First grade teachers' knowledge of phonological awareness and code concepts: Examining gains from an intensive form of professional development and corresponding teacher attitudes

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Abstract   The study examined the efficacy of an intensive form of professional development (PD) for building the knowledge of first-grade teachers in the areas of phonological awareness and phonics. The PD featured frequent in-class support from highly knowledgeable mentors for one school year, in addition to an introductory two-day summer institute and monthly workshops. Pre- and post-assessment of participants on a Teacher Knowledge Survey (TKS) indicated weak knowledge of phonological awareness and phonics concepts prior to PD and large, significant gains in each area by year-end. In addition, to investigate factors potentially associated with teachers' responses to training, a Teacher Attitude Survey (TAS) was administered before and after the PD. The TAS measured teachers' attitudes regarding PD, external and internal motivation to participate, intentions to actively engage in learning and implementing new instructional methods, sense of self-efficacy as reading instructors, and premises about reading instruction (e.g., about whole language). Attitudes on a subset of these factors, teachers' initial knowledge scores on the TKS, and years of teaching experience (estimated by age) accounted for significant portions of the variance in performance on the TKS after training.

Keywords   Literacy · Professional development · Reading instruction ·
Response to training · Teacher attitudes · Teacher knowledge

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Introduction

There is growing recognition that teachers of beginning readers often lack sufficient knowledge about the structure of spoken language or about the characteristics of the English writing system, both of which are necessary for explicit instruction in beginning reading (e.g., Brady & Moats, 1997; Moats, 1999; National Reading Panel [NRP], 2000). Research on reading acquisition has corroborated that for students to become successful readers, they must attain awareness of the individual phonemes in spoken words and they must develop fluent word reading ability (for reviews, see Adams, 1990; McCardle & Chhabra, 2004; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). Studies examining the benefits of directly teaching these skills in the early grades have demonstrated higher levels of student achievement in literacy and reduced numbers of students who are at-risk for reading failure (e.g., Ball & Blachman, 1991; Blachman, Tangel, Ball, Black, & McGraw, 1999; Blachman et al., 2004; Connor, Morrison, & Underwood, 2006; Cunningham, 1990; Lundberg, Frost, & Petersen, 1988; NRP, 2000; Torgesen et al., 1999, 2001). Further, if students do not acquire these basic reading competencies early on, their chances of catching up in the later grades are discouragingly small (Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997; Jorm, Share, MacClean, & Matthews, 1984; Juel, 1988; Spira, Bracken, & Fischel, 2005). Yet, the background knowledge and instructional methods needed to prevent and alleviate these problems generally are not taught sufficiently to prospective teachers (e.g., Brady & Moats, 1997; NRP, 2000; Snow, Griffin, & Burns, 1998; Walsh, 2006).

An emerging research focus is investigating the extent of increases in teachers' knowledge, as well as attendant changes in student achievement, that result from professional development (PD) targeting foundational concepts in the structure of spoken language and in the writing system. The purpose of the present study, part of a larger professional development project (Mastering Reading Instruction [MRIn]), was to evaluate the magnitude of gains in first-grade teachers' knowledge in the areas of phonological awareness and code concepts (i.e., phonics) that can be attained with an intensive method of professional development. In addition, because previous studies suggest wide differences in teacher knowledge, even after PD, we explored some of the possible factors that may contribute to differences in outcomes from professional development.

The professional content knowledge required to teach basic skills in reading

First grade is a critical year in the lives of young children: this is when they need to make essential inroads toward understanding and acquiring the alphabetic writing system in order to make timely progress toward skilled reading (Juel, 1988). As noted above, research now converges on the conclusion that explicit, systematic instruction in phoneme awareness and in orthographic principles facilitates that process and children's likelihood of success. A further necessary step in the study of effective teaching methods is to clarify what teachers need to know in order to be able to provide explicit instruction (cf., Cunningham, Perry, Stanovich, & Stanovich, 2004). Thus far, efforts to detail the requisite knowledge base has come

from analysis of the relevant structural units in spoken language and of the common orthographic elements in the English writing system (e.g., Bear, Invernizzi, & Templeton, 2007; Ganske, 2000; Henry, 2003; Moats, 2000; Shankweiler & Fowler, 2004). Studies of the development of phoneme awareness and code abilities also are sources of information about sequencing and relative difficulty levels of concepts for children (e. g., Fowler, Liberman, & Shankweiler, 1977; Geudens & Sandra, 2003; Henderson & Beers, 1980; Lovett, 1987; Siegel & Faux, 1989; Stuart, 1990; Uhry & Ehri, 2006; Yopp, 1988). In addition, the content and techniques of explicit remedial approaches to reading instruction provide information about orthographic concepts that often have been used to teach vowel patterns, facilitate reading of multisyllabic words, and improve spelling (Birsch, 2005).

Drawing on these sources, a small number of investigators have been specifying and studying the domain knowledge teachers should have that is pertinent for directly teaching foundational reading skills (e.g., Bos, Mather, Friedman Narr, & Babur, 1999; Cunningham et al., 2004; Foorman & Moats, 2004; Mather, Bos, & Babur, 2001; McCutchen & Berninger, 1999; McCutchen et al., 2002b; O'Connor, 2000). The content studied has varied slightly, but there is considerable convergence on which concepts are germane (e.g., being able to accurately segment and identify the phonemes in words). Here we will present the domain knowledge we have synthesized from the various sources. This closely corresponds with the recommendations of the researchers cited above, and in turn frames the content of the professional development in our project.

In terms of phoneme awareness, the teacher should understand why discovery of the individual speech sounds in spoken words is essential for understanding the alphabetic principle of the English orthography. To aid students in making that discovery, the teacher needs to know: (a) what the speech sounds of English are; (b) how phonological awareness develops and the characteristics of advanced levels of phoneme awareness;[1] (c) what kinds of activities foster development; (d) what speech sounds (and in which combinations) are easier for children to segment and identify, as well as which are harder and why; (e) what constitutes an adequate level of phoneme awareness for literacy purposes; and (f) how weaknesses in phoneme awareness are evident in reading and spelling errors. With that knowledge, teachers have the potential to choose appropriate activities, provide accurate feedback, ascertain students' instructional needs in phoneme awareness, and differentiate instruction accordingly (cf., Moats, 1994). Without it, the needs of students in this domain are likely to be misunderstood, the instruction offered may well be haphazard and inadequate (e.g., only targeting lower levels of phonological awareness such as rhyme or onset tasks), and feedback to students may be faulty and

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[1] Terminology regarding phonological awareness and phoneme awareness is not always used consistently in the literature. Here we follow the definitions specified in Scarborough & Brady (2002). In that glossary, phonological awareness is defined as a broad umbrella term encompassing all levels of awareness of the phonological structure of spoken words, including rhymes, syllables, onset-rimes, and individual phonemes. Awareness of the first three structural units more recently is being referred to as phonological sensitivity, while the term phoneme awareness is restricted to awareness of individual phonemes. At the phoneme level, development of phonemes commonly progresses from awareness of initial and final phonemes, to medial phonemes, to awareness of the individual phonemes in consonant clusters (e.g., at the beginning and end of a word such as 'blast').

confusing (e.g., incorrectly identifying the phonemes in a word by stating that the word 'thing' has five rather than three speech sounds, or that the last sound in the word 'may' is /y/).

The knowledge first grade teachers require for explicit code instruction dovetails with knowledge of phonemes and phoneme awareness. First, the teacher needs to know how the 44 speech sounds of English are represented by graphemes. The teacher should know which letter-sound correspondences are easier to acquire and which are commonly harder to acquire. Because explicit instruction builds on the concepts of consonants and vowels, teachers should be able to explain what they are and how they differ. Likewise, teachers should be able to assist children in understanding the distinction between blends (i.e., two letters, two phonemes) and digraphs (i.e., two letters, one phoneme), a common area of confusion. Further, because many phonemes are represented by more than a single letter (e.g., consonant digraphs, vowel teams) and many have multiple spellings (e.g., /k/ spelled k, c, ck, ch, or q; /i/ spelled ee, ea, ei, i.e, ey, or e), phonics requires more than simply teaching letter-sound correspondences. Experts in research on phonics-based instruction support explicitly teaching patterns and spelling contexts in order to give students insights and techniques to facilitate learning how to read and spell (e.g., Blachman et al., 2004; Cunningham et al., 2004; Foorman & Moats, 2004; Foorman et al., 2006; Henry, 2003; Juel & Minden-Cupp, 2000; Moats, 2000; Spear-Swerling & Brucker, 2003, 2004). One method, and a central part of our approach, teaches syllable types[2] to provide students with an understanding of contextual constraints that influence vowel spelling and pronunciation (e.g., Blachman et al., 1999).

Of course, teachers also require a skill set that goes beyond the knowledge base described here in order to be able to successfully implement systematic instruction in the classroom (e.g., mastery of instructional activities, efficient use of progress monitoring techniques, ability to differentiate instruction, knowing how to design and manage effective literacy centers). However, the knowledge base sets the stage for quality application in the classroom.

