teachers do not have a working knowledge of language structure, they are likely to misinterpret or not understand the types of errors students make when spelling. For example, a student may spell the word *potato* as

*botado*. The teacher may attribute the spelling error to a lack of attention to detail; however, further investigation indicates that the errors are a result of the student's difficulty hearing the difference between the voiced (*b*) (*d*) and unvoiced (*p*) (*t*) consonant sounds. Without an accurate understanding of the cause of these errors, the teacher would not be able to provide appropriate instruction. McCutchen, Harry, et al. (2002) provided another example of how a savvy teacher would recognize that a child's misspellings of *train* as *chran*, or *dragon* as *jragin* illustrate sophisticated phonological analysis on the child's part, rather than a lack of attention to spelling-sound correspondences. They explain that these spellings are caused because the sounds of the alveolar stop consonants *t* and *d* are similar to the articulatory affricates represented by the *ch* and *j* and the similarities are exaggerated when alveolar stops are followed by a prevocalic *r*.

Although most classroom teachers do not possess this depth of linguistic knowledge, many may also be unfamiliar with or unsure of differences in meaning among more common terminology, such as: phonemic awareness, phonological awareness, and phonics (McCutchen, Abbott, et al., 2002; Moats, 1994; Moats & Lyon, 1996). They may not be aware that phonemic awareness is the ability to hear and manipulate the individual sounds within spoken words (e.g., the word *box* has four sounds: /b/, /o/, /k/, and /s/). Phonological awareness is often used as a broader term that encompasses phonemic awareness but also includes the ability to recognize, identify, and manipulate larger sound units in our language, such as syllables. Phonics is a method of reading instruction that provides explicit instruction in letter-sound correspondences and how they are used for reading and spelling words.

As noted in the recommendations of NCLB, as well as the findings of the National Reading Panel, teachers do need to know how to teach children the principles and application of phonics to reading and spelling. The National Reading Panel (2000) explained that "...the

primary focus of phonics instruction is to help beginning readers understand how letters are linked to sounds (phonemes) to form letter-sound correspondences and spelling patterns and to help them learn how to apply this knowledge in their reading” (p. 8). Depending on the needs of their students, teachers need to know how to implement phonics instruction in a systematic way, in which a sequential set of phonics elements are taught and practiced explicitly, as well as in a more supplementary format, where particular elements of phonics are taught to a child as the need arises within reading and spelling instruction.

### ***Teacher Knowledge of Word Structure***

In order to teach phonics, a teacher must have some understanding of language structure. Based on recent research studies and surveys of teacher knowledge concerning reading development and difficulties, many elementary and special education teachers are underprepared to teach reading and have limited knowledge of language structure (Moats, 1995). From surveys of teachers, Moats (2004) reported that about half of the teacher believed that the last sound in the word nose was /s/ rather than /z/. Cunningham et al. (2004) found that approximately 70% of the teachers in their sample could not identify a schwa sound which suggests that they would not be able to explain this common vowel sound to children. Thus, a substantial gap exists between research on reading and teacher preparation (Moats & Foorman, 2003).

In a recent study examining teachers’ self-perceptions and knowledge about reading, Spear-Swerling, Brucker, and Alfano (2005) found that teachers lacked knowledge of language structure. These findings are similar to the results of several earlier studies (e.g., Bos, Mather, Dickson, Podhajski, & Chard, 2001; Bos, Mather, Narr, & Babur, 1999; Cunningham et al., 2004; McCutchen & Berninger, 1999; McCutchen, Harry, et al., 2002). Furthermore, Spear-Swerling et al. found that even the teachers with the most experience and training performed well

below the upper limit on the measures of knowledge about word structure. Teachers of struggling readers also have reported that limited knowledge about how to teach word recognition and phonics are major obstacles to their instruction (Bos, Mather, Silver-Pacuilla, & Narr, 2000; McCutchen & Berninger, 1999). Direct observations further substantiate that teachers spend minimal instructional time in classrooms teaching students various word analysis skills (e.g., Juel & Minden-Cupp, 2000; Vaughn, Moody, & Schumm, 1998).

### ***Self Ratings of Knowledge***

Teachers may also believe that they are more knowledgeable and prepared for teaching reading than they actually are. Cunningham et al. (2004) found that even though kindergarten to third-grade teachers rated their knowledge of children's literature, phonemic awareness, and phonics as being *high*, the majority actually demonstrated limited knowledge about phonemic awareness and phonics. In fact, the teachers that reported they were experts in phonological awareness had a more difficult time counting the number of phonemes in words than the teachers who indicated they had minimal skills. The researchers concluded that teachers tend to overestimate their reading related knowledge and this overestimation may hinder their receptiveness to new ideas presented in professional development training. In another study, Bell, Ziegler, and McCallum (2004) found similar results, finding little relationship between educators' knowledge of reading and their self-ratings of their knowledge.

Spear-Swerling et al. (2005) found that when teachers were asked to provide self-reflections of their knowledge of the English language structure, the teachers thought they knew a lot about written language, but they failed to demonstrate understanding that the language is both phonemically and morphologically represented. That is, the teachers did not demonstrate explicit knowledge that complex word mappings exist at both the phoneme level (e.g., the letter

*d* in *dog* represents the sound /d/), as well as the morpheme level (e.g., the spelling of the base word *photograph* remains the same even though its pronunciation changes in the words *photography* and *photographer*).

### ***The Teacher's Own Facility with Speech Sounds***

Another aspect of teacher knowledge includes the teacher's own ability to understand various aspects of phonological awareness and phoneme-grapheme relationships. Lindamood (1994) suggested that some teachers themselves do not have adequate phonemic processing skills and that their own limited abilities may interfere with their effectiveness in explicitly teaching these language skills. If teachers have difficulty with speech sounds, such as not being able to pronounce phonemes correctly, they will not be able to teach these sounds to children effectively.

