# Disciplinary Knowledge of K-3 Teachers and their Knowledge Calibration in the Domain of Early Literacy

*Anne E. Cunningham*

*Kathryn E. Perry*

University of California, Berkeley
Berkeley, California

*Keith E. Stanovich*

*Paula J. Stanovich*

University of Toronto/OISE
Toronto, Canada

*Recently, investigators have begun to pay increasing attention to the role of teachers' domain-specific knowledge in the area of reading, and its implications for both classroom practice and student learning. The aims of the present study were to assess kindergarten to third grade teachers' actual and perceived reading related subject matter knowledge, and to investigate the extent to which teachers calibrate their reading related subject matter knowledge by examining relationships between actual and perceived knowledge. Results indicated that while teachers demonstrated limited knowledge of children's literature, phoneme awareness, and phonics, the majority of these same teachers evaluated their knowledge levels quite positively. Teachers demonstrated some ability to calibrate their own knowledge levels in the area*

*of children's literature, yet they were poorly calibrated in the domains of phoneme awareness and phonics. These findings suggest that teachers tend to overestimate their reading related subject matter knowledge, and are often unaware of what they know and do not know. Implications for the design of teacher education at both the preservice and inservice levels are discussed.*

We have recently seen many important educational policy initiatives in the area of children's literacy. These initiatives have, in part, occurred as a response to the challenges an increasingly diverse society places on our school systems. The increase in the variability of students' cognitive, linguistic, and academic abilities has put great pressure on teachers to become ever more proficient and knowledgeable across the curriculum, but has most especially put a premium on teachers' abilities to foster literacy in their classrooms. As a result, the identification of an area of concern within our schools (i.e., how to improve children's literacy) and the resulting policy initiatives lead us to focus on questions of teacher preparation and development.

There has been a corresponding increase in interest in the research on teacher knowledge. Shulman (1987) argued that it is entirely possible to examine the disciplinary knowledge base of teachers, which enables them to engage in "best practices." Examination of the extent of teachers' knowledge across the academic disciplines has varied greatly, however. For example, the investigation of teachers' subject-matter knowledge and beliefs and how they affect the teaching of disciplines such as mathematics and social studies has been an active area of research for decades (e.g., Clark & Peterson, 1986; Lampert, 1988; Thompson, 1992; Wilson & Wineburg, 1988). These studies have shown that teachers differ in their disciplinary knowledge and beliefs (Ball, 1991; Ball & McDiarmid, 1992; Grossman, 1991; Richardson, 1996; Sowder, Philipp, Armstrong, & Schappelle, 1998; Wilson & Wineburg, 1988), and that these differences have important consequences for classroom practice (e.g., Grossman, Wilson, & Shulman, 1989; Wilson, Shulman, & Richert, 1987).

Unlike science, mathematics, and social studies—all areas that are well beyond the initial stages of research—studies of the declarative knowledge of teachers in the domain of literacy are in their very earliest stages. While there is a long history and a large body of research examining pedagogical practices in literacy (e.g., Brophy, 1983; Grossman, Valencia, & Hamel, 1995; Pressley, 2001; Pressley, Wharton-McDonald, Allington, Block, Morrow, Tracey, Baker, Brooks, Cronin, Nelson, & Woo, 2001;

Wharton-McDonald, Pressley, & Hampston, 1998) and much theoretical discussion of literacy practices (e.g., Pearson, 1996), there is very little empirical data on the *disciplinary* (i.e., content) knowledge teachers possess in the domain of reading and how (or if) this disciplinary knowledge is linked to practice. Fundamental questions regarding this domain are largely unanswered: What do teachers need to know to be effective practitioners in teaching reading? How deep and explicit must their knowledge base be to provide effective instruction?

There are presently numerous state and federal initiatives (e.g., No Child Left Behind, 2001) aimed at providing a comprehensive redesign of teacher-preparation and in-service professional development. While we may be able to improve our models of professional development in reading and writing, it can be argued that this endeavor must begin with a definition of the knowledge and skills necessary for effective practice and a demonstration of how practicing teachers acquire this knowledge. While we *are* able to delineate (at a theoretical level) what that knowledge base may be, a corresponding body of research is needed to serve as a base from which to set policy, develop curricula, and impact teacher education. As described in the National Research Council's 1998 report Preventing Reading Difficulties in Young Children, "Efforts have been made to delineate the preferred content of teacher education with respect to reading at both the pre-service and in-service stages, but none are complete models; the best way to develop and use them for maximum effect on children's learning has not been studied" (Snow, Burns, & Griffin, 1998, p. 293).

One of the next steps in understanding what constitutes the effective teaching of reading and writing for K-3 students must necessarily include investigating the knowledge components and belief structures among K-3 teachers. Early efforts to delineate this domain have focused primarily on teachers' philosophical beliefs (e.g., DeFord, 1985; Shanahan, 1994) but less so on the knowledge component. A handful of investigators, however, have recently begun to study teachers' domain knowledge of literacy-related skills (Bos, Mather, Dickson, Podhajski, & Chard, 2001; McCutchen, Harry, Cunningham, Cox, Sidman, & Covill, 2002; Moats, 1994; Moats & Foorman, 2003). In the present study, our aims were twofold: first, to add to the literature on teacher knowledge in the domain of early literacy via an examination of a very large sample of 722 teachers in an urban inner-city school system, and second, to add a new cognitive dimension to the study of teachers' declarative knowledge: that of knowledge calibration.