Teachers' knowledge of foundational reading concepts

The previous section briefly described the terms and concepts that should be the common currency and knowledge base of educators using explicit methods of beginning reading instruction. Yet, prior studies have revealed striking gaps in teachers' knowledge about the speech sounds in spoken English and about the nature of the orthography. Using informal surveys of linguistic knowledge, Moats (1994) first reported on the knowledge deficits in these areas for a diverse group of teachers who varied in years of experience. Other studies, using Moats' survey or similarly constructed measures, have consistently corroborated the finding of limited

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[2] Vowel spelling patterns, notably variable at the letter level, become quite predictable if what follows the vowel is considered. Six syllable patterns are commonly described: closed (VC: at, cup), open (V: me, I), silent-e (VCe: tape, hike), vowel team (VV: coat, boy), r-controlled (Vr: harp, cord) and consonant-le (Cle: maple, bugle) (see Henry 2003; Moats 2000). Cheney & Cohen (2000) further divide vowel team syllables into two subtypes: talkers (e.g., coat, bait) and whiners (e.g., ow, boy), an approach we adopted in our MRIn PD.

knowledge by teachers of linguistic and orthographic concepts that are pertinent for teaching phoneme awareness and beginning reading (Bos, Mather, Dickson, Podhajski, & Chard, 2001; Bos et al., 1999; Cunningham et al., 2004; Fielding-Barnsley & Purdie, 2005; McCutchen et al., 2002b; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003, 2004; Spear-Swerling, Brucker, & Alfano, 2005).

Several factors no doubt contribute to this state of affairs. First, while awareness of the speech sounds in spoken words is valuable for early stages of reading development, it appears that older readers, once proficient with using a combination of phonological and orthographic units, often find it difficult to use a purely phonemic analysis without training (Scarborough, Ehri, Olson, & Fowler, 1998). The results of many studies indicate that adults with no history of reading difficulties often lack adequate levels of phoneme awareness and in turn, of phoneme-grapheme correspondences, necessary for teaching beginning readers. Accordingly, future and current teachers need to be taught these concepts in teacher preparation or PD programs.

An impediment to taking such steps is the prevalence of beliefs in the education establishment that question the value of direct instruction in phoneme awareness and phonics concepts for reading instruction. Historically falling under the heading of Whole Language, the framework long dominant in the field of education rests on core assumptions that learning to read is natural and hence direct instruction is unnecessary (e.g., Allington, 1991, 2005; Goodman, 1996; Goodman & Goodman, 1979; Liberman & Liberman, 1990; Moorman, Blanton, & McLaughlin, 1994; Smith, 1994).

Two additional issues are whether teachers are aware of gaps in their knowledge and if they have corresponding concerns about their abilities to teach reading. In a large-scale study with kindergarten to third grade teachers, Cunningham et al. (2004) documented widespread knowledge deficits similar to those discussed earlier. Yet, 64% of the teachers rated themselves as having proficient or expert mastery of phoneme awareness and even more rated their knowledge and ability to teach phonics to be high. Cunningham and her colleagues note that inaccurate self-perceptions about teaching knowledge and skills may impede recognition of the need for further training. Similarly, confusion about key concepts and teaching methods would contribute to the difficulty teachers have evaluating their own expertise (e.g., Fielding-Barnsley & Purdie, 2005; Mather et al., 2001; McCutchen et al., 2002b).

Building teachers' knowledge

With increasing recognition of the need to provide teachers with training about foundational concepts in reading, efforts to do so have begun. Initial studies have reported significant gains in the knowledge of preservice and inservice teachers as a result of PD on the structures in spoken language and orthography. At the pre-service level, Spear-Swerling & Brucker (2003) obtained significant increases in knowledge for college students who received six hours of instruction on these concepts. However, the authors reported that only about half of the participants obtained a score of 80% or better on the post-test, indicating the need for more extensive training (for similar findings, see Spear-Swerling & Brucker, 2004; Spear-Swerling et al., 2005).

School-based studies have offered training over longer periods, providing both summer programs and support during the following school year (e.g., Bos et al., 1999; Foorman & Moats, 2004; Moats & Foorman, 2003). For example, McCutchen et al. (2002a) targeted in-depth professional development for kindergarten and first grade teachers on an array of topics including phonology, phonological awareness, orthographic concepts, handwriting, and discourse genres. The study documented links between teachers' levels of linguistic and orthographic knowledge and their instructional practices in the classroom, and correspondences of improved knowledge and practices with greater advances in students' literacy progress. These noteworthy outcomes were obtained, despite the fact that the magnitude of the average gain on the teacher knowledge survey was modest (an 8% increase to a post-test score of 53.6% correct).

The findings from the studies conducted thus far affirm the value of building teachers' background knowledge and skills for teaching foundational concepts in reading. Gains in teacher knowledge vary in the different studies, but in most the increases in knowledge were small to moderate. With the ultimate goal of improving students' reading achievement, the studies to date indicate that it takes considerable time and practice for teachers to master the relevant linguistic and orthographic concepts.

Teacher variables influencing response to professional development in literacy

In addition to the quality and depth of professional development, teachers' openness to participating and actively engaging in PD is likely to moderate the extent to which they benefit from the training. Studies of the relationships between teachers' attitudes and the efficacy of professional development have been conducted in various areas of education. These investigations have emphasized the relevance of several factors for explaining differences in teachers' responses to training, the first two of which overlap with influences discussed earlier concerning gaps in teacher knowledge of literacy concepts: (a) prior beliefs or attitudes regarding the philosophy underlying the training technique (Gregoire, 2003; Guskey, 2002; Mathewson, 1994); (b) self-efficacy of teaching ability (Gregoire, 2003; Mathewson, 1994); (c) attitudes regarding the process of continued learning (Giovannelli, 2003; Moore, Edwards, Halpin, & George, 2002); (d) perception of the professional development being offered (Gregoire, 2003; Mathewson, 1994); (e) external motivation (e.g., administrative policy, salary promotion, peer attitudes) (Gregoire, 2003; Guskey, 2002; Mathewson, 1994); (f) internal emotional states (e.g., level of satisfaction with student progress) (Mathewson, 1994); and (g) intention to incorporate the techniques, a construct in turn influenced in various potential ways by the previous attitudes and perceptions (Mathewson, 1994; Prochaska, Velicer, DiClimente, & Fava, 1988).

Beyond the factors listed above, models of response to PD have sometimes included the cyclical nature of behavior change or the effects of witnessing technique success during the PD (Guskey, 2002; Martin & Pear, 2003; Mathewson, 1994). As a consequence, attitudes held at the beginning of the training experience

may alter during PD, yielding a greater correspondence between final attitudes and knowledge outcomes.

A further contribution may be the effect of prior knowledge in the domain(s) addressed by the PD. One might anticipate links between initial knowledge levels and final knowledge scores for two reasons. First, in keeping with cognitive and pedagogical theories (e.g., Beier & Ackerman, 2005; Daneman, 1991; Willingham, 2006), relative knowledge levels might influence how easy it is to acquire new information: individuals with more prior knowledge would have more of a conceptual framework for the material being taught. Second, greater knowledge at the start might indicate greater receptivity to the philosophical orientation of the PD, reducing the occurrence of potentially conflicting views about how reading should be taught.

The present study

In the study reported here, our main goal was to evaluate whether substantial gains in first grade teachers' knowledge would be obtained with an intensive professional development program. Similar to prior studies, teachers were given training in a summer institute followed by monthly workshops. However, to extend and intensify the professional development, an in-class mentor component was included to provide greater feedback, modeling, and on-going support for the teachers as they learned the new information and methods, and as they tried them out in their classrooms.

The professional development focused primarily on phonological awareness and code concepts relevant to literacy instruction in first grade. Fluency of the skills being acquired by students was addressed to a lesser degree. (In the MRIn project, the number of domains of literacy introduced each year of PD is limited in order to allow teachers time to master what they are learning and ample opportunities to apply what they have learned in their classes. In later phases of the project, additional domains were introduced.) To assess teacher knowledge, a Teacher Knowledge Survey (TKS) was developed to correspond with the concepts identified earlier as important for teaching basic reading skills. The TKS assesses knowledge in other components of reading as well, serving in the present study as points of comparison for change in teacher knowledge. The instrument was administered before and after the year of PD, allowing evaluation of gains in knowledge and the association of initial knowledge with final performance.

In addition, to explore factors potentially associated with teachers' responses to the training, we also assessed teachers' attitudes and collected information about the extent of their teaching experience. A Teacher Attitude Survey (TAS) was created to measure teachers' attitudes regarding professional development, external and internal motivation to participate, intentions to actively engage in learning and implement instructional methods, individuals' sense of self-efficacy as reading instructors, and their premises about reading instruction (e.g., about the value of direct instruction).

Method

Participants

Sixty-five first-grade teachers from Connecticut participated in this portion of the MRIn professional development project. Demographic information about the teachers was obtained in survey format in a questionnaire attached to the front of the TAS. Eight teachers did not complete the demographic information (or the TAS), resulting in a pool of 57 teachers for the demographic data set.