Findings from one study indicated that teachers' ability to spell pseudowords was related to student spelling outcomes (Kroese, Mather, & Sammons, 2006). At the end of the school year, eleven primary grade teachers from the same school were administered a nonsense word spelling test, where the words conformed to common English spelling patterns. Two of the teachers performed well below average. When the students of these low scoring teachers were compared to the students in the other classes, a much larger proportion of students scored significantly below average in spelling. Although this study had two limitations: (a) the teacher sample size was small (N = 11) and (b) testing was completed at only one point in time (end of school year), the findings suggest that the effectiveness of spelling instruction appears somewhat contingent upon the teacher's understanding of and ability to teach phoneme-grapheme relationships.

Some teachers may enhance their own phonological awareness through specific training and the study of language structure. In one study, graduate students enrolled in a one-year

teacher certification program demonstrated increased skill on phonological awareness tasks at the end of the year (Stainthorp, 2004). At the pretraining level, students' knowledge of phonemic tasks appeared to be implicit; however, by the post training assessment, students were able to explicitly discuss phonological skills. These findings suggest that preservice training can help teachers increase their own understanding of phonology.

### ***Preservice and Inservice Teacher Training***

To develop a deep understanding of language structure, teachers require both intensive preservice preparation related to reading, as well as ongoing professional development (Foorman & Moats, 2004; International Reading Association, 2000; National Reading Panel, 2000; National Research Council, 1998). Institutes of higher education train as many as 125,000 teachers per year (National Center for Education Statistics, 2001), but one may wonder how many of these novice teachers are truly prepared to teach reading effectively? Teaching colleges traditionally permit professors to determine the theoretical principles of instruction of courses. Although states mandate that specific curricular areas be taught (e.g., English immersion, Mainstreaming/Inclusion, and core subject method courses), a diverse range of philosophical perspective drives the content of teacher training programs.

To ensure teachers receive adequate training, Brady and Moats (1997) proposed three key components for teacher training programs in reading: (a) provide teachers with a solid foundation in theory and research-based concepts for understanding literacy development; (b) ensure that teachers understand the structure of language, both speech and print; and (c) provide teachers with many teaching opportunities with a mentor. The National Commission on Teaching and America's Future (n.d.) also recommended the use of mentoring or coaching programs for beginning teachers. Courses and workshops followed by classroom coaching must

*also engage the imagination, affect, and commitment of the teachers (Moats, 2004).*

Several studies have demonstrated that systematic and extended inservice trainings can enhance teacher knowledge and bring about change in teaching practices. In the McCutchen, Abbott, et al. (2002) study, teachers attended a two-week summer training institute, part of which focused on how to provide instruction in phonological awareness, as well as evidence-based instruction in key reading components. In addition, classroom visits and follow-up sessions provided support and feedback in the implementation of literacy instruction. Results indicated that the teachers changed their teaching practices and were able to implement their new knowledge successfully.

In a similar study, training was provided for both general and special education teachers (McCutchen & Berninger, 1999). After the inservice training, McCutchen and Berninger (1999) observed the following about their most “skeptical” teachers: “Not only had their own knowledge and classroom practice been transformed, but also they were actively engaged in sharing this newly evolved knowledge with their colleagues—an important aspect of teachers’ continuing professional development” (p. 224). Once teachers understand the nature and the role of speech sounds and the alphabetic principle in learning to read, they do not challenge the importance of this insight (Moats, 2004).

Other professional development models have included additional school personnel, such as the speech-language therapist, school psychologist, special education teachers, and the principal (Bos, Mather, Narr, & Babur, 1999; Mather, Bos, & Babur, 2001). McCutchen and Berninger proposed that the inservice training would be most effective if school personnel were trained together because they would be able to implement teaching changes collaboratively. Bos et al. found that: (a) teachers reported a feeling of unity during the training; (b) all school

personnel developed a common language for planning and interpreting assessments and interventions for individual students; and (c) general and special education interventions became more collaborative in nature or as noted by McCutchen and Berninger (1999), the services were less fragmented. Teachers also increased their knowledge of language structure as demonstrated by pretest and posttest surveys (Bos et al., 2001; Bos et al., 1999; McCutchen, Abbott, et al., 2002; McCutchen & Berninger, 1999).

### ***Improved Student Outcomes***

In addition to increased teacher knowledge resulting in changes in the delivery of instruction, it is also important to demonstrate that when teachers provide explicit reading instruction, students progress more rapidly in reading (McCutchen, Abbott, et al., 2002; Snow et al., 2005). Numerous research studies have demonstrated that when students receive explicit instruction in phonology and phonics, their reading performance improves at a faster rate (e.g., Ball & Blachman, 1991; Bos et al., 1999; Cunningham, 1990; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Moats & Foorman, 2003; O'Connor, 1999; Podhajski & Nathan, 2005; Torgesen, 1997). For example, after teachers participated in a two-week institute in critical early reading components and received additional mentorship and feedback throughout the following school year, their kindergarten students made greater gains than control students in phonological awareness, orthographic fluency, and word reading (McCutchen, Harry, et al., 2002).

McCutchen, Abbott, et al. (2002) also addressed the effect of teacher knowledge on the teacher's implementation in the classroom, as well as the effect of that knowledge on student learning when compared to peers in other classrooms. For kindergarten students, the teachers' implementation score (amount of time spent in explicit phonological activities) was significantly

related to student growth in phonological awareness and alphabet letter production. For the first-grade students, teacher implementation was related to growth in spelling, reading vocabulary and comprehension, and composition fluency.

An additional consideration is that explicit training in phonological awareness and phonics is likely to be most beneficial for children at-risk for reading failure, rather than children who have normally developing reading skills. Hatcher, Hulme, and Snowling (2004) found that explicit training in phonological awareness improved the phonological skills of children with normal reading development, but the improvement did not translate to improvement in literacy skills. In contrast, for children at risk for reading failure, explicit interventions in phonemic awareness and phonics resulted in significant improvements in reading skill.

For this present study, teachers also participated in a professional development literacy course that centered upon how to provide effective instruction to students in phonemic awareness, phonics, and fluency. The course was then followed by an on-site coaching program for the teachers within their own classrooms. The purpose of the study was to address the effects of a professional development program on teacher knowledge, as well as to explore whether increased knowledge would contribute to improved student reading achievement.