Our investigation focused on three domains of knowledge in the area of early literacy: children's literature, phonological awareness, and phonics. These three domains are all recognized as important knowledge domains for K-3 teachers by a wide range of reading educators; are considered critical to children's literacy development, especially for those children with reading and language disabilities; and are supported as such by a growing research consensus (National Reading Panel, 2000; Pressley, 2001; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001; Snow, Burns, & Griffin, 1998). From a research perspective, these domains of knowledge are also readily sampled and easily operationalized. Although the focus of this research is on these three domains, it is not intended to minimize the importance of other areas of teacher knowledge, teacher characteristics, or pedagogy.

The first domain that we studied was teachers' knowledge of children's literature and narrative, an integral part of any language arts curriculum. A consensus of reading experts agree that knowledge of good children's literature and the ability to apply that knowledge to classroom activities is a fundamental component of early reading instruction (e.g., Harste, Woodward, & Burke, 1984; Holdaway, 1979; Sulzby & Teale, 1991; Tierney & Pearson, 1984; Wolf, 1988). It is well accepted that immersing children in quality literature from an early age helps them develop literacy (Goodman, 1986; Manning & Manning, 1989). There are important links between children's level of print exposure and motivation to read when a varied and engaging selection of children's literature is included in the curriculum.

Research has shown that reading volume and motivation to read are linked to a host of cognitive predictors of learning to read as well as consequences of learning to read (Cunningham & Stanovich, 1997, 1998; Guthrie, Wigfield, Metsala, & Cox, 1999; Stanovich, 1993, 2000; Taylor, Frye, & Maruyama, 1990; Wigfield & Guthrie, 1997). Furthermore, teachers report that providing opportunities to read text that is of personal interest to their students is the primary mechanism for motivating them to become independent and fluent readers (Sweet, Guthrie, & Ng, 1998). If teachers are to provide an environment that encourages reading engagement and motivation to read, knowledge of children's literature is essential. Concerns have been raised that many teachers are not knowledgeable enough in this area to be effective teachers of reading (e.g., Allington, Guice, Micheleson, Baker, & Li, 1996), but there is little research documenting the problem. We know of only one study that has ex-

amined teachers' knowledge of literature and its relation to classroom practices (McCutchen, Abbott, Green, Beretvas, Cox, Potter, Quiroga, & Gray, 2002). Clearly, more evidence is needed to determine how wide and varied teachers' experiences with children's literature need to be in order for them to effectively choose books as part of their overall early literacy programs.

The two other knowledge domains that we sampled, phonological awareness and phonics, are both research-based, well operationalized in the literature, and have been shown to be critical to reading acquisition. These two distinct knowledge domains are especially important for those teachers whose students need greater assistance in developing beginning reading skills due to constitutional problems or lack of experience with language and literacy. In her study, Moats (1994, 1995; see also Bos et al., 2001) observed that few teachers possess high levels of knowledge in these domains. However, McCutchen, Abbott, et al. (2002), and more recently Moats and Foorman (2003), have demonstrated that teachers' increased understanding of phonology and spelling patterns positively influences their instructional practices and effectiveness.

The present study thus samples three declarative knowledge domains within the field of literacy. Previous research demonstrates the importance of knowledge within all of these domains, and they span a variety of conceptual approaches. In addition to these declarative knowledge domains, we explored a critical metacognitive skill: how teachers calibrate the knowledge they have (or have not) obtained. Knowledge calibration has received extensive study in cognitive psychology (e.g., Fischhoff, 1988; Lichtenstein & Fischhoff, 1977; Lichtenstein, Fischhoff, & Phillips, 1982; Stanovich, 1999) because it is a critical component of epistemic regulation: how individuals use their present knowledge structures to acquire new knowledge (Lichtenstein & Fischhoff, 1980). In general terms, knowledge calibration is concerned with whether people are aware of what they know and do not know (e.g., Fischhoff, Slovic, & Lichtenstein, 1977; Ronis & Yates, 1987). It has been shown that people learn information more readily when they are relatively well calibrated as to their current level of knowledge because they can focus on areas where their knowledge is uncertain and allocate less attention to areas of relative expertise. A person who is well calibrated knows what they do not know (or is able to discriminate; see Fischoff, et al., 1977; Ronis & Yates, 1987; Yates, Zhu, Ronis, Wang, Shinotsuka, & Toda, 1989) and, therefore, is more prone to collect information in the proper domains; that is, in domains in

which they truly lack knowledge. Our study thus adds an important new metacognitive dimension to the research on the degree of declarative knowledge that teachers bring to the classroom. The relevance of knowledge calibration in the domain of reading becomes particularly important in the context of professional development and education. If teachers of beginning reading are well calibrated in their disciplinary knowledge, they presumably will be more receptive to seeking out and/or receiving information they do not possess (e.g., information in the three declarative knowledge domains studied here that research indicates are critical to children's reading development).