The sample of 57 teachers consisted of 54 females and 3 males. The majority ($n = 48$) were White, whereas much smaller numbers were of other ethnicities (i.e., 4 African Americans, 1 Hispanic, 1 Asian, 1 Native American, 1 who self-classified as Other, and 1 who declined to report this information). Participants checked one of four age ranges presented in the survey: 20–25 years ($n = 6$), 26–35 years ($n = 18$), 36–45 years ($n = 10$), and 46+ years ($n = 23$). Most of these teachers reported having a Master's degree ($n = 43$), with the remaining fourteen saying they had attained a Bachelor's degree. The average number of reading courses they had prior to the present PD experience was 2.26 ($SD = 2.01$), although the number of courses taken ranged widely from zero to ten courses. This sample reflects the typical teacher profile in Connecticut, where individuals in the teaching profession are mainly White females with graduate-level college training. The mean duration of teaching experience for this group of teachers was 10.42 years ($SD = 9.76$). Because our question about teaching experience in the demographic section appears to have generated occasional confusion about whether teachers should report all teaching experience (e.g., special education classes) or only experience teaching regular early elementary classes, we have elected to use reported age values as a proxy for years of teaching experience in subsequent analyses. Spot-checking of participants confirmed consistent alignment between teachers' age bracket and years of experience teaching young students.

Measures

Teacher Knowledge Survey

The TKS has a maximum score of 60 points[3] with 20 points for items assessing phoneme awareness concepts (PA), 20 points for code concepts (C), 6 for fluency-related items (F), and 14 for knowledge pertaining to vocabulary and other aspects of oral language (OL). Expanding on the content of existing instruments, the PA and C sections included questions about each of the topics described earlier in the section *The professional content knowledge required to teach basic skills in*

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[3] The TKS included an additional 14 items that have been dropped from the present analyses. With the goal of reducing the number of items both for psychometric purposes and to avoid over-representing a particular concept (e.g., counting phonemes in spoken words), ten items were dropped. Another four items were eliminated because, upon further reflection, we felt they were poor questions (e.g., had ambiguous wording). Therefore, from the original 74 items, the number included in the present analyses was reduced to 60 items.

reading. (See Appendix 1 for a list of the items included in the PA and C sections.) In addition, the F items addressed the importance of fluency for reading success, target goals for fluency in the first grade, and ways to foster improvements in fluency. Lastly, the OL items encompassed concepts about vocabulary, narrative development, and comprehension. The measure was administered to all 65 participants prior to any MRIn PD and again at the end of the school year.

Reliability for the TKS was assessed using Cronbach's coefficient alpha (Cronbach, 1951) for times one and two (i.e., before and after training). For the entire measure (60 items), reliability was moderate at time one and high at time two ($\alpha = .63$, $\alpha = .81$). Reliability statistics also were calculated for both time points for each of the subsections. PA (20 items) reliability was low at time one and high at time two ($\alpha_1 = .36$, $\alpha_2 = .76$). For C (20 items), reliability was high at time one and dropped to moderate by time two ($\alpha_1 = .73$, $\alpha_2 = .54$). Reliability for F (6 items) was low at both time points ($\alpha_1 = .38$, $\alpha_2 = .16$). Because the number of items in the fluency section was small and the reliability level is inadequate, the analyses presented focus primarily on teacher knowledge in the areas of PA and C. For the OL portion of the TKS, not the focus of the present paper, the reliability was low at time one and moderate at time two ($\alpha_1 = .07$, $\alpha_2 = .45$). (We note that in subsequent analyses with additional cohorts from the larger project, the F construct has continued to be unstable and needs more extensive revision than the two other subtests reported here [Smith, 2008].) On the test as a whole, and for the PA and C subtests, we have observed that increased amounts of training generally seem to create more stable scores. However, further test development is needed to improve the psychometric properties for each of the subtests in the TKS.

Data analyses were based on raw scores for the number correct for each section. All 65 participants were included in analyses when only TKS scores were used. However, for analyses using TKS data in combination with teacher attitude or demographic information from the TAS, TKS scores for the subset of 57 teachers were used for whom complete data were available.

Teacher Attitude Survey

The TAS included 59 Likert-type items with a five-point scale for responding (strongly disagree [1] to strongly agree [5]). Questions were created to correspond with those identified by previous research as linked to response to PD. These were organized in six sections: The first addressed self-efficacy about teaching children to read in terms of basic reading skills and other skills, similar to questions in other studies of literacy self-efficacy (17 items); the second targeted attitudes regarding approaches to reading instruction that reflect direct instruction and whole language perspectives (8 items); and the remaining four sections addressed different aspects of attitudes about professional development (34 items) (see Smith, 2008, for further discussion of TAS development). The sections regarding professional development included the following subtopics: (a) How do you feel about continued professional development? (5 items); (b) How do you feel about professional development from Haskins? (9 items); (c) Why are you participating in the PD from Haskins?

(12 items designed to assess both external [e.g., The only reason I am participating is because of my school administration] and internal factors [e.g., My purpose for participating is to learn new teaching methods]); (d) What are your plans regarding degree of involvement in the PD from Haskins (e.g., After being trained, I plan to assess my students' progress; I intend to take risks trying new methods), or, at the end of the year, what was your degree of involvement? (8 items). The teachers were asked to complete the TAS prior to any professional development and again at the end of the school year.[4]

Following review of the data to evaluate whether items appeared to function as intended (e.g., whether the items targeting particular constructs correlated appropriately), scores were calculated (averaging the scores on the five item scales) for seven categories of responses: self-efficacy to teach basic reading skills (Cronbach's coefficient alpha, pre and post: $\alpha_1 = .82$, $\alpha_2 = .86$), self-efficacy to teach other reading skills ($\alpha_1 = .83$, $\alpha_2 = .84$), extent of endorsement of whole language premises ($\alpha_1 = .66$, $\alpha_2 = .60$), attitudes pro-PD ($\alpha_1 = .63$, $\alpha_2 = .72$), attitudes con-Haskins PD ($\alpha_1 = .82$, $\alpha_2 = .76$.), intentions to engage ($\alpha_1 = .89$, $\alpha_2 = .94$), and internal motivation ($\alpha_1 = .77$, $\alpha_2 = .84$). A remaining category, intended to assess external motivation, had items that did not align well and some that appeared to have been interpreted differently prior to and after PD. Consequently, the decision was made to include four of the items and to analyze the pattern of results for each of these items separately. The four items probed attitudes about the importance of release time for the PD, the importance of receiving Continuing Education Units (CEUs), whether the administration was positive about the PD, and whether the teacher's only reason for participating was because the administration encouraged them to do so. The present analyses utilize pre- and post-scores for each participant for each of the seven scales and the four individual items. The attitude data is available for 57 of the 65 teachers who completed the TAS on both occasions (i.e., as noted earlier regarding the attached demographic survey, eight individuals did not do so).

Procedure

In the larger study, 38 schools qualified to participate in the MRIn project out of the 42 for which we received applications (i.e., all of the first-grade teachers wanted to participate, there was administrative support, the school served pupils from lower socio-economic communities, participants agreed to random assignment to one of two professional development conditions, and they were willing to engage in the research components of the study [e.g., assessment of teacher knowledge and attitudes]). The schools were placed in categories according to school size (i.e., number of first-grade classrooms) and average poverty level of students (i.e., using

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[4] Of the 57 participants, 11 (19%) had partial data. Each of these 11 individuals had missing data for one or two questions. (Out of the 59 items on the TAS, 17 of the items (28%) had one to two cases with missing data.) Because the data set is small, and because the review of the missing data indicated that assumptions for data missing at random were met, multiple imputation (MI) of missing data was performed. Subsequent statistical analyses for TAS data utilized an averaged imputed dataset, following guidelines reported by Rubin (1976; 1987).

the classification for economic status utilized by the Connecticut State Department of Education). After the schools were sorted by those criteria, they were randomly assigned to conditions within each category. The 65 teachers in the condition examined in this paper (i.e., professional development with in-class mentor support) came from 19 public elementary schools in nine districts in Connecticut. During the PD, the schools in the project used a variety of reading series and programs including Success for All, Harcourt Trophies, Scott-Foresman, and Guided Reading.

As noted earlier, the professional development began with a 2-day Summer Institute during which the participants were given an overview of research findings on reading development and an introduction to the content of the professional development they would be receiving. Subsequent monthly workshops were based on modules developed for each of the main content areas to be covered that year (primarily phonological awareness and phonics); the same content was presented by each of the mentors, utilizing powerpoint presentations and materials developed for each workshop. The modules encompassed relevant research, instructional content, and application to the classroom. All of the topics described in the introduction as relevant for first grade reading instruction in phonological awareness and phonics instruction were addressed in the PD. In addition to the content knowledge, training included teaching methods for direct instruction, how to conduct and use assessment procedures, ways to engage students in discovery and practice activities, and how to differentiate instruction. The emphasis in the PD was to foster the necessary knowledge and skills for reading instruction, involve the teacher as an active participant in learning, and provide sufficient opportunities for practice and feedback (Gersten, Chard, & Baker, 2000; Richardson & Anders, 2005).

Seven mentors participated in the delivery of the PD. Four of the mentors participated on a full-time basis and each worked with 12 teachers during the year, visiting each teacher approximately one time per week. The remaining three mentors participated part-time, each supporting the learning of six teachers. The mentors are highly knowledgeable experts in direct methods of reading instruction who have backgrounds in a variety of fields (e.g., special education, speech and language, regular education, reading disabilities). During an earlier professional development effort at Haskins Laboratories, the mentors were recruited based on their knowledge of reading development and reading instruction, as well as for their interpersonal skills. In addition, during this earlier project they had participated in continuous training with the project leaders to increase their knowledge and hone their mentoring skills in the different components of reading instruction. For the current MRIn project, the mentors were full partners in the design and content of the PD. During the present project, the mentors participated in two meetings each month with one or both of the co-Principal Investigators to discuss the content, methods and timing of each PD workshop, as well as to address issues arising in individual schools.