## **Method**

### ***Teacher Participants***

The experimental group of teachers consisted of two first-grade teachers, one second-grade teacher, and one teacher of a first- and second-grade combination classroom. All taught in the same rural Vermont school and represented 20% of the total number of teachers in each grade. The control group consisted of one first-grade teacher, one second-grade teacher, and one teacher

of a first- and second-grade combination classroom. All taught in the same school within a district adjacent to Vermont's largest city. All teachers were female. As compensation for participating in this study, the experimental teachers were: (a) offered the 35-hour course and 10 mentorship visits at no charge, (b) provided continuing education credits, and (c) received \$100 worth of related instructional materials. Control teachers received a \$25 gift certificate to Barnes and Noble upon completion of the project and were offered the opportunity to participate in the course/mentorship program the following year at no charge.

### ***Student Participants***

Complete pre and posttest data were obtained on 33 first- and twenty second-grade students in the experimental group. In the first grade, three students were on 504 plans and three students were on Individualized Education Plans (IEPS). In the second grade, one student was on a 504 plan and three students were on IEPS. The control group consisted of fourteen first-grade and twenty two second-grade students. In the second grade, one student was on a 504 plan and one student was on an IEP. Most recent economic and educational information available obtained from the 2000 U.S. Census report demonstrated that the mean income and educational levels were significantly higher for the children in the control group.

### ***Procedure***

All experimental teachers completed the 35-hour course TIME for Teachers course presented over five consecutive days during the summer preceding the school year. TIME, an acronym for Training in Instructional Methods of Efficacy, is a professional development program course for primary educators designed to share advances in reading research along with best practices of assessment and intervention in the areas of phonological awareness, phonics, and fluency

(Podhajski, 2000). In addition to the didactic training, TIME includes a year-long mentorship in teacher participants' schools. A masters' level experienced reading mentor visited teachers at their schools 10 times throughout the school year. Schools also received teaching materials (e.g., controlled readers) to support implementation of research-based practices.

The TIME for Teachers course offered teachers an opportunity to increase their understanding of how the language works: how the English language is constructed and how speech maps to print. The course was highly interactive and gave participants opportunities to explore and contrast both explicit and implicit teaching strategies. The goal of the TIME for Teachers was to extend teacher knowledge about language structure and to address best practices for reading assessment and intervention based on the research findings from the National Research Council (Snow, Burns, & Griffin, 1998), as well as the National Reading Panel (2000). Most importantly, the course and accompanying collaborative mentorship not only offered teachers information about the key elements of phonological awareness, phonics, fluency, vocabulary, and reading comprehension, but also helped teachers learn how to translate these findings into practice. Throughout the course and mentorship, teacher participants learned research-based assessment tools and intervention strategies. For example, teachers were shown how to: (a) develop sound walls and word walls, (b) link speech to print through phoneme-grapheme mapping (Grace, 2007), (c) follow a scope and sequence for teaching phonics skills, (d) use text mapping, and (e) use controlled sentence dictation for spelling.

At the end of the 35-hour course, teachers were assigned a mentor, who visited them for 30 minutes to one hour once a month over the next 10 months. The visits began approximately six to eight weeks after the initial two-day workshop. The mentor was a masters' level experienced reading teacher who had been trained to model assessment and intervention practices, observe a

teacher working with their students, and offer feedback. During each visit, time was always provided for the teachers to discuss with their mentor any questions or concerns about classroom applications.

### ***Teacher Measures***

Experimental and control teachers were given the same pre and posttest assessment of knowledge about language structure and early reading and spelling instruction. They were also asked to complete course and project evaluations. Measures had been developed for TIME for Teachers and Project RIME (Reading Instructional Methods of Efficacy), a partnership professional development project at the University of Arizona (Bos, Mather, Friedman Narr, & Babur, 1999). The Survey of Teacher Knowledge consisted of 32 multiple-choice questions that examined teachers' knowledge of English language structure at the sound and word levels. Items were adapted from language inventories designed by Lerner (1997), Moats (1994), and Rath (1994). Appendix A provides several examples of items. Teachers in the experimental group completed an evaluation of the project at the conclusion of the school year using a five-point scale ranging from not valuable (1) to extremely valuable (5). For the course evaluation, participants were asked to rate the quality of instruction as well as course content and its relevance to classroom practice.

### ***Student Measures***

Experimental and control children were assessed at the beginning and end of the school year following course completion using the following instruments:

Dynamic Indicators of Basic Early Literacy Skills (DIBELS 5<sup>th</sup> Ed.) The DIBELS is a standardized individually administered measure of early literacy development designed to assess

phonological awareness, letter recognition, and word retrieval. Specific subtests given to first-grade students included Letter Naming Fluency, Phonemic Segmentation, and Nonsense Word Fluency. Second-grade students were given the Phonemic Segmentation subtest designed for first graders because of concerns regarding weak skills in this area. When necessary, DIBELS benchmark scores were adjusted to align with the developmental levels of the students..

Letter Name Fluency measures the student's ability to name upper- and lower-case letters within a minute. Phonemic Segmentation Fluency assesses a child's skill to produce the individual sounds within a given word. Nonsense Word Fluency assesses a child's knowledge of letter-sound correspondences as well as the ability to blend letters together to form unfamiliar "nonsense" words. For ease of analysis, scores were converted to the percent correct as follows: Letter Name Fluency (number correct out of 110 possible in one minute); Phonemic Segmentation Fluency (number correct out of 80 possible in one minute); and Nonsense Word Fluency (number correct out of 145 possible in one minute).

Texas Primary Reading Inventory (TPRI). The TPRI was developed to inform reading instruction for teachers. The inventory is used to match reading instruction with individual student needs. The Oral Reading Fluency and Reading/Listening Comprehension subtests were given to both first- and second-grade students. Scores on the Oral Reading are measured in the number of words read correctly per minute (wcpm). Those on Reading/Listening Comprehension were calculated in percent by determining the number correct out of the five test questions administered.