## METHOD

### PARTICIPANTS

Seven hundred and twenty-two kindergarten through third grade teachers (561 females, 89 males, 72 unreported) from 48 elementary schools in a large, urban school district in northern California participated in this study. The teachers in our sample were invited to attend a series of professional development institutes on reading and writing instruction during the summer. On the first day of the institute, the teachers were given 45 minutes to complete the survey measure included in this study. Of the 858 teachers in attendance, 84% (722) volunteered to complete our survey. In groups of approximately 30, the teachers completed the survey independently at their tables without any consultation among themselves. The professional development coaches and support staff monitored the administration of the survey and only answered procedural questions regarding the survey. The teachers reported that they found some sections of the survey to be challenging, but were motivated to complete the survey due to its challenging nature and were eager to receive the answers afterward. After completing the survey, the teachers were given the opportunity to debrief and discuss the questions and answers with the researchers.

The average age of the teachers in this sample was 41.16 years ($SD$ = 11.68 years; range = 22 to 74). The average number of years teaching experience in this sample was 11.97 ($SD$ = 10.73 years; range = 0 to 50 years). The sample was ethnically diverse: 36.7% of the teachers were Caucasian, 21.3% African American, 10.5% Asian American, 8.7% Latino/a, and .6% Native American (22.2% of teachers did not report their ethnicity). The majority of teachers (76%) held a full teaching creden-

tial, while 4.7% had an emergency credential. With an emergency credential, teachers have an undergraduate degree but do not have a multiple-subject teaching credential. Teachers with emergency credentials are required to complete their university coursework within five years. The third group of teachers (16.6%) had an intern credential. With an intern credential, teachers are enrolled in a multisubject credential program but work full time teaching in a district under supervision of the college or university. Nearly 11% of the teachers also held a special education credential. Teachers possessing a special education credential have a multisubject credential to teach general education students in addition to specialized expertise teaching students with special needs. Fifty-eight percent of teachers had a bachelor's degree, 30.9% had a master's degree, and less than 2% had a doctoral degree or equivalent. The year in which their degree was received ranged from 1942 to 2000 (mean year = 1986; $SD = 10.97$ years).

## TASKS AND PROCEDURE

At the beginning of our professional development institutes, teachers were invited to complete a large and comprehensive battery of measures tapping teachers' disciplinary knowledge and self-perceptions in the domain of reading. The survey included knowledge measures of children's literature and various dimensions of the English language (e.g., knowledge of phonological awareness, phonics, syllables, morphemes, orthography, and the like), as well as measures of teachers' perceptions of their own knowledge in each of these domains.

*Knowledge of Children's Literature.* We assessed teachers' knowledge of children's literature using the Title Recognition Test (TRT), a measure analogous to those used in previous studies of reading volume and engagement (e.g., Cunningham & Stanovich, 1990, 1991; Stanovich & West, 1989). A new version of the TRT was developed for this investigation. The titles chosen were common and popular children's literature. The present version of the TRT included 35 children's book titles and 15 false book titles or foils. The real book titles included on this measure were selected using several databases (e.g., *New York Times* bestsellers lists) that provided us with current information on the most popular literature for children in the kindergarten to third grade age range. We also interviewed a group of over 25 K-3 teachers not in the study sample. The pilot teachers were asked to review our list of books, comment on the appropriateness of the titles, and suggest other titles that should be

on the list. Teacher responses were incorporated when at least 10 of the teachers suggested a title should be added or deleted. To ensure that our selection of book titles was relevant in an urban environment, we also included several popular children's books that included multicultural themes and characters. Teachers were instructed to put a check mark next to the book titles they recognized. To take into account possible differential thresholds for guessing, a derived score was calculated by subtracting the proportion of foils checked from the proportion of correct titles checked. This derived score was used in all analyses (mean = 0.33; $SD$ = 0.17; range = 0 to 0.71). This task displayed strong reliability (Cronbach's alpha = .86) and took approximately five minutes to administer.

Previous studies have found the TRT to be a highly reliable indicator of an individual's level of reading engagement (e.g., Cunningham & Stanovich, 1990, 1991; Stanovich & West, 1989). Research that speaks to the validity of the TRT has demonstrated strong correlations with actual time spent on literacy activities (e.g., Allen, Cipielewski, & Stanovich, 1992; West, Stanovich, & Mitchell, 1993) and adult and children's knowledge of literature.