The individual support provided for each teacher by a mentor occurred, for the most part, in the teacher's classroom, adapted to the wishes and needs of the teacher. Following a monthly workshop at which a new lesson or technique was introduced, the mentor might model the lesson in the teacher's classroom with the teacher observing the process and the students' responses. Subsequently, the mentor might

co-plan with the teacher regarding the implementation of the lesson plan and later observe the teacher conducting the lesson herself. Afterwards, the teacher could discuss her questions and concerns, asking for clarification or advice, and the mentor could provide feedback. A key component of the coaching related to the administration, scoring and interpretation of student assessment measures in order to foster teachers' abilities to identify students' instructional needs and progress. The mentors assisted teachers with the linkage between assessment results and instructional planning.

Results

Teacher knowledge

The descriptive data for teacher performance on the TKS are presented in Table 1. Total test scores and scores for each subsection (i.e., PA, C, F and OL) are presented for the entire cohort ($N = 65$). The levels of performance at the outset were moderately low with a mean initial TKS score of 25.26 out of 60 points (i.e., 42% correct). By the end of one year of PD, gains were obtained on all subtests and on the total score. For the three areas that were taught during the year, the average knowledge score at the outset was 19.59 points (42.6% correct) and at the end was 34.07 points (74.1% correct).

Correlational analyses were calculated to examine the associations between teachers' knowledge in the different areas of basic reading instruction before and after the professional development (see Table 2). Teachers' performance on the PA and C sections of the TKS correlated significantly before the training, as did PA and F scores; all three areas correlated significantly after the PD. Initial scores also correlated significantly with teachers' post-scores for PA and C. Initial scores also were significantly correlated with the change scores. However, we note that the direction of the association was negative. In other words, those teachers who had higher scores at the outset generally had smaller gains, likely to have occurred because of a reduced range of possibility for further knowledge gains. Likewise, teachers with initially low scores had the potential for larger improvement on the

Table 1 Means and standard deviations for performance on the TKS ($N = 65$)

Portion of TKS	Max. score	Pre			Post		
		M	*SD*	% Correct	*M*	*SD*	% Correct
PA	20	7.60	2.49	38	13.97	3.69	70
C	20	9.55	3.57	48	16.05	2.37	80
F	6	2.44	1.26	41	4.05	1.14	68
OL[a]	14	5.66	1.54	40	6.31	2.07	45
Total TKS	60	25.26	5.76	42	40.37	7.13	–[b]

[a] OL was not covered in this phase of the PD project

[b] Not averaged because only three of TKS components were taught during the year of PD

Table 2 Correlations among pre-, post-, and change scores on the Teacher Knowledge Survey ($N = 65$)

	Pre				Post			
	PA	C	F	OL	PA	C	F	OL
Pre								
PA	1.00							
C	.26*	1.00						
F	.29*	.20	1.00					
OL	.05	.05	.27*	1.00				
Post								
PA	.25*	.38**	.28*	.12	1.00			
C	.32*	.45**	.32**	.16	.69**	1.00		
F	.38**	.26*	.24	.15	.31*	.32**	1.00	
OL	.20	.25*	.36**	.41**	.29*	.31*	.44**	1.00
Change score pre/post								
PA	−.41**	.19	.08	.08	.79**	.45**	.05	.15
C	−.06	−.76**	.01	.06	.09	.23	−.04	−.05
F	.04	.02	−.67**	−.11	.00	−.03	.57**	.03
OL	.17	.22	.17	−.35**	.21	.19	.33**	.72**

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

TKS measures. Therefore, for outcome measures, we focus more on final scores than on change scores. For the area not taught during this phase of the PD, OL, performance at the beginning was not associated with PA and C knowledge, suggesting that previous training in these basic skills was separate from training that may or may not have occurred regarding oral language development and instruction.

A repeated measure multivariate analysis of variance (MANOVA) was performed with the total TKS scores, as well as on the four TKS subtests (PA, C, F and OL) in order to analyze whether changes in knowledge levels were significant. There was a significant effect for time for the combined independent variables, Wilk's Lambda $= .12$, $F (4, 61) = 114.37$, $p < .0001$, $\eta_p^2 = .88$. Follow-up repeated measure analyses of variance (ANOVAs) were carried out on the dependent variables. For the subtests, the results were: PA, $F (1, 63) = 172.36$, $p < .0001$, $\eta_p^2 = .73$; C, $F (1, 64) = 257.01$, $p < .0001$, $\eta_p^2 = .80$; F, $F (1, 64) = 75.2$, $p < .0001$, $\eta_p^2 = .54$; and OL, $F (1, 64) = 6.7$, $p < .01$, $\eta_p^2 = .09$. Thus, there are effects for time with final teacher knowledge scores in the areas that were targeted in the PD being significantly higher than their respective beginning scores.[5] Further, the effect sizes for gains in the focal areas of the PD are robust.

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[5] Although gains in knowledge were obtained on the F portion of the measure, in light of the poor reliability of this section of the TKS, we cannot draw strong conclusions about that portion of the teacher knowledge survey. In terms of OL concepts, not focal points of the PD, knowledge remained low at the end of the year with an average of 45% correct at year end. While this final score was significantly higher than the starting point of 40% correct, it represented an average gain of less than one item and probably occurred as a result of occasional questions from teachers about oral language topics.

Table 3 Descriptive data for performance on constructs in the TAS; univariate tests of change from pre- to post-testing (df = 1, n = 57)

Attitude constructs		Pre		Post		ANOVA Results		
	Max. score	M	SD	M	SD	F	p	η^2
Average of sets of items								
Self-efficacy—basic skills	5	3.83	.48	4.10	.42	21.00	<.001	.27
Self-efficacy—other reading	5	3.57	.59	3.60	.59	.27	.606	.01
Whole language philosophy	5	2.87	.53	2.52	.52	19.24	<.001	.26
Pro-professional development	5	4.05	.48	4.30	.48	14.85	<.001	.21
Con-Haskins PD	5	2.35	.58	1.91	.54	41.71	<.001	.43
Intentions to engage	5	4.24	.52	4.54	.63	18.25	<.001	.25
Internal motivation	5	4.05	.52	4.25	.60	9.57	.003	.15
Individual items								
Release time important	5	4.02	.81	4.49	.63	13.21	<.001	.19
CEUs important	5	3.33	1.24	3.75	1.17	7.78	.007	.12
School administration very Pro-PD	5	4.30	.87	4.47	.73	2.44	.124	.04
Administration—only reason participate	5	2.51	1.28	1.82	1.26	23.23	<.001	.29

Teacher attitudes

The descriptive data for teachers' performance for the TAS are presented in Table 3 for the 57 participants who completed the survey. To ascertain whether the changes in teachers' attitudes were significant, a repeated measure MANOVA was performed with the attitude variables on the TAS. There was a significant effect for time for the combined dependent variables, $\Lambda = .34$, $F (11, 46) = 8.15$, $p < .001$, $\eta_p^2 = .66$. Follow-up repeated measure ANOVAs (see the right side of Table 3) indicated significant effects of time with higher scores at the end of the year for self-efficacy of ability to teach basic reading skills (self-efficacy—basic skills) and for positive attitudes toward PD in general (pro-PD). Correspondingly, significantly lower scores were obtained at the end of the year on items tapping negative attitudes toward the Haskins PD in particular (con-Haskins PD). Likewise, a significant drop was obtained in the teachers' ratings of whether the administration was the only reason they were participating. Other indications of positive shifts in attitudes are indicated by significant increases in teachers' internal motivation and intentions to engage scores, along with greater appreciation of the importance of having release time for the PD. A significant effect of time also was obtained for the ratings of whole language beliefs, but in this case whole language scores by teachers were significantly lower on the second administration of the TAS. Nonsignificant differences in attitudes at year end were obtained regarding whether the administration was enthusiastic about the PD, whether CEUs were important, and regarding teachers' self-efficacy about teaching 'other' aspects of reading instruction not addressed in the current PD. In short, assessment of teacher attitudes indicates that positive feelings about the PD increased, as did personal commitment

Table 4 Correlations among teachers' attitudes and age prior to professional development ($n = 57$)

	1	2	3	4	5	6	7	8	9	10	Age
1. Self-efficacy—basic	1.00										.24
2. Self-efficacy—other	.53**	1.00									.21
3. Whole language	-.05	-.16	1.00								-.03
4. Pro PD	.18	.03	-.05	1.00							-.17
5. Con-Haskins PD	.08	.07	.19	-.48**	1.00						.25
6. Intent to engage	-.13	-.12	-.27*	.59**	-.54**	1.00					-.13
7. Internal motivation	-.11	-.25	-.02	.55**	-.44**	.71**	1.00				-.29*
8. Release time important	.22	.13	.10	.32*	.17	.06	.13	1.00			.13
9. CEUs important	-.18	.06	.12	.01	.25	-.13	-.03	.45**	1.00		.20
10. School administration Pro PD	.11	.08	.06	.11	.19	.13	.19	.14	.10	1.00	.16
11. Administration—only reason to participate	.34*	.32*	.13	-.23	.42**	-.33*	-.41**	.11	.10	.28*	.59**

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Table 5 Correlations among teachers' attitudes and age after professional development ($n = 57$)

	1	2	3	4	5	6	7	8	9	10	Age
1. Self-efficacy—basic	1.00										.00
2. Self-efficacy—other	.38**	1.00									.00
3. Whole language	-.25	-.03	1.00								.08
4. Pro PD	.22	-.09	-.14	1.00							-.31*
5. Con-Haskins PD	-.35**	.00	.00	-.56**	1.00						.39**
6. Intent to engage	.32*	.00	-.11	.64**	-.60**	1.00					-.25
7. Internal motivation	.29*	-.01	.08	.52**	-.66**	.67**	1.00				-.19
8. Release time Import.	.20	-.02	.01	.50**	-.50**	.62**	.64**	1.00			-.23
9. CEUs important	.10	.12	-.01	-.01	.02	.14	.09	.12	1.00		.13
10. School administration Pro PD	.27*	-.08	-.04	.11	-.19	.07	.33*	.34*	-.13	1.00	.12
11. Administration—only reason to participate	-.12	.14	-.01	-.47**	.71**	-.70**	-.70**	-.57**	-.16	-.04	.36**

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

to participate and heightened recognition of the need for time to learn the instructional concepts and methods.