Test of Word Reading Efficiency (TOWRE). This test is a measure of an individual's abilities to sound out phonically regular nonsense words quickly and accurately and the ability to recognize real words accurately and quickly. The TOWRE is used to monitor growth in

efficiency of phonemic decoding and sight word reading skills. The Sight Word Efficiency subtest assesses the number of printed words that can accurately be identified in 45 seconds. The Phonemic Decoding Efficiency subtest measures the number of pronounceable printed nonwords that are accurately decoded within 45 seconds. This test was administered to second-grade students only using Form A in the fall and Form B in the spring. Scores are standardized with a mean of 100 and a standard deviation of 15.

Teachers in the experimental and control groups were trained by project staff to administer the pretests so as to help provide them with information for instruction. Posttests were administered by project staff approximately seven months later.

## **Results**

Prior to analyses, all data were screened for accuracy of data entry, missing values, and fit between their distribution and the assumptions of the analysis. No transformations were performed on the data. To determine the associations between variables, hypotheses were investigated by means of independent and paired *t* tests. Difference scores were calculated to compare average individual pre- to post-test gains between the experimental and control groups. An alpha of  $p = .05$  was used to determine significance for all statistical tests and unless otherwise noted, results are based on 2-tailed significance values.

### *Teacher Results*

Four experimental teachers took the Survey of Teacher Knowledge Test prior to the TIME instruction and mentoring and obtained a mean pretest score of 45%. Control teachers took the same test and obtained a mean pretest score of 69%. Analysis by independent samples *t*-

test showed this difference to be significant, with control teachers initially demonstrating greater knowledge of literacy concepts than the experimental group ( $t(5) = 2.86, p = .035$ ).

Seven months later both groups took the posttest. Following the TIME course and the mentoring, the experimental group mean rose to 81%. Paired  $t$ -test analyses showed the individual gains to be significant ( $t(3) = -13.28, p = .001$ ). The control group posttest mean also rose to 81%, however paired  $t$ -test analyses indicated that individual gains on average were not significant ( $t(2) = -3.46, p = .074$ ).

### *First-Grade Student Results*

Pretest and posttest means and standard deviations for first-grade students are reported in Table 1. Bar graphs reflecting the following first-grade results can be found in Figures 1 through 3. Independent samples  $t$  tests indicated that the experimental group initially scored lower than the control group on the DIBELS Letter Naming Fluency ( $t(45) = 3.39, p = .001$ ), Phoneme Segmentation Fluency ( $t(45) = 2.84, p = .007$ ), and Nonsense Word Fluency ( $t(45) = 3.92, p = .001$ ) measures. They also scored lower on the TPRI Oral Reading test ( $t(45) = 2.17, p = .045$ ), but not on the Reading/Listening Comprehension test ( $t(45) = .026, p = .979$ ).

In terms of pretest to posttest gains, paired  $t$ -tests showed that the experimental students made gains on the DIBELS Letter Naming Fluency ( $t(32) = -12.46, p = .000$ ), Phoneme Segmentation Fluency ( $t(32) = -11.94, p = .000$ ), and Nonsense Word Fluency ( $t(31) = -15.02, p = .000$ ). They also made significant gains on the TPRI Oral Reading ( $t(28) = -10.20, p = .000$ ) and Reading/Listening Comprehension tests ( $t(31) = -3.88, p = .001$ ). The control students made significant pretest to posttest gains on the DIBELS Letter Naming Fluency ( $t(13) = -4.17, p = .001$ ) and Nonsense Word Fluency measures ( $t(13) = -6.98, p = .000$ ) and also the TPRI Oral Reading ( $t(13) = -4.54, p = .001$ ) and Reading/Listening Comprehension tests ( $t(13) = -3.82, p$

= .002). They did not, however, make significant gains on the DIBELS Phoneme Segmentation Fluency measure ( $t(13) = -1.49, p = .160$ ).

Individual difference scores were used to analyze growth differences between the experimental and control students. Results indicated that on average, the experimental students made significantly greater gains than the controls on the DIBELS Letter Naming Fluency ( $t(45) = -3.46, p = .001$ ), Phoneme Segmentation Fluency ( $t(45) = -4.30, p = .000$ ), and Nonsense Word Fluency ( $t(44) = -3.66, p = .001$ ) measures. They also made greater gains on the TPRI Oral Reading test ( $t(41) = -2.22, p = .032$ ), but not on the Reading/Listening Comprehension test ( $t(44) = 1.11, p = .271$ ).

By the time the posttests were administered, independent samples  $t$ -test showed that as a group, the experimental students caught up to the controls on the DIBELS Letter Naming Fluency ( $t(45) = .50, p = .617$ ) and Nonsense Word Fluency ( $t(44) = .50, p = .622$ ) measures, as well as the TPRI Oral Reading ( $t(41) = .96, p = .344$ ) test. There were still no significant group differences on the Reading/Listening Comprehension test ( $t(44) = 1.74, p = .090$ ). There continued, however, to be significant group differences on the DIBELS Phoneme Segmentation Fluency, but unlike the pretest, where the control group outscored the experimental group, the experimental group now outscored the controls ( $t(45) = -3.00, p = .004$ ).

### *Second-Grade Student Results*

Second grade pretest and posttest means and standard deviations are reported in Table 2. Bar graphs reflecting the following second-grade results can be found in Figures 4 through 7. Initially, the experimental group scored lower than the control group on the TOWRE Sight Word Efficiency ( $t(41) = 3.01, p = .004$ ) and Phonemic Decoding Fluency ( $t(41) = 2.21, p = .033$ ) subtests as well as on the TPRI Oral Reading Fluency ( $t(40) = 3.06, p = .004$ ) and

Reading/Listening Comprehension ( $t(40) = 2.74, p = .009$ ) tests. There were no pretest group differences on the DIBELS Phoneme Segmentation Fluency measure ( $t(41) = .855, p = .397$ ).