*Phonological Awareness Knowledge.* The task used to assess teachers' ability to perceive the number of sounds in words was similar to a task developed by Moats (1994). On this phonological awareness task, teachers were asked to supply the number of phonemes or sounds in 11 different words (sun, laughed, grass, Christmas, though, psychology, scratch, each, say, chalk, exit). An example of how to complete the phoneme counting task was provided. The directions said, "Count the number of speech sounds you hear in each of the words below. It may help if you circle the letter or letter clusters that represent each sound after you have counted the number of phonemes in each word. As an example, the word *meat* has three sounds /m/ /e/ /t/ but four letters." The score on this task was the number of words for which the teacher identified the correct number of speech sounds (mean = 4.42, $SD$ = 3.10; range = 0 to 11). The measure displayed strong reliability (Cronbach's alpha = .86). This task took approximately five minutes to complete.

*Phonics Knowledge.* Two tasks were used to assess teachers' knowledge of phonics. First, we asked teachers to identify words that contained regular and irregular spelling patterns. This first task was designed to capture teacher's *implicit* knowledge of sound-symbol correspondences and their relation to

English orthography, a core knowledge component for a teacher of reading. Teachers were asked to identify the words that contained irregular spelling patterns (the, done, said, have, was, give, what, one, does, pint, yacht) from a list of 26 words (e.g., make, chunk, but, rebate) children are commonly taught to read in kindergarten through second grade. Their score on this task was the number of irregular words identified out of the 11 irregular words included in the list (mean = 6.37, $SD$ = 3.17; range = 0 to 11). This measure displayed good reliability (Cronbach's alpha = .77) and took approximately five minutes to complete.

The second task was designed to assess teacher's *explicit* knowledge of the rules and conventions of the English language and its orthography. Teachers were asked to respond to seven multiple choice questions that represented core knowledge content of the structure of the English language at the level of both words and sounds. Their score on this task was the number of correct items out of seven (mean = 2.42, $SD$ = 1.52; range = 0–7). This measure displayed relatively low reliability (Cronbach's alpha = .40). We feel this is most probably due to the limited number of items on the scale, as well as the characteristics of several of the items (e.g., the wording of the questions), and thus revision of the explicit measure is warranted. The task took approximately five minutes to complete.

*Knowledge Calibration in the Three Domains.* To assess teachers' perceptions of their knowledge/skill in children's literature, we asked them to respond to the following question: "How would you describe your current skill level, based on past success, in your knowledge of children's literature?" Teachers were asked to make one of four choices: 1) no experience, 2) minimal skills, 3) proficient, or 4) expert. Two subgroups of teachers were identified. A *low perceived knowledge of children's literature* subgroup ($n$ = 199) represented those teachers who responded that they had either no experience or minimal knowledge and skills. A *high perceived knowledge of children's literature* subgroup ($n$ = 455) represented those teachers who responded that they had either expert or proficient knowledge and skills. The majority of teachers evaluated their knowledge positively, indicating that they thought they were either proficient or expert in the domain of children's literature.

To assess teachers' perceptions of their knowledge and skill in teaching phonological awareness, they responded to the following question: "How would you describe your current knowledge or skill level, based on past success, with teaching and providing students with structured practice in phonemic

awareness?". Teachers were asked to make one of four choices: 1) no experience, 2) minimal skills, 3) proficient, or 4) expert. Based on their responses, two subgroups of teachers were identified. A *low perceived knowledge of phonological awareness* subgroup (n = 227) represented those teachers who responded that they had either no experience or minimal knowledge and skills. A *high perceived knowledge of phonological awareness* subgroup (n = 464) represented those teachers who responded that they had either expert or proficient knowledge and skills. In general, teachers were quite positive in their self-evaluations, with approximately two-thirds of the participants indicating that they felt they were knowledgeable and proficient or expert at providing instruction in phonemic awareness to children.

To assess teachers' perceptions of their knowledge and skill in phonics, they responded to two questions: 1) "How would you describe your current knowledge or skill level, based on past success, instructing students to relate sounds to letters and to spelling?" and 2) "How would you describe your current knowledge or skill level, based on past success, with teaching and providing students with explicit phonics instruction?" Teachers were asked to make one of four choices: 1) no experience, 2) minimal skills, 3) proficient, or 4) expert. Subgroups of teachers who reported high versus low knowledge in the domains of both implicit and explicit phonics were identified. A first category of perceived knowledge of implicit phonics was comprised of two subgroups: *low perceived knowledge of implicit phonics* (n = 155) representing those teachers who reported they had either no knowledge or experience or minimal knowledge and skills, and *high perceived knowledge of implicit phonics* subgroup (n = 540) representing those teachers who reported that they had either expert or proficient knowledge and skills.

A second category of explicit phonics knowledge was also comprised of two subgroups: *low perceived knowledge of explicit phonics* (n = 207) representing those teachers who reported they had either no experience or minimal knowledge and skills, and *high perceived knowledge of explicit phonics* (n = 490) representing those teachers who responded they had either expert or proficient knowledge and skills. Overall, teachers were once again positive in their self-evaluations, with approximately two-thirds indicating they felt proficient or expert at using both implicit and explicit instructional strategies in teaching children to read.