To review the relations among the attitude constructs, correlations were calculated for the responses prior to the PD and after the training. Before the PD (Table 4), the two self-efficacy constructs correlated strongly, suggesting that teachers' perceptions of their abilities to teach different components of reading initially tended to be consistent. For the group as a whole, positive correlations were obtained between constructs reflecting level of commitment to take part in the PD (e.g., significant correlations between intent to engage and internal motivation and between intent to engage and pro-PD ratings). It is noteworthy that age of participants had a significant, negative association with internal motivation and a corresponding strong link with the administration being the only reason to participate: older teachers in this sample more often were somewhat less positive about the up-coming PD than were younger, less-experienced teachers. Agreement with whole language principles also was significantly negatively correlated with intent to engage, suggesting that those teachers who initially expressed stronger support of whole language were more reticent about actively participating.

After the PD (see Table 5), the association between whole language ratings and intent to engage was no longer significant, perhaps reflecting greater acceptance by the participants that the content of the PD was worthwhile. Other significant correlations point to two different patterns of attitudes. On the one hand, teachers' evaluations of their self-efficacy to teach basic reading skills correlated significantly at the end of the year with their personal goals (intent to engage and internal motivation): the higher the teacher's sense of self-efficacy, the higher her internal motivation to participate in the PD and the greater her intention to engage in the activities. Similarly, the importance of release time was now significantly correlated with those variables as well: having time to receive PD was valued more highly. Likewise, greater self-efficacy to teach basic skills corresponded with lower con-Haskins PD attitudes. On the other hand, some teachers did not have as positive attitudes: age was still significantly negatively correlated with pro-PD ratings and positively linked with administration as the only reason to participate.

Association of attitudes with performance on the TKS

At the beginning of the study, attitude ratings were unrelated to performance on the TKS: actual knowledge levels on the sections of the TKS did not significantly correspond with teachers' ratings of their abilities to teach those components of beginning reading (e.g., self-efficacy basic/PA score: $r = .21$; self-efficacy basic/C score: $r = .07$). Likewise, opinions relating to whole language and with how positively teachers felt about the upcoming PD did not correlate significantly with their knowledge scores. Furthermore, age did not correlate significantly with knowledge (e.g., age/PA score: $r = -.04$); age/C score: $r = .11$): neither younger teachers who more recently graduated from teacher preparation programs nor older teachers with more classroom experience did better on the TKS.

Table 6 Summaries of hierarchical regression analyses for variables predicting teachers' PA and C knowledge scores at the end of one year of professional development ($N = 57$)

Variable	B	SE B	β	t	Significance
a. *Pre-knowledge scores predicting post-PA performance*[a]					
Constant	9.182	1.616		7.724	<.001
Pre-PA knowledge	.307	.182	.219	.098	ns
Pre-C knowledge	.299	.132	.294	2.260	<.05
b. *Pre-knowledge scores predicting post-C performance*[a]					
Constant	12.101	.955		12.676	<.001
Pre-C knowledge	.212	.078	.333	2.716	<.01
Pre-PA knowledge	.267	.108	.304	2.479	<.05
c. *Pre-knowledge scores and attitude/age variables predicting post-PA performance*[b]					
Constant	.724	3.673		.197	ns
Pre-code knowledge	.312	.095	.307	3.295	<.01
Pre-importance of release time	2.405	.472	.534	5.095	<.001
Post-self-efficacy—basic skills	1.939	.809	.223	2.396	<.05
Pre-importance of CEUs	−1.327	.309	−.450	−4.292	<.001
Teacher's age/experience	−.944	.323	−.276	−2.923	<.01

[a] No additional variance was accounted for by pre-fluency or oral language scores

[b] For post-C performance, no additional variance beyond that accounted for by pre-knowledge scores was contributed by attitude/age variables.

However, at the end of the year of PD, a small number of significant associations were evident between initial attitudes and year-end performance on the PA portion of the TKS. Teachers' initial ratings of the importance of release time corresponded significantly with final PA performance ($r = .36$, $p < .01$), suggesting that desire to receive training at the outset corresponded with how much teachers learned. In contrast, higher ratings at the outset of the importance of receiving CEUs had a significant negative correlation with final PA scores ($r = −.28$, $p < .05$). This pattern suggests that CEUs served as a consolation for those who were less enthused about taking part and, in turn, those teachers learned less. A significant negative association also was evident between age and final knowledge in PA ($r = −.27$, $p < .05$). Although there had not been a significant correlation between knowledge scores and age at the beginning, older teachers tended to learn less during the year of PD.

By the end of the year of training, self-efficacy to teach basic reading areas now correlated significantly with performance on the PA section of the TKS ($r = .32$, $p < .05$) and had a positive trend ($p = .06$) with scores on the C portion. This outcome suggests that teachers had acquired a better understanding of their own skill level for providing basic reading instruction. In contrast, a significant negative correlation was obtained between change scores on PA and con-Haskins PD: those teachers who felt less positively about the PD at the end had increased their scores less than those who felt more positively.

Predicting final PA and C knowledge scores

To examine how much variance in the final TKS scores on PA and C concepts can be accounted for with the variables studied, hierarchical multiple regression analyses were conducted for each of these two TKS components. First, the focus was on variance accounted for by prior knowledge. For final PA knowledge, a significant model emerged (Adjusted $R^2 = .14$; $F = 5.70$, $p < .05$). Only prior C knowledge was found to be a significant predictor of PA knowledge at the end of the year (Table 6a). For final C scores, a significant model also was obtained (Adjusted $R^2 = .24$; $F = 9.78$, $p < .001$) in which both prior phonological awareness and prior code knowledge made significant contributions (Table 6b). Prior phonological awareness scores accounted for 18% of the variance; prior code scores added a further 8% of variance accounted for. For both of these analyses, tolerance values were .904 for each of the code and phonological scores, negating the occurrence of multicollinearity between the variables.

Subsequently, to examine whether additional variance in final PA knowledge was accounted for by attitude and age variables, a hierarchical regression analysis was conducted that included initial knowledge on the C section of the TKS and then each of four variables that were significant predictors of final PA (pre-release time important, post-self-efficacy for basic skills, pre-CEUs important, and age). Tolerance scores ranged from .764 to .967, again indicating lack of collinearity between the predictor variables. A significant model emerged (Adjusted $R^2 = .53$; $F = 13.58$, $p < .001$) with each of the variables accounting for significant unique variance (Table 6c). C knowledge prior to the PD accounted for 13% of the final PA knowledge score. For the attitude and age variables, the amounts of additional variance accounted for were: pre-release time (11%), post-self-efficacy to teach basic skills (6%), pre-important to receive CEUs (20%), and age (7%).

In the case of final C knowledge, none of the attitude or age variables accounted for additional variance, perhaps because final C scores were fairly uniformly high.

Discussion

Our primary goal in this study was to examine the efficacy of an intensive form of professional development for building the knowledge of teachers in the areas of phonological awareness and phonics. The year-long PD featured weekly in-class support from highly knowledgeable mentors, in addition to an introductory 2-day summer institute and monthly workshops.

Encouragingly, this model of PD generated substantial overall gains on the survey of teachers' knowledge created for the study. Prior to receiving any training, on the PA portion of the survey, the participants on average were only 38% correct; on the C portion, the average performance level was 48% correct. By the end of the year the average had increased to 70% correct for the PA content and 80% correct for the C content with large effect sizes for each (.73 and .80, respectively). These results converge with other findings of increases in professional knowledge with instruction (e.g., Bos et al., 2001; McCutchen et al., 2002b; Spear-Swerling &

Brucker, 2003, 2004). Although research has not yet determined precisely what levels of teacher knowledge are requisite for effective teaching in these areas, there are indications that higher levels of knowledge correspond with better student achievement (e.g., McCutchen et al., 2002a; Spear-Swerling et al., 2005). The average increases of over 30% in the scores on both the PA and C portions of the TKS reflect noteworthy improvement in teachers' knowledge of a number of important elements for each of these domains. Initial knowledge levels accounted for 14% of the variance in final phonological awareness knowledge and 24% of the variance in final code knowledge. Even after confirming the relevance of starting knowledge, most of the variance in knowledge outcomes was not attributable to background preparation for the material.