Pretest to posttest gains, using paired  $t$ -test analysis, showed the experimental students made gains on the DIBELS Phoneme Segmentation Fluency ( $t(19) = -9.12, p = .000$ ), the TOWRE Phonemic Decoding Efficiency ( $t(20) = -2.11, p = .048$ ), and the TPRI Oral Reading Fluency ( $t(18) = -5.16, p = .000$ ) and Reading/Listening Comprehension tests ( $t(18) = -4.17, p = .001$ ). Pretest to posttest gains on the TOWRE Sight Word Efficiency were not significant ( $t(20) = -.98, p = .338$ ). Controls students made significant pretest to posttest gains on the DIBELS Phonemic Segmentation Fluency ( $t(21) = -4.93, p = .000$ ) and the TPRI Oral Reading Fluency ( $t(21) = -6.02, p = .000$ ) and Reading/Listening Comprehension ( $t(21) = -3.25, p = .004$ ) measures. Gains were not significant on the TOWRE Sight Word Efficiency ( $t(21) = -.51, p = .618$ ) or Phonemic Decoding Efficiency subtests ( $t(21) = -1.81, p = .085$ ).

Again, individual score differences were used to compare growth between the experimental and control students. Results indicated that on average, experimental students made greater gains than the controls on Phoneme Segmentation Fluency only ( $t(40) = -3.15, p = .003$ ). The remaining individual gains were not significantly different among the two groups, including on the TOWRE Sight Word Efficiency ( $t(40) = -.93, p = .358$ ), Phonemic Decoding Efficiency ( $t(40) = -1.25, p = .217$ ), or the TPRI Oral Reading ( $t(38) = -.004, p = .997$ ) and Reading/Listening Comprehension tests ( $t(38) = -1.91, p = .067$ ).

By the time of the post testing, there were still no group differences between the experimental and control on the DIBELS Phoneme Segmentation Fluency ( $t(40) = -1.85, p = .072$ ). The experimental group had caught up to the controls on the TOWRE Phonemic Decoding Efficiency ( $t(41) = 1.69, p = .098$ ) and the TPRI Reading Listening/Comprehension ( $t(39) =$

.79,  $p = .432$ ). Group differences still were found on the TOWRE Sight Word Efficiency ( $t(41) = 2.55$ ,  $p = .014$ ) and minimally, on the TPRI Oral Reading ( $t(39) = 2.03$ ,  $p = .049$ ), with the control group continuing to score above the experimental students.

Satisfaction surveys were also analyzed across experimental and control groups of teacher participants. The majority of experimental teachers found that their instruction changed as a result of participation in the project. They found both the didactic course and the mentorship helpful towards effecting that change. They also very much liked the materials they were given to help apply new knowledge learned. They did not find pretest administration to their students that helpful in driving instruction.

Interesting, the control group of teachers who did not participate in the course found the pretest data “somewhat valuable” although they acknowledged not feeling as invested in the assessment procedure since they were not a part of the project. They did feel that they became more familiar with some of the instructional terms, e.g., segmentation, deletion, and began using them in their practice.

## **Discussion**

This study was conducted to investigate differences in children’s reading outcomes when their primary educators were presented with a combination of didactic coursework and onsite classroom mentorship in language structure and best practices for assessment and intervention based on scientific research. An experimental group of first and second grade students and their teachers participated in the intervention and results were compared to a control group. There

were significant differences between these groups in terms of the educational and economic levels with initial results in favor of the control students. We expected and we found the control students to outscore the experimental students on most variables initially, likely due to their enriched environment. This was the case in first graders for nonsense word fluency, letter name fluency, phonemic segmentation, and oral reading fluency. For second graders, it was the case with sight words, phonemic decoding, oral reading fluency, reading/listening comprehension, and phoneme segmentation.

Results yielded some interesting growth patterns in the experimental group that supports the success of the intervention. In terms of DIBELS results, we were pleased to find that the first grade experimental students showed greater gains than control students overtime on nonsense word fluency, letter name fluency, and phonemic segmentation. As a group they caught up to the level of the control students and in fact, exceeded the level attained by the control students on phonemic segmentation by the end of the year. This was a particularly powerful finding as research demonstrates the predictive capacity of phonemic segmentation to future reading success (Shaywitz, 2003; Lyon, 1995). This pattern of phonemic segmentation growth was similar in the second grade students who on average made greater gains than controls, closing group differences by the end of the year. Teachers who participated in the project successfully helped their students map speech to print, consistent with research that phonemic awareness instruction is most effective when linked to letters.

Analysis of TPRI oral reading fluency test results pre to post suggested greater gains by the first graders. The experimental group started significantly lower than the controls on the pretest, but made greater individual gains and caught up as a group to the controls by the end of the school year. In second grade, both groups grew significantly overtime and about the same

amount. There were still group differences on the posttest, with the control students continuing to outscore the experimental group. Children in the control group may have profited from having had more developed reading skills in general prior to initiation of the project.

It was interesting that TPRI reading/listening comprehension scores were different for first and second graders. While both the first grade experimental and control groups started out and grew at the same level, the second grade experimental group began lower on the pretest and as a group caught up to the controls by post test. In first grade, students' comprehension skills are primarily impacted by teachers reading to them since they are not yet at a level of reading ability that emphasizes verbal thinking. By second grade, as students gain independent reading skill, comprehension increases. The ability to read and comprehend depends on rapid and automatic decoding of single words (Lyon, 1994; Stanovich & Siegel, 1994; Fletcher, Shaywitz, Shankweiler, et al, 1994), a major emphasis of intervention strategies presented to teachers.

Finally, results of the TOWRE sight word subtest administered to second graders did not show significant growth pre to post for either group. The controls were significantly higher than experimentals at both the pre and the post test. Sight words were not directly taught in either condition. Furthermore, youngsters were at the youngest age and lowest norming levels for test administration.

Results on the TOWRE phonemic decoding subtest, however, revealed that the experimental group initially scored lower than controls on the pretest. They made significant gains overtime while the controls did not. In fact, by the end of the year, as a group, they caught up to the level attained by the control group. The emphasis teachers placed on decoding instruction impacted experimental children's ability to read phonetically regular syllables.