It is noteworthy that similar patterns of knowledge estimation were found. That is, similar proportions of teachers rated themselves as having high versus low knowledge across all

three tasks. Similarly, correlational analyses revealed that over-all individual teachers were consistent in their self-perceived knowledge across the domains of phonics, phoneme awareness, and children's literature. Strong relationships were observed be-tween teachers' reports of phonics and phoneme awareness knowledge (r's ranged from .69 to .75). In contrast, more mod-erate relationships were found between teachers knowledge of children's literature, and explicit and implicit phonics and phoneme awareness (r's = .37, .38, and .38, respectively). It is perhaps not surprising that teachers' estimations of their knowledge within the domains of phonics and phoneme aware-ness were more consistent.

## RESULTS

A series of analyses were conducted to examine 1) levels of teacher knowledge in the domains of children's literature, phonological awareness, and phonics; and 2) relations between teacher's perceptions of their knowledge and their actual knowl-edge (knowledge calibration) in each of these three domains.

## LEVELS OF KNOWLEDGE IN THE THREE KNOWLEDGE DOMAINS

### TEACHERS' KNOWLEDGE OF CHILDREN'S LITERATURE

First, we focused our attention on teacher knowledge in the do-main of children's literature. A critical component of early liter-acy instruction entails exposure to a wide variety of text and genre; thus, we felt it was equally important to explore this di-mension of teachers' disciplinary knowledge as represented in their recognition of popular children's books. We found that ap-proximately 10% of our sample was able to identify half or more of the most popular children's book titles. However, 90% of the teachers were not familiar enough with the most popular books for children in kindergarten through third grade to recog-nize even a majority of the titles. This result surprised us, as we had expected the teachers would do very well in this domain. When examining individual items, we expected that some titles would be known by all of the members of our college-educated sample of teachers of K-3 children, and on several titles, teach-ers did demonstrate high recognition levels, but no title was

recognized by all of the teachers. For example, *Where the Wild Things Are* was recognized by 75% and *Corduroy* by 71% of our sample. Interestingly, titles that we included because of their multicultural contribution to the list, which we expected might be more familiar to teachers in urban settings who work with diverse learners, did not fare as well. For example, *Kofi and his Magic* was known by 54% of the teachers while *Follow the Drinking Gourd* was recognized by only 10% of our sample (see Appendix A for a complete listing of each book title and the percentage of teachers who correctly identified them). Overall, foil checking was relatively low, suggesting that teachers did not rely on guessing when identifying children's books.

## TEACHERS' KNOWLEDGE OF PHONOLOGICAL AWARENESS

When examining levels of knowledge about phonological awareness, we found that almost 20% of the teachers were not able to correctly identify the number of phonemes in *any* of the 11 words presented to them. However, 30% of the teachers could correctly identify the number of phonemes in half of the stimuli. Less than 1% of the sample was able to correctly identify the phonemes in all 11 words. Next, we examined the individual items to learn in more detail about teachers' knowledge within the domain of phonological awareness (see table I). We

TABLE I.   Percentage of Teachers Responding Correctly to Phonological Awareness Task Items.

| Item (answer) | Entire Sample | High Perceived Knowledge (n = 464) | Low Perceived Knowledge (n = 227) |
|---|---|---|---|
| Count the number of speech sounds you hear in each of the words below. | | | |
| 1. sun (3) | 63.4% | 60.7% | 67.1% |
| 2. laughed (4) | 42.0% | 40.3% | 44.4% |
| 3. grass (4) | 28.5% | 26.6% | 29.1% |
| 4. Christmas (7)* | 22.6% | 20.0% | 27.4% |
| 5. though (2) | 55.1% | 52.5% | 60.7% |
| 6. psychology (8) | 19.9% | 18.8% | 22.8% |
| 7. scratch (5) | 19.5% | 17.4% | 22.7% |
| 8. each (2)* | 77.5% | 72.7% | 85.4% |
| 9. say (2)* | 60.3% | 56.8% | 67.2% |
| 10. chalk (3) | 51.1% | 49.5% | 52.9% |
| 11. exit (5) | 02.6% | 02.3% | 03.4% |

*unpaired t-test significant at .05 (two-tailed)

observed that even when presented with a very simple consonant-vowel-consonant word such as "sun," only 63% of teachers were able to correctly identify the number of phonemes (three). The flip side of this analysis demonstrates, however, that 37% of K-3 teachers in our sample could not do what we commonly ask a kindergarten child to do in a beginning reading program (i.e., a simple phonemic awareness task of segmenting sounds). Not surprisingly then, with the introduction of increasingly complex letter-sound patterns such as consonant blends, performance declined further. For example, we found that only 29% of teachers were able to determine that "grass" contains four phonemes and fewer than 20% were able to identify that "scratch" contains five phonemes. Finally, on more challenging words such as "exit," only 3% of teachers were able to correctly identify that it contains five phonemes.