Determining what were the critical properties of the professional development offered in this program is beyond the scope of this study. Several attributes are likely to have contributed to the gains achieved. The year-long program only targeted two primary content domains, phonological awareness and code/phonics concepts, allowing time for multiple workshops and follow-up practice on each topic. In addition, the mentors had in-depth knowledge of the content, including how the components of literacy develop, how to use formal and informal assessment results to guide instructional decisions, mastery of the background concepts in phonology and orthography, and expertise in child-friendly ways to directly teach the relevant skills and content. They also were knowledgeable about coaching principles and deeply committed to sharing evidence-based practices with teachers. Further, a particular design feature of this PD was the fact that the mentors supported each teacher on a nearly weekly basis in the teachers' classes. This extended time on a topic provided opportunities for the mentor to discuss student assessment results, model differentiation of instruction to meet individual student needs, discuss lesson planning, and as a consequence increased both the amount of instructional time for each teacher and the application of the content to her students. At this point one cannot conclude whether the gains stem from the extent of classroom support provided for individual teachers or from other attributes. However, we can note that although a few teachers balked at a mentor observing in their classes, most indicated that the support was very valuable (e.g., "Having (*mentor*) come into my class has made such a positive impact on my teaching techniques as well as on my students' learning;" "I learned a great deal from the modeling activities and have incorporated many of the materials into my reading lessons and centers.").

Accordingly, a further factor in teacher outcomes pertains to how teachers feel about participating in the professional development (Gregoire, 2003; Mathewson, 1994). The second goal of the present study was to investigate whether teachers' attitudes would significantly correspond with their knowledge gains from the professional development. Using a new instrument created for this purpose, the TAS, teacher attitudes were assessed before and after the project. At the outset, the set of attitude variables bore little relationship to teachers' performance on the knowledge survey, as predicted. Notably, self-efficacy ratings by teachers did not significantly correspond with initial performance levels on the TKS. This result converges with outcomes of other studies showing discrepancies between teachers'

evaluations of their effectiveness at teaching basic reading skills and their actual knowledge levels on measures tapping basic skills (e.g., Cunningham et al., 2004).

Yet, a small number of variables on the TAS emerged as accounting for approximately 44% the variance in the teachers' PA performance at the end of the year of training. Two variables appear to have tapped negative attitudes or reluctance about participating at the outset. First, the importance of earning CEUs was inversely related to final knowledge of phonological awareness constructs, accounting for 20% of the variance: teachers who placed more value at the outset on earning CEUs, an external motivation, tended to learn less during the year. Second, age of the teachers was negatively related to final knowledge of phonological awareness, accounting for 7% of the variance. Review of the correlations on the TAS revealed a constellation of less favorable responses linked with age: older teachers more often indicated that the main reason for participating stemmed from administrative pressure and were significantly less enthusiastic about the Haskins PD. Although we had not predicted this pattern, it became apparent that newer teachers in this cohort more often felt unprepared for teaching students to read and welcomed the PD, whereas some of the veteran teachers saw less value in further training, a fact that undoubtedly impeded learning of new information and methods (Richardson & Anders, 2005). This difference in perspective for newer vs. experienced teachers was expressed in some of the comments submitted at the end of the year (e.g., from a new teacher: "Being a first year, first-grade teacher, I feel the Haskins techniques and strategies that I was introduced to were extremely helpful and effective"; from a teacher nearing retirement: "I believe this program would be best for beginning teachers, not those with 30 plus years of teaching.").

On the positive side, those teachers who placed more emphasis on the importance of having release time in order to have the opportunity to participate in the professional development tended to have learned more about phonological awareness by the end of the year (accounting for 11% of the variance in PA scores). One additional variable, self-efficacy to teach basic reading skills, emerged at the end of the year as a significant predictor of final PA performance. In this case, teachers who had learned more were significantly more likely to have more confidence about their abilities to teach children to read. Not surprisingly, the combination of knowledge and confidence is empowering. The unsolicited remarks from many of the teachers reflected their greater sense of efficacy as teachers of reading. Two such comments are included here: "…my teaching competence increased significantly and my students' reading progress shows it"; "After working with Haskins this year, I feel very empowered. I am much more confident in my ability to assess and plan instruction for my students.").

These results underscore the importance of positive teacher attitudes for professional development efforts. In other fields studying how to foster changes in behavior, research has corroborated that there are stages of readiness for change (i.e., precontemplative, contemplative, action, maintenance) and has shown that the nature of intervention has to be tailored to an individual's particular stage (Prochaska et al., 1988). These issues raise questions about how to determine which teachers might benefit most from PD and how to foster readiness in others.

Limitations of the study and future directions

A number of characteristics of the study limit the interpretation of the results at this time. One is the lack of information regarding actual teacher practices and student achievement. Despite the fact that teacher knowledge is a necessary underpinning for what is taught in class, the bottom line is whether the increases in knowledge attained result in higher levels of reading success by students. In a later phase of the project, we plan to analyze whether there are associations between teacher knowledge and classroom outcome measures (i.e., teacher practices and student performance) in multiple PD conditions.

In addition, we want to acknowledge issues pertaining to assessment of teacher knowledge. The instrument we developed, the TKS, like others employed in research studies on this topic, has not been normed or standardized. The knowledge it tested has construct validity from a theoretical perspective (e.g., Rayner et al., 2001), was selected based on research evidence about the value of teaching phoneme awareness and phonics concepts explicitly (e.g., NRP, 2000), and makes pragmatic sense (i.e., if a teacher has difficulty identifying the number of phonemes in a word, she is likely to have difficulty providing constructive feedback or instruction on phoneme awareness or phoneme-grapheme correspondences). Yet, at the present we cannot make normative claims about the significance of different knowledge levels on the TKS. In the future it will be important to verify the specific knowledge and skills of teachers who have expertise in explicit teaching of basic reading skills versus those who do not to help validate the composition of teacher knowledge evaluation tools and the content of training programs.

Lastly, we want to acknowledge that in this study we only have been able to identify a modest portion of the variance accounting for teachers' responses to training and final knowledge scores. The TAS, drawing on theories about response to PD, was an exploratory effort to ascertain some of the sources of variability. The measure had reasonable reliability and the patterns of results of the intercorrelations among scales and/or items was fairly consistent. Nonetheless, only a small subset of the constructs accounted for variance in final knowledge scores. Furthermore, many of the individual and systemic factors that may have accounted for additional variance were not identified through this study. For example, mentors noted the importance of, and variability in, the extent of administrative support and provision of sufficient time and resources for professional development meetings. A further possible source of variance is the degree of correspondence between the content and recommendations provided in the PD and the scope, philosophy, and sequence of instruction of the core reading programs used in different schools. One potential weakness of our approach to PD is that in working with multiple school systems in a single project, we were not able to require the use of a single research-based reading program. We hypothesize that teacher learning and application would be further enhanced if both the school assessment materials and the core reading program aligned well with PD on research-based methods, giving teachers a consistent framework and more opportunities to operationalize what they are learning (Brady & Gillis, 2005; Foorman and Moats, 2004; Kameenui, Simmons, & Coyne, 2000).

Closing remarks

Because of the widespread need to help practicing teachers adopt research-based methods of reading instruction, it is important to learn more about the characteristics of effective professional development programs. The present study demonstrated the value of an intensive form of PD provided by skilled mentors for building teacher knowledge in the core areas of phonological awareness and phonics. At the same time, teachers' attitudes before and after the training accounted for significant variance in teachers' year-end knowledge of what they had been taught. As this and other studies add to what is known about important features of PD in these subjects, two of the on-going issues will be how to best foster receptivity and learning by teachers. A third issue will be how to bring effective training programs to scale. To do so, it would be essential to have sufficient numbers of personnel who can provide such training. Yet, in our experience, it is difficult to find individuals who have the depth of knowledge and skills necessary to provide informed mentoring on these key areas of reading development. Consequently, in order to bring the insights and implications of research to classrooms on a larger scale, it also may be necessary to establish high-quality mentor preparation programs.

Appendix 1

Teacher Knowledge Survey: Items targeting phonological awareness and code concepts. (Correct answers are italicized.)

Notes: a) the items for all domains were intermixed in the actual survey.

b) Some of the items overlap with both phoneme awareness and code concepts. For those items, assignment to one or the other category was based on the relative emphasis or on the context in which the concept typically arises.

<u>Phoneme Awareness Items</u>

1. Phoneme awareness is important for children learning to read because:
a. It shows children how to decode words.
b. It fosters fluency in reading.
c. It provides children with the concept of rhyme.
d. *It provides the basis for understanding what letters represent.*

e. I'm not sure.

2. Which set of words should a teacher select for a phoneme awareness activity to give children practice with segmentation of four phonemes in one-syllable words?

a. *thrill, sting*   b. shark, string   c. witch, dodge   d. all of the above
e. I'm not sure.

For each of the following, choose whether the activity would help children acquire:
a. Phonological Sensitivity (sometimes referred to as phonological awareness);
b. Phoneme Awareness   c. Neither   d. Both   e. Not sure.

3. Clapping the number of syllables in a word. *(a)*
4. Segmenting each of the phonemes (speech sounds) in a word. *(b)*
5. Practicing the naming of letters. *(c)*
6. Identifying the final phoneme in a word. *(b)*
7. Identifying which word in a set of words rhymes with a target word. *(a)*
8. Naming letters as quickly as possible. *(c)*
9. Identifying nonspeech sounds (e.g., ball bouncing, whistle, sound of a hammer). *(c)*
10. If you wanted to see if a child had mastered phoneme awareness, which is the best word to use (by asking a child to say each of the speech sounds)?

    a. cat   *b. blast*   c. cabinet   d. crash   e. I'm not sure.