In terms of teacher data, results showed that the teacher participants enjoyed being able to immediately implement new knowledge learned in this professional development program within their classrooms. Mentoring seemed to add increased confidence to this application. That they did not find having access to the children's pretest data as valuable may be a function of their needing more explicit training in data based decision making.

### **Conclusion**

As with the McCutchen, Abbott, et al. (2002) study, this professional development training program did not provide teachers with a prescribed curriculum, but instead emphasized training in the English language structure, how to provide explicit reading instruction, and how to transform this knowledge into classroom practice.

Similar to the findings of earlier studies, one main implication is that enhanced teacher knowledge appears to produce better reading and spelling outcomes for students. Thus, knowledge of language structure, language and reading development, and research-based reading interventions are essential tools of the trade. An important goal of teacher training is to ensure that all primary teachers are prepared to observe, evaluate, and plan differentiated instruction in basic reading skills for students.

Clearly, the teaching of reading involves much more than word recognition skills but instruction in these skills is essential, particularly for students with learning disabilities in reading. Brady and Moats (1997) noted that although children benefit from explicit, systematic, and sequential reading instruction that is dynamic and engaging, the instruction must also emphasize discovery and understanding, and include frequent opportunities to practice basic reading and writing skills within meaningful contexts. As word identification skill improves, reading becomes less effortful and students can allocate greater attention to comprehension.

Scarborough (2001) artfully depicts the strands of word recognition becomingly increasing automatic to braid with increasingly strategic language comprehension toward the end goal of skilled reading. Effective teachers understand that reading is complex and requires fluid interaction between word identification and comprehension (Snow et al., 2005). Although this study focused on instruction in phonology, phonics, and fluency, low performing students appear to benefit most when explicit instruction is provided in both word recognition and reading comprehension (Berninger et al., 2003).

If teachers are to provide effective reading instruction, they will require: (a) instruction in language and scientifically-based reading instructional strategies, (b) provision of time and feedback from trained observers so that they can learn how to implement the new knowledge, and (c) practice providing individualized instruction to a variety of students (Foorman & Schatschneider, 2003). This type of training helps teachers to deepen their knowledge of language structure and then make appropriate changes in their instructional practices (Bos et al., 1999; Cunningham et al., 2004; McCutchen, Abbott, et al., 2002; McCutchen & Berninger, 1999; McCutchen, Harry, et al., 2002; Spear-Swerling et al., 2005). Furthermore, this type of instruction can be provided as an early intervention or after a reading disability diagnosis. Either way, student progress can be rapid when teachers employ methods that are developmentally appropriate (Ehri & McCormick, 1998).

Many children have trouble learning to read, including children with reading disabilities, children with language disabilities, children of poverty, and children who enter school with limited English language proficiency. Snow et al. (2005) aptly described the relationship between the gap in teacher education and the gap that exists among children's life experiences in the following way: "...the achievement gap between rich and poor, the privileged and

marginalized, the advantaged and disadvantaged in our society is still unconscionably wide. If for no other reason than getting serious about narrowing that gap, ...we must take seriously our own learning...and make it as a high a priority as eliminating the achievement gap that robs so many students of the opportunity that, as Americans, they are entitled to. We cannot, we believe, eliminate the achievement gap in our schools without closing the knowledge gap in our profession” (p. 223).

To close this gap, both special and general education teachers must receive supportive, professional development. If gains are to be made on a national scale, teachers must be provided with sustained, embedded, and substantive professional development (Moats, 2004). By improving teacher preparation requirements in reading and helping teachers to increase their understanding of reading processes and the essential components of effective instruction, teachers can become *agents* of change, rather than *objects* of educational reform (Nolen, McCutchen, & Berninger, 1990). Teachers must have knowledge of and the ability to deliver scientifically based reading instruction. This is the only way we can close the reading gap and reduce the number of children who struggle daily to become efficient readers. This intervention demonstrates that effective professional development, which informs teacher knowledge, can positively impact children’s outcomes by helping to close this gap particularly for children from under enriched environments.

## Appendix A

### Samples of Teacher Knowledge of Language Structure

1. Which word contains a consonant digraph?

- flop
- bang
- sink
- box
- none of the above
- I don't know.

2. How many morphemes are in the word *unhappiness*?

- two
- three
- four
- one
- I don't know.

3. A pronounceable group of letters containing a vowel sound is a:

- a phoneme
- a grapheme

- a syllable
- morpheme
- I don't know.

4. How many speech sounds are in the word *eight*?

- two
- three
- four
- five

5. Research suggests that difficulties with rapid automatic naming are predictive of problems with:

- reading comprehension
- answering wh- questions
- phonemic awareness
- reading fluency
- all of the above
- I don't know.

6. A diphthong is:

- a vowel sound comprised of two parts that glide together
- a vowel sound spelled with two vowel letters
- a set of two or three consonant letters pronounced together

- two consonant letters that represent one consonant sound
- a spelling pattern with a silent letter
- I don't know.

7. Which of the following demonstrates phoneme segmentation?

- Say this word slowly. Listen for all the sounds. caaaaaasssst
- "Say 'catnip' without 'cat'."
- Let's break this word down. Stem -- / st -em/
- Let's say the sounds in place: / p - l - a - s /
- Put these sounds together and tell me the word: / f - i - sh / -- fish
- I don't know.