This pattern of results suggests to us that many teachers of beginning reading operate more on the level of orthographic patterns (i.e., the spelling of "x" instead of hearing the sounds /k/ and /s/ in "x") when attempting to dissect a word, and fail to shift their attention to the sound stream within words. We have little reason to believe that teachers would spontaneously make this shift in a teaching situation. The implications of our findings for teaching phonemic awareness and later phonics knowledge are of concern because of the misleading information that teachers could provide to the developing reader. That is, if a teacher perceived that "box" contained three sounds (as was reported in this study) and used a corresponding number of blocks or empty boxes to scaffold his or her students' perception of these unique sounds, he or she would be misleading the students. The word "box" contains four phonemes or sounds that map onto three letters. This is a fundamental concept that undergirds the teaching of reading in English; that is, there is an imprecise mapping of sound to symbol, and some words contain more sounds than graphemes and vice versa. These results suggest that we must improve our efforts to instruct teachers to shift their own attention to the sound stream of language and away from the more salient orthographic level when teaching children to read.

## TEACHERS' KNOWLEDGE OF PHONICS

*Explicit Phonics Knowledge.* When examining teachers' levels of explicit phonics knowledge, we found that overall performance on the seven items tapping this was quite poor (see table II). Only 28% of the teachers were able to correctly answer

TABLE II.   Percentage of Teachers Responding Correctly to Phonics—
Explicit Knowledge Task Items.

| Item | Entire Sample | High Perceived Knowledge (n = 490) | Low Perceived Knowledge (n = 207) |
|---|---|---|---|
| 1. A requirement of a syllable is that a) it contain at least one consonant letter; b) it contain no more than one vowel letter; c) it be a pronounceable unit; d) it contain no more than one phoneme; e) all of the above. | 46.5% | 44.8% | 48.5% |
| 2. The consonant speech sounds in the American-English language are represented by a) the distinctive speech sounds we associate with the 21 consonant letters of the alphabet; b) 18 of the consonant letters of the alphabet plus certain digraphs; c) the single letter consonants plus their two-and three-letter blends; d) the consonant-vowel combinations; e) the American-English language is too irregular to represent the consonant speech sounds with any degree of accuracy. | 18.3% | 16.5% | 21.0% |
| 3. The open syllable of the nonsense word *botem* would most likely rhyme with a) coat; b) hot; c) rah; d) low; e) gem. | 28.9% | 27.9% | 31.1% |
| 4. A diphthong is best illustrated by the vowels representing the sound of a) *ow* in *snow*; b) *ou* in *mouse*; c) *oo* in *foot*; d) *ai* in *said*; e) a and b. | 35.3% | 34.6% | 37.9% |
| 5. The sound of the *schwa* is represented by a) the *a* in *baited*; b) the *e* in *early*; c) the *e* in *happen*; d) the *w* in *show*; e) All of these. | 28.4% | 29.9% | 24.0% |

| TABLE II. Continued | | | |
|---|---|---|---|
| 6. An example of a closed syllable is a) desk; b) home; c) tight; d) All of these; e) None of these. | 55.6% | 57.1% | 52.5% |
| 7. If *e* were the only vowel in an open syllable, the *e* would most likely represent the same sound as a) the *e* in *pine*; b) the *ea* in *meat*; c) the *y* in *my*; d) the *e* in *set*; e) None of these. | 35.5% | 35.6% | 36.4% |

more than half of these questions, and less than 1% (four teachers) answered all seven items. Knowledge deficiencies become of even greater concern when one examines particular responses provided by teachers on this survey. For example, we found it worrisome to entertain the thought that only 18% of a large sample of K-3 teachers responsible for teaching beginning reading were aware of how the consonant speech sounds are represented in the English language system. Current research demonstrates that young children need to be introduced to these letter-sound patterns to enable them to make adequate progress in decoding common words found in the elementary curriculum (National Reading Panel, 2000). In the debriefing after administration of the survey, the teachers reported that they had not received any training surrounding the complexity of consonant and vowel sounds in their credential programs, and their teaching materials did not emphasize these patterns. In another example, we observed that only 28% of the teachers could correctly identify the sound of a schwa, as represented in the final syllable of the word "happen." From our point of view, it is essential that teachers of reading be knowledgeable about this vowel pattern, not only because it is the most commonly spoken vowel in English (Hannah, Hannah, Hodges, & Rudorf, 1966), but also because of the challenge it presents for children in learning to read and spell. The schwa sound represents a unique yet important construct for the developing reader in that it cannot easily be sounded out and is not represented by any one single vowel letter. However, approximately 72% of the teachers in our sample could not identify a schwa sound, leaving us doubtful that they could, in turn, convey its complexities to young children.

*Implicit Phonics Knowledge.* We believed that while teachers did not possess enough explicit knowledge to perform well on the types of questions outlined above, they might still

have the implicit understanding of phonics rules that would allow them to perform well on a different type of task. That is, while they may not have declarative knowledge of the English language system, we felt they could possibly possess a level of procedural knowledge sufficient enough to scaffold children's beginning reading and spelling. Our results, however, falsified this hypothesis. While their scores were not as low as their explicit knowledge, teachers' implicit levels of knowledge of phonics were relatively low (see table III). The teachers' ability to recognize common irregular words was surprisingly poor. Only 11% of teachers were able to identify all 11 irregular words. When the threshold of identifying half of the words was applied, we found that approximately 60% of teachers were able to identify common irregular words. Of course, this can also be interpreted as four out of 10 teachers could not show, and thus could not teach, beginning readers that words like "what" and "the" cannot be sounded out.