Below is an authentic list of words written by first graders *(items from the list pertaining to phoneme awareness are listed below)*. For each child's spelling, choose whether the child's error most likely indicates that the child may be having trouble with: a. Phoneme Awareness b. Problems applying the code (phonics) c. Difficulty with other spelling features d. Not sure.
(Select only one answer.)
   Target Word Child's Spelling

11.   play   pa   *(a)*
12.   went   wet   *(a)*

Circle the number of speech sounds in each word:
a. 1   b. 2   c. 3   d. 4   e. 5   f. 6   h. 7   i. not sure

13. best   *d. 4*
14. through   *c. 3*
15. chirp   *c. 3*
16. fresh   *d. 4*
17. quaint   *e. 5*
18. scratch   *e. 5*
19. shore   *b. 2*
20. next   *e. 5*

Code Items

1. What would be the best response if one of your students asked you: "What is the difference between consonants and vowels?
a. The vowels are just AEIOU and sometimes Y, and the consonants are all the rest.
b. All words have to have a vowel but they don't have to have a consonant.
c. *In contrast to how we make consonant sounds, when we make vowel sounds our mouths are open and nothing gets in the way of the air coming out.*
d. I'm not sure.

Below is an authentic list of words written by first graders *(items from the list pertaining to problems with the Code are listed below)*. For each child's spelling, choose whether the child's error most likely indicates that the child may be having trouble with: a. Phoneme Awareness b. Problems applying the Code (phonics) c. Difficulty with Other spelling features d. Not sure.
(Select only one answer.)

Target Word   Child's Spelling

2.	beet	bet	*(b)*
3.	rain	rayn	*(b)*
4.	trap	chrap	*(b)*

Mark the one feature that occurs in each word.
a. Blend b. Consonant digraph c. Vowel team d. Trigraph e. None g. Not Sure

5. brim   *(a)*
6. lion   *(e)*
7. bush   *(b)*
8. charge   *(b)*
9. pipe   *(e)*
10. silk   *(a)*
11. seam   *(c)*

And from a similar list (other items were dropped from analyses because they are redundant with the preceding list):
Select the one descriptor that applies to the underlined items:
a. Digraph   b. Blend   c. Trigraph   d. Suffix   e. Vowel Team   f. None
g. Not Sure

12.   jump<u>ed</u> *(d)*

13.   Phonics instruction is:
a. Teaching the correspondences between letters and sounds.
b. Most effective when it incorporates other cueing systems such as meaning and syntax.
c. Most effective when taught as needed while children are reading leveled text or authentic literature.

d. *Most effective when explicitly taught in a sequence from easier to more complex code patterns.*

e. I'm not sure.

14. If you were testing kids to see if they had mastered how to spell the silent "e" pattern, is there a value to including nonsense words such as *tupe* and *snede*?

a. No. Nonsense words are not authentic because they have no meaning.

b. No. Students would just confuse nonsense words with real words.

c. *Yes. Nonsense words allow the teacher to see if students can apply the pattern.*

d. Yes. Nonsense words are more difficult to spell because children haven't seen them before.

e. I'm not sure.

15. Consonants are:

a. Speech sounds that are connected to letters.

b. *A group of speech sounds formed when the vocal airflow is obstructed either completely or partially.*

c. A group of speech sounds that are open, vocal and obstructed.

d. Letters that children use to spell words.

e. I'm not sure.

In the following poem, find examples that contain the syllable types listed below. The words with two or more syllables (2+, multisyllabic words) may contain different syllables types. In those cases, carefully circle the syllable that illustrates the pattern. Choose one word for each line below. If you are not sure, write NS.

An Exciting Trip

I ride the elevator up
In our apartment house
And no one knows I'm playing
For I'm a quiet mouse.

But I pretend I'm piloting
A rocket, swift as light,
That's full of passengers I'll land
Upon the Moon tonight.

When we ride down, my rocket ship
Falls like a shooting star,
And lands upon the earth again
Without the slightest jar.

> The other people never know,
> As up and down we flip,
> That I am taking them upon
> A wild exciting trip!
> > Frances Gorman Risser
> > *(one set of correct answers included)*

16. <u>Closed</u>

    In a one-syllable word: <u>*ship*</u>
    In a 2+ syllable word: pre<u>***tend***</u>

17. <u>Open</u>

    In a one-syllable word: <u>*we*</u>
    In a 2+ syllable word: <u>***pre***</u>tend

18. <u>Silent e</u>

    Given one example: <u>*ride*</u>

19. <u>Vowel teams</u>

    'Talker' syllable type: <u>***play***</u>ing
    'Whiner' syllable type: <u>*house*</u>

20. <u>R-controlled</u>

    In a one-syllable word: <u>*star*</u>
    In a 2+ syllable word: passe<u>***ngers***</u>

References

Adams, M. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT.

Allington, R. L. (1991). The legacy of "slow it down and make it more concrete". In J. Zutell & S. McCormick (Eds.), *Learner factors/teacher factors: Issues in literacy research and instruction* (pp. 19–29). Chicago: National Reading Conference.

Allington, R. L. (2005). Ignoring the policy makers to improve teacher preparation. *Journal of Teacher Education, 56*, 199–204. doi:10.1177/0022487105275845.

Ball, E. W., & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 24*, 49–66. doi:10.1598/RRQ.26.1.3.

Bear, D. R., Invernizzi, M., & Templeton, S. (2007). *Words their way: Word study for phonics, vocabulary, and spelling instruction* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Beier, M. E., & Ackerman, P. L. (2005). Age, ability and the role of prior knowledge on the acquisition of new domain knowledge: Promising results in a real-world environment. *Psychology and Aging, 20*, 341–355. doi:10.1037/0882-7974.20.2.341.

Birsch, J. (2005). *Multisensory teaching of basic language skills*. Baltimore: Paul H. Brookes.

Blachman, B. A., Fletcher, J. M., Schatschneider, C., Francis, D. J., Clonan, S. M., Shaywitz, B. A., et al. (2004). Effects of intensive reading remediation for second and third graders and a 1-year follow-up. *Journal of Educational Psychology, 96*, 444–461. doi:10.1037/0022-0663.96.3.444.

Blachman, B. A., Tangel, D. M., Ball, E. W., Black, R., & McGraw, C. K. (1999). Developing phonological awareness and word recognition skills: A two-year intervention with low-income, inner-city children. *Reading and Writing: An Interdisciplinary Journal, 11*, 239–273. doi: 10.1023/A:1008050403932.

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. doi:10.1007/s11881-001-0007-0.

Bos, C., Mather, N., Friedman Narr, R., & Babur, N. (1999). Interactive, collaborative professional development in early literacy instruction: Supporting the balancing act. *Learning Disabilities Research & Practice, 14*, 227–238. doi:10.1207/sldrp1404_4.

Brady, S., & Gillis, M. (July, 2005). *Common challenges in schools wanting to raise reading achievement: Lessons from the front lines.* Paper presented at the advances in reading and literacy conference sponsored by the International Dyslexia Association, Washington, DC.

Brady, S., & Moats, L. (1997). *Informed instruction for reading success: Foundations for teacher preparation.* Baltimore, MD: International Dyslexia Association.

Cheney, W. S., & Cohen, J. (2000). *Focus on phonics: Assessment and instruction.* DeSoto, TX: The Wright Group.

Connor, C., Morrison, F., & Underwood, P. S. (2006). A second chance in second grade: The independent and cumulative impact of first and second grade reading instruction and students' letter-word reading skill growth. *Scientific Studies of Reading, 11*, 199–234.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334. doi:10.1007/BF02310555.

Cunningham, A. E. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology, 50*, 429–444. doi:10.1016/0022-0965(90)90079-N.

Cunningham, A., 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. doi:10.1007/s11881-004-0007-y.

Daneman, M. (1991). Individual differences in reading skills. In R. Barr, M. L. Kamil, P. B. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research* (Vol. 2, pp. 512–538). New York: Longman.

Fielding-Barnsley, R., & Purdie, N. (2005). Teachers' attitude to and knowledge of metalinguistics in the process of learning to read. *Asia-Pacific Journal of Teacher Education, 33*, 65–76. doi: 10.1080/1359866052000341133.

Foorman, B. R., Francis, D. J., Shaywitz, S. E., Shaywitz, B. A., & Fletcher, J. M. (1997). The case for early reading intervention. In B. A. Blachman (Ed.), *Foundations of reading acquisition and dyslexia: Implications for early intervention* (pp. 243–264). Mahwah, NJ: Erlbaum.

Foorman, B. R., & Moats, L. C. (2004). Conditions for sustaining research-based practices in early reading instruction. *Remedial and Special Education, 25*, 51–60. doi:10.1177/074193250402 50010601.

Foorman, B. R., Schatschneider, C., Eakin, M. N., Fletcher, J. M., Moats, L. C., & Francis, D. J. (2006). The impact of instructional practices in grades 1 and 2 on reading and spelling achievement in high poverty schools. *Contemporary Educational Psychology, 31*, 1–29. doi:10.1016/j.cedpsych.2004. 11.003.

Fowler, C. A., Liberman, I. Y., & Shankweiler, D. (1977). On interpreting the error pattern of the beginning reader. *Language and Speech, 20*, 162–173.