## References

- American Federation of Teachers. (1999, June). *Teaching reading is rocket science: What expert teachers of reading should know and be able to do.* (Item No. 372 6/99). Washington, DC: Author.
- Ball, E. W. & Blachman, B. A. (1991). Does phonemic awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 26*, 49-66.
- Beck, I. L., & Juel, C. (1995). The role of decoding in learning to read. *American Educator, 19*(8), 21-25, 39-42.
- Bell, S. M., Ziegler, M., & R. S. McCallum. (2004). What adult educators know compared with what they say they know about providing research-based reading instruction. *Journal of Adolescent & Adult Literacy, 47*, 542-563.
- Berninger, V. W., Vermeulen, K., Abbott, R. D., McCutchen, D., Cotton, S., Cude, J., et al. (2003). Comparison of three approaches to supplementary reading instruction for low-achieving second-grade readers. *Language, Speech, and Hearing Services in Schools, 34*, 101-116.
- Brady, S. & Moats, L. C. (1997, Spring). Informed instruction for reading success: Foundations for teacher preparation. *Perspectives: A position paper of The International Dyslexia Association.* Baltimore: The International Dyslexia Association.
- Bos, C., Mather, N., Dickson, S., Podhajski, B., & Chard, D. (2001). Perceptions and knowledge of preservice and inservice educators about early reading instruction. *Annals of Dyslexia, 51*, 97-120.
- Bos, C.S., Mather, N., Freidman Narr, R.F., & Babur, N. (1999). Interactive, collaborative professional development in early literacy instruction: Supporting the Balancing Act. *Learning Disabilities Research & Practice, 14*, 215-226.
- Bos, C., Mather, N., Silver-Pacuilla, H., & Friedman Narr, R. (2000). Learning to teach early literacy skills-collaboratively. *Teaching Exceptional Children, 32*(5), 38-45.
- Cunningham, A. E. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology, 50*, 429-444.
- Cunningham, A. E., Perry, K. E., Stanovich, K. E., Stanovich, P. J. (2004). Disciplinary knowledge of K-3 teachers and their knowledge calibration in the domain of early literacy. *Annals of Dyslexia, 54*, 139-167.
- Ehri, L. C. (2002). Phases of Acquisition in Learning to Read Words and Implications for Teaching. *British Journal of Education Psychology: Monograph Series. 1*, 7-28.
- Ehri, L. C. & McCormick, S. (1998). Phases of word learning: Implications for instruction with delayed and disabled readers. *Reading and Writing Quarterly: Overcoming Learning Difficulties, 14*, 153-163.
- Fletcher, J.M., Shaywitz, S.E., Shankweiler, D.P., Katz, L., Liberman, I.Y., Steubing, K.K., Francis, D.J., Fowler, A.E., and Shaywitz, B.A. (1994). Cognitive profiles of reading disability: Comparisons of discrepancy and low achievement definitions. *Journal of Educational Psychology, 86*, 6-23.
- Foorman, B. R., Francis, D. J., Fletcher, J. M., Schatschneider, C., & Mehta, P. (1998). The role of instruction in learning to read: Preventing reading failure in at-risk children. *Journal of Educational Psychology, 90*, 37-55.
- Foorman, B.R. & Moats, L.C.(2004). Conditions for sustaining research-based practices in early reading instruction. *Remedial and Special Education, 25*, 51-60.

- Foorman, B.R. & Schatschneider, C. (2003). Measurement of teaching practices during reading/language arts instruction and its relationship to student achievement. In S. Vaughn & K.L. Briggs (Eds.), *Reading in the classroom: Systems for the observation of teaching and learning* (pp. 1-30). Baltimore: Paul H. Brookes Publishing Co.
- Francis, D. J., Shaywitz, S. E., Stuebing, K. K., Shaywitz, B. A., & Fletcher, J. M. (1996). Developmental lag versus deficit models of reading disability: A longitudinal, individual growth curves study. *Journal of Education Psychology*, 88, 3-17.
- Gilman, R. & Gabriel, S. (2004). Perceptions of school psychological services by education professionals: Results from a multi-state survey pilot study. *School Psychology Review*, 33, 271-286.
- Grace, K.E.S. (2007). *Phonics and Spelling Through Phoneme-Grapheme Mapping*. Boston, MA: Sopris West Educational Services.
- Hall, S., & Moats, L. C. (1999). *Straight talk about reading: How parents can make a difference during the early years*. Lincolnwood, IL: NTC/Contemporary Publishing Group.
- Hatcher, P. J., Hulme, C., & Snowling, M. J. (2004). Explicit phoneme training combined with phonic reading instruction helps young children at risk of reading failure. *Journal of Child Psychology and Psychiatry*, 45, 338-358.
- International Reading Association. (2003). *Investment in teacher preparation in the United States*. Newark, DE: Author.
- Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology*, 80, 437-447.
- Juel, C., & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly*, 35, 458-492.
- Kroese, J., Mather, N., & Sammons, J. (2006). The relationship between nonword spelling abilities of K-3 Teachers and student spelling outcomes. *Learning Disabilities: A Multidisciplinary Journal*, 14, 85-89.
- Lerner J. (1997). *Learning Disabilities: Theories, Diagnoses, and Teaching Strategies*. Boston, MA: Houghton Mifflin Co.
- Lindamood, P. (1994). Issues in researching the link between phonological awareness, learning disabilities, and spelling. In G. R. Lyon (Ed.), *Frames of reference for the assessment of learning disabilities* (pp.351-373). Baltimore: Paul H. Brookes Publishing Co.
- Lyon, G.R. (Ed.) (1994). *Frames of Reference for the Assessment of Learning Disabilities: New Views on Measurement Issues*. Baltimore, MD: Brookes Publishing.
- Lyon, G.R. (1995). Research Initiatives in Learning Disabilities: Contributions from Scientists Supported by the National Institute of Child Health and Human Development. *Journal of Child Neurology*. 10, 120-126.
- Lyon, G. R. (1995). Towards a definition of dyslexia. *Annals of Dyslexia*, 45, 3-27.
- Mather, N., Bos, C., & Babur, N. (2001). Perceptions and knowledge of preservice and inservice teachers about early literacy instruction. *Journal of Learning Disabilities*, 4, 471-482.
- McCardle, P. & Chhabra, V., (Eds.). (2004). *The voice of evidence in reading research*. Baltimore, MD: Paul H. Brookes Publishing Co.
- McCutchen, D., Abbott, R D., Green, L. B., Beretvas, S. N., Cox, S. Potter, N. S., et al. (2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities*, 35, 69-86.