The importance of being able to teach these words correctly is highlighted by the fact that we only chose words that are commonly found in K-3 students' curriculum and texts. For example, children read the words "what" and "the" on a daily basis. However, the list contained levels of irregularity; that is, some words are more irregular (e.g., "yacht" and "the") than

TABLE III.  Percentage of Teachers Responding Correctly to Phonics—Implicit Knowledge Task Items.

| Item | Entire Sample | High Perceived Knowledge ($n = 540$) | Low Perceived Knowledge ($n = 155$) |
|------|---------------|--------------------------------------|-------------------------------------|
| the | 65.0% | 66.4% | 62.2% |
| done | 61.2% | 61.7% | 59.8% |
| said | 65.6% | 65.3% | 67.7% |
| have | 47.6% | 45.9% | 52.8% |
| was* | 51.7% | 54.1% | 44.1% |
| give | 41.3% | 41.9% | 40.2% |
| what | 45.6% | 47.7% | 38.6% |
| one | 60.9% | 60.1% | 66.1% |
| yacht | 82.1% | 82.4% | 81.1% |
| does | 71.4% | 72.3% | 70.9% |
| pint | 44.2% | 43.2% | 47.2% |

*unpaired t-test significant at .05 (two-tailed)

others (e.g., "have" and "give"). Nevertheless, the analyses of individual items did not demonstrate an appreciation of this, but rather highlighted some of the patterns of inadequate knowledge. For example, 40% of teachers did not recognize as irregular the word "done," over 40% did not recognize the word "one" as irregular, and 55% did not recognize the word "what" as irregular.

These findings illustrate that many K-3 teachers may not be knowledgeable enough to discern which set of words should be taught via sight word methods rather than encouraging their students to employ their decoding skills. One of the hallmarks of skilled reading is automatic word recognition (Stanovich, 1980). When children recognize the subtle distinction between words that are decodable with the English system and those that are not, they are able to conserve valuable cognitive resources by avoiding unsuccessful attempts to sound out the latter. Also, when teachers fail to recognize irregularities in words, they may, for example, respond inappropriately to children's errors (e.g., encouraging children to "sound out" an irregular word) or may inadvertently select inappropriate examples of words for instruction (e.g., choosing "done" as an example of a "magic-e" word).

## RELATIONS BETWEEN ACTUAL AND PERCEIVED KNOWLEDGE

A second component surrounding the disciplinary knowledge base of teachers was their awareness of what they know and do not know (i.e., the ability to calibrate their knowledge). In the next set of analyses, we explored whether teachers who differed in the amount of knowledge they *actually* possessed also differed in their self-assessments. Thus, in addition to the knowledge levels, we explored teachers' ability to calibrate this knowledge within the three distinct domains of children's literature, phonological awareness, and phonics.

### ARE TEACHERS CALIBRATED IN THEIR KNOWLEDGE OF CHILDREN'S LITERATURE?

We examined the relationship between teachers' actual and perceived knowledge of children's literature by comparing those teachers who said they were either expert or proficient in the domain of children's literature and those who thought they had minimal skills or knowledge or no experience or knowledge.

The results of an unpaired t-test revealed a significant difference in actual knowledge of children's literature (see table IV), whereby those teachers who categorized themselves as possessing higher levels of knowledge in children's literature in fact performed significantly higher on the TRT than those teachers who perceived themselves as less knowledgeable. Thus, teachers did show some evidence of calibration of knowledge in the domain of children's literature. Although the pattern of findings observed here revealed calibration that was far from perfect, there was what knowledge calibration researchers call "discrimination" (i.e., participants more confident in their knowledge actually performed better). Knowledge discrimination refers to an awareness of one's own knowledge state, and these participants demonstrated such awareness. In our study, the effect size of the difference in actual knowledge of children's literature between those high in perceived knowledge and those low in perceived knowledge was .41.

## ARE TEACHERS CALIBRATED IN THEIR KNOWLEDGE OF PHONOLOGICAL AWARENESS?

Unpaired t-tests were used to compare the actual knowledge of teachers who described themselves as either expert or proficient in the domain of phonological awareness and those who described themselves as having either minimal skills or knowledge or no knowledge or experience. An analysis of teachers' mean scores on this task revealed a significant difference be-

TABLE IV. Comparison of Knowledge in the Domains of Phonological Awareness, Phonics, and Children's Literature in Teachers with High and Low Perceived Knowledge.

| | High Perceived Knowledge Mean (SD) | Low Perceived Knowledge Mean (SD) | t | Effect size (Cohen's d) |
|---|---|---|---|---|
| TRT score[1] | 0.34 (0.17) | 0.28 (0.15) | 3.87* | .41 |
| PA task score[2] | 4.18 (3.17) | 4.80 (3.00) | −2.28* | .20 |
| ExPhonics task score[3] | 2.60 (1.58) | 2.60 (1.44) | −0.06 | . |
| ImPhonics task score[4] | 6.41 (3.18) | 6.31 (3.13) | 0.33 | . |

[1]High perceived knowledge of children's literature $n = 455$; Low perceived knowledge of children's literature $n = 108$; [2]High perceived knowledge of phonological awareness $n = 377$; Low perceived knowledge of phonological awareness $n = 199$; [3]High perceived knowledge of explicit phonics $n = 299$; Low perceived knowledge of explicit phonics $n = 134$; [4]High perceived knowledge of phonics $n = 444$; Low perceived knowledge of phonics $n = 127$.