Ganske, K. (2000). *Word journeys: Assessment-guided phonics, spelling, and vocabulary instruction.* New York: The Guilford Press.

Gersten, R., Chard, D., & Baker, S. (2000). Factors enhancing sustained use of research-based instructional practices. *Journal of Learning Disabilities, 33*, 445–457. doi:10.1177/00222194000 3300505.

Geudens, A., & Sandra, D. (2003). Beyond children's implicit phonological knowledge: No support for an onset-rime structure in children's explicit phonological awareness. *Journal of Memory and Language, 49*, 157–182. doi:10.1016/S0749-596X(03)00036-6.

Giovannelli, M. (2003). Relationship between reflective disposition toward teaching and effective teaching. *The Journal of Educational Research, 96*, 293–309.

Goodman, K. (1996). *On reading.* Portsmouth, NH: Heineman.

Goodman, K., & Goodman, Y. (1979). Learning to read is natural. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 1). Hillsdale, NJ: Erlbaum Associates.

Gregoire, M. (2003). Is it a challenge or a threat? A dual-process model of teachers' cognition and appraisal processes during conceptual change. *Educational Psychology Review, 15*, 147–179. doi: 10.1023/A:1023477131081.

Guskey, T. R. (2002). Professional development and teacher change. *Teachers & Teaching: Theory & Practice, 8*, 381–391. doi:10.1080/135406002100000512.

Henderson, E. H., & Beers, J. W. (1980). *Developmental and cognitive aspects of learning to spell: A reflection of word knowledge*. Newark, NJ: International Reading Association.

Henry, M. (2003). *Unlocking literacy: Effective decoding and spelling instruction*. Baltimore: Paul H. Brookes.

Jorm, A., Share, D., McLean, R., & Matthews, R. (1984). Phonological recoding and learning to read: A longitudinal study. *Applied Psycholinguistics, 5*, 201–207. doi:10.1017/S0142716400005075.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 22*, 437–447. doi:10.1037/0022-0663.80.4.437.

Juel, C., & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly, 35*, 458–498. doi:10.1598/RRQ.35.4.2.

Kameenui, E., Simmons, D., & Coyne, M. (2000). Schools as host environments: Toward a schoolwide reading improvement model. *Annals of Dyslexia, 50*, 33–51.

Liberman, I. Y., & Liberman, A. M. (1990). Whole language vs. code emphasis: Underlying assumptions and their implications for reading instruction. *Annals of Dyslexia, 40*, 51–76. doi:10.1007/BF02648140.

Lovett, M. W. (1987). A developmental approach to reading disability: Accuracy and speed criteria of normal and deficient reading skill. *Child Development, 58*, 234–260. doi:10.2307/1130305.

Lundberg, I., Frost, J., & Petersen, O. P. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23*, 264–284. doi: 10.1598/RRQ.23.3.1.

Martin, G., & Pear, J. (2003). *Behavior modification: What is it and how to do it* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Mather, N., Bos, C., & Babur, N. (2001). Perceptions and knowledge of preservice and inservice teachers about early literacy instruction. *Journal of Learning Disabilities, 34*, 472–482. doi:10.1177/002221940103400508.

Mathewson, G. C. (1994). Model of attitude influence upon reading and learning to read. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical model and processes of reading* (4th ed., pp. 1131–1161). Newark, DE: International Reading Association.

McCardle, P., & Chhabra, V. (Eds.). (2004). *The voice of evidence in reading research*. Baltimore: Paul H. Brookes.

McCutchen, D., Abbott, R. D., Green, L. B., Beretvas, S. N., Cox, S., Potter, N. S., et al. (2002a). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities, 35*, 69–86. doi:10.1177/002221940203500106.

McCutchen, D., & Berninger, G. (1999). Those who know teach well: Helping teachers master literacy-related subject matter knowledge. *Learning Disabilities Research & Practice, 14*, 215–226. doi: 10.1207/sldrp1404_3.

McCutchen, D., Harry, D., Cunningham, A. E., Cox, S., Sidman, S., & Covill, A. (2002b). Content knowledge of teachers of beginning reading. *Annals of Dyslexia, 52*, 207–228. doi:10.1007/s11881-002-0013-x.

Moats, L. (2000). *Speech to print: Language essentials for teachers*. Baltimore: Paul H. Brookes.

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. doi:10.1007/BF02648156.

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.

Moats, L. C., & Foorman, B. F. (2003). Measuring teachers' content knowledge of language and reading. *Annals of Dyslexia, 53*, 23–45. doi:10.1007/s11881-003-0003-7.

Moore, A., Edwards, G., Halpin, D., & George, R. (2002). Compliance, resistance and pragmatism: The reconstruction of schoolteacher identities in a period of intensive educational reform. *British Educational Research Journal, 28*, 551–565. doi:10.1080/0141192022000005823.

Moorman, G. B., Blanton, W., & McLaughlin, T. (1994). The rhetoric of whole language. *Reading Research Quarterly, 29*, 308–332. doi:10.2307/747779.

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research on reading and its implications for reading instruction*. Washington, DC: National Institute of Child Health and Human Development.

O'Connor, R. E. (2000). Teachers learning 'Ladders to Literacy'. *Learning Disabilities Research & Practice, 14*, 203–214. doi:10.1207/sldrp1404_2.

Prochaska, J. O., Velicer, W. J., DiClemente, C. C., & Fava, J. L. (1988). Measuring the processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology, 56*, 520–528. doi:10.1037/0022-006X.56.4.520.

Rayner, K., Foorman, B., Perfetti, C. A., Pesetsky, D., & Seidenberg, M. (2001). How psychological science informs the teaching of reading. *Psychological Science in the Public Interest, 2*, 31–74. doi:10.1111/1529-1006.00004.

Richardson, V., & Anders, P. L. (2005). Professional preparation and development of teachers in literacy instruction for urban settings. In J. Flood & P. Anders (Eds.), *Literacy development of students in urban schools: Research and policy*. Newark, DE: International Reading Association.

Rubin, D. B. (1976). Inferences and missing data. *Biometrika, 63*, 581–592. doi:10.1093/biomet/63.3.581.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Scarborough, H. S., & Brady, S. A. (2002). Toward a common terminology for talking about speech and reading: A glossary of the "Phon" words and some related terms. *Journal of Literacy Research, 34*, 299–334. doi:10.1207/s15548430jlr3403_3.

Scarborough, H. S., Ehri, L. C., Olson, R. C., & Fowler, A. E. (1998). The fate of phonemic awareness beyond the elementary school years. *Scientific Studies of Reading, 2*, 115–142. doi:10.1207/s1532799xssr0202_2.

Shankweiler, D. P., & Fowler, A. E. (2004). Questions people ask about the role of phonological processes in learning to read. *Reading and Writing: An Interdisciplinary Journal, 17*, 483–515. doi:10.1023/B:READ.0000044598.81628.e6.

Siegel, L. S., & Faux, D. (1989). Acquisition of certain grapheme-phoneme correspondences in normally achieving and disabled readers. *Reading and Writing: An Interdisciplinary Journal, 1*, 37–52.

Smith, F. (1994). *Understanding reading: A psycholinguistic analysis of reading and learning to read* (6th ed.). Mahwah, NJ: Lawrence Erlbaum.

Smith, T. (2008). *The effect of teacher attitudes on response to professional development in literacy*. Doctoral dissertation, University of Rhode Island.

Snow, C., Griffin, P., & Burns, M. S. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy.

Spear-Swerling, L., & Brucker, P. (2003). Teachers' acquisition of knowledge about English word structure. *Annals of Dyslexia, 53*, 72–103. doi:10.1007/s11881-003-0005-5.

Spear-Swerling, L., & Brucker, P. (2004). Preparing novice teachers to develop basic reading and spelling skills in children. *Annals of Dyslexia, 54*, 332–364. doi:10.1007/s11881-004-0016-x.

Spear-Swerling, L., Brucker, P., & Alfano, M. P. (2005). Teachers' literacy-related knowledge and self-perceptions in relation to preparation and experience. *Annals of Dyslexia, 55*, 266–296. doi:10.1007/s11881-005-0014-7.

Spira, E. G., Bracken, S. S., & Fischel, J. E. (2005). Predicting improvement after first-grade reading difficulties: The effects of oral language, emergent literacy, and behavior skills. *Developmental Psychology, 41*, 225–234. doi:10.1037/0012-1649.41.1.225.

Stuart, M. (1990). Factors influencing word recognition in pre-reading children. *The British Journal of Psychology, 81*, 135–146.

Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K., Conway, T., et al. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34*, 33–58. doi:10.1177/002221940103400104.

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Rose, E., Lindamood, P., Conway, T., et al. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology, 91*, 579–593. doi:10.1037/0022-0663.91.4.579.

Uhry, J. K., & Ehri, L. C. (June, 2006). *Rime cohesion in kindergarten phoneme segmentation? The controversy continues*. Paper presented at the Society for Scientific Study of Reading, Vancouver, CA.

Walsh, K. (2006). *What teacher preparation programs aren't teaching, and what elementary teachers aren't learning*. Washington, DC: National Council on Teacher Quality.

Willingham, D. T. (2006, Spring). How knowledge helps: It speeds and strengthens reading comprehension, learning and thinking. *American Educator, Spring,* 30–37.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly, 23*, 159–177. doi:10.2307/747800.