- McCutchen, D. & Berninger, V. W. (1999). Those who know, teach well: Helping teachers master literacy-related subject-matter knowledge. *Learning Disabilities Research & Practice, 14*, 215-226.
- McCutchen, D., Harry, D. R., Cunningham, A. E., Cox, S. Sidman, S., & Covill, A. E. (2002). Reading teachers' content knowledge of children's literature and phonology. *Annals of Dyslexia, 52*, 207-228.
- Moats, L. C. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of Dyslexia, 44*, 81-102.
- Moats, L. C. (1995). The missing foundation in teacher education. *American Educator, 19*(2), 9, 43-51.
- Moats, L. C. (1997). California reading initiative: A revolution in education policy. *Perspectives, 23*(1), pp 1, 4-5, 9-12.
- Moats, L. C. (1999). *Teaching reading is rocket science: What expert teachers of reading should know and be able to do*. Washington, DC: American Federation of Teachers. (Item No. 39-0372).
- Moats, L. C. (2003). *The speech to print workbook*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Moats, L. C. (2004). Science, language, and imagination in the professional development of reading teachers. In P. McCardle & V. Chhabra (Eds.), *The voice of evidence in reading instruction* (pp. 269-287). Baltimore, MD: Paul H. Brookes Publishing Company.
- Moats, L. C. & Foorman, B. R. (2003). Measuring teachers' content knowledge of language and reading. *Annals of Dyslexia, 52*, 23-45.
- Moats, L. C. & Lyon, G. R. (1996). Wanted: Teachers with knowledge of language. *Topics in Language Disorders, 16*(2), 73-86.
- National Assessment of Educational Progress (NAEP). (2003). *The nation's report card: Reading 2003*. Washington, DC: Author.
- National Center for Education Statistics (NCES). (2001, January). *Digest of education statistics 2000*. Washington, DC: Author. Also available online: <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001034>.
- National Commission on Teaching and America's Future (n.d.) Retrieved April 1, 2006 from <http://www.nctaf.org/article/?c=14>
- National Institute of Child Health and Human Development (NICHD). (1998, June). *Why children succeed or fail at reading*. Bethesda, Maryland: NICHD Public Information and Communications Branch.
- National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: National Institutes of Health.
- National Research Council. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press. No Child Left Behind Act of 2001, PL 107-110, 115 Stat. 1425, 20 U.S. C. §§ 6301 et seq.
- No Child Left Behind Act of 2001, PL 107-110, 115 Stat. 1425, 20 U.S. C. §§ 6301 et seq.
- Nolen, P. A., McCutchen, D., & Berninger, V. (1990). Ensuring tomorrow's literacy: A shared responsibility. *Journal of Teacher Education, 41*(3), 63-72.
- O'Connor, R. E. (1999). Teachers learning Ladders to Literacy. *Learning Disabilities Research & Practice, 14*, 203-214.
- Podhajski, B. (1995). *TIME for Teachers*. Williston, VT: Stern Center for Language and

## Learning.

- Podhajski, B. (2000). TIME for Teachers: A model professional development program to increase early literacy. *Their World*, 35-37.
- Podhajski, B. & Nathan, J. (2005). Promoting early literacy through professional development for childcare providers. *Early Education and Development Journal*, 16, 23-41.
- Rath L. K. (1994). The Phonemic Awareness of Reading Teachers: Examining Aspects of Knowledge. *Unpublished Doctoral Dissertation*. Cambridge, MA: Harvard University.
- Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook for research in early literacy* (pp.97-110). NY: Guilford Press.
- Shaywitz S. E., Fletcher, J. M., & Shaywitz, B. A. (1994). Issues in the definition and classification of attention deficit disorder. *Topics in Language Disabilities*, 14, 1–25.
- Shaywitz, S. E. (2003). *Overcoming Dyslexia: A New and Complete Science-Based Program for Reading Problems at Any Level*. New York, NY: Alfred A. Knopf.
- Snow, C., Burns, S., & Griffin, P. (Eds.). (1998). Preventing reading difficulties in young children. Washington, DC: National Academy Press (NAP).
- Snow, C. E., Griffin, P., & Burns, M. S. (2005). *Knowledge to support the teaching of reading: preparing teachers for a changing world*. San Francisco: John Wiley & Sons, Inc.
- Spear-Swerling, L., Brucker, P. O., Alfano, M. P. (2005). Teachers' literacy-related knowledge and self-perceptions in relation to preparation and experience. *Annals of Dyslexia*, 55, 266-296.
- Stainthorp, R. (2004). W(h)ither phonological awareness? Literate trainee teachers' lack of stable knowledge about the sound structure of words. *Educational Psychology*, 24, 753-765.
- Stanovich, K.E., Siegel, L.S. (1994). Phenotypic performance profile of children with reading disabilities: A regression –based test of the phonological-core variable-difference model. *Journal of Educational Psychology*, 86, 24-53.
- Torgesen, J. K. (1997). The prevention and remediation of reading disabilities: Evaluating what we know from research. *Journal of Academic Language Therapy*, 1, 11-47.
- U.S. Department of Education (2005). *The nation's report card: Reading 2005* (NCES 2006-451). Retrieved from <http://nces.ed.gov/nationsreportcard>
- Vaughn, S., Linan-Thompson, S., Kouzekanani, K., Bryant, D. P., Dickson, S., & Blozis, S. A. (2003). Reading instruction grouping for students with reading difficulties. *Remedial and Special Education*, 24, 301-315.
- Vaughn, S., Moody, S., & Schumm, J. S. (1998). Broken promises: Reading instruction in the resource room. *Exceptional Children*, 64(2), 211-226.
- White House. (2001, September 8). *President emphasizes education reform in radio address*. Retrieved April 1, 2006, from <http://www.whitehouse.gov.news/releases/2001/09/20010908.html>
- Yell, M. L., Katsiyannas, A., & Shiner, J. G. (2006). The No Child Left Behind Act, adequate yearly progress, and students with disabilities. *Teaching Exceptional Children*, 38(4), 32-39.