*$p < .01$.

tween the two groups (see table IV); however, counterintuitively, the group that thought they had greater knowledge of phonological awareness actually achieved lower mean scores on the task. Additional t-tests conducted on each individual item mirrored these findings (see table I). On three of the 10 items, teachers in the low perceived knowledge group performed significantly better than teachers in the high perceived knowledge group. Overall, the results of these analyses indicate that teachers had negligible ability to calibrate their knowledge in the domain of phonological awareness. Furthermore, we found that teachers tended to overestimate, rather than underestimate, their knowledge. Overestimation can limit or constrain one's level of receptivity to learning new information. In contrast, an accurate awareness of the limitations of one's knowledge can presumably increase the actions that one would take to acquire new information and experiences. For example, in our sample, approximately 9% of teachers correctly estimated their lack of knowledge in the domain of phoneme awareness; that is, they reported that they had either minimal skills or knowledge or no experience or knowledge, and, in fact, their performance on the knowledge measure confirmed this self-assessment. This subsample of teachers appears well poised to benefit from professional development experiences.

## ARE TEACHERS CALIBRATED IN THEIR PHONICS KNOWLEDGE?

Unpaired t-tests were used to compare the actual phonics knowledge, both implicit and explicit, of teachers who thought they had a lot of knowledge compared to those who thought they knew little in these domains.

*Implicit Phonics Knowledge.* In the domain of implicit phonics, we found no significant difference between the performance of teachers who described themselves as either expert or proficient and those who described themselves as having either minimal skills or knowledge or no experience or knowledge in this domain (see table IV). Teachers displayed very little ability to calibrate their knowledge of implicit phonics. Additional t-tests were conducted on each individual item (see table III) to allow for further comparisons among teachers in the high and low knowledge groups. With the exception of one item ("was"), the pattern of findings mirrored those outlined above and indicated poor calibration.

*Explicit Phonics Knowledge.* We examined differences in the actual knowledge of teachers with high and low perceived

knowledge in this domain using t-tests on the mean scores on this task (see table IV). As was the case in the analyses of implicit phonics, no significant difference was found. Additional t-tests on individual items revealed findings consistent with the mean scores t-test. No significant differences were found on any single item between teachers who perceived their explicit phonics knowledge to be high as compared with those who perceived their explicit phonics knowledge to be low. Overall, in the domains of implicit and explicit phonics, the results of these analyses suggest no relationship between teachers' perceived and actual knowledge. Teachers displayed a complete lack of calibration in these two domains.

## EXAMINING THE ROLE OF EXPERIENCE AND LEVEL OF EXPERTISE IN ACTUAL KNOWLEDGE, PERCEIVED KNOWLEDGE AND CALIBRATION

We explored whether two critical teacher characteristics that could be of theoretical and practical importance—years of experience and level of expertise—were associated with different patterns of actual knowledge, perceived knowledge, and knowledge calibration. To explore the possible effect of years of experience, two subgroups were identified: one group that had between 0 and three years experience, and another that had 15 or more years experience. Unpaired t-tests examining differences in both actual and perceived knowledge between teachers with more and less experience were conducted (see table V). Surprisingly, the least experienced teachers had significantly more positive perceptions of their knowledge in all three domains than did the most experienced. With regard to actual knowledge, least experienced teachers did know more in the areas of phoneme awareness and explicit phonics, while no differences were observed in the areas of implicit phonics and children's literature. With the advent of recent changes in pedagogy and practice, it may be the case that teachers who have entered the profession more recently have benefited from increased exposure to research on early reading acquisition through either teacher training programs or professional development activities.

To explore the possible effect of level of expertise (as evidenced by teacher credentials), two subgroups were identified: one group that had a full and clear credential and another group that consisted of teachers that held any other type of credential (e.g., emergency or intern), or no credential at all. It is important to note that teachers in the latter group ranged in

TABLE V.  Differences in Both Actual and Perceived Knowledge Between Teachers with More and Less Experience and Expertise.

| Experience | Least Mean (SD) | Most Mean (SD) | t | Effect Size (Cohen's d) |
|---|---|---|---|---|
| Knowledge | (n = 175) | (n = 186) | | |
| PA task | 5.05 (3.16) | 3.29 (2.94) | 5.71** | .60 |
| ImPhonics task | 6.54 (3.20) | 6.01 (3.16) | 1.48 | |
| ExPhonics task | 2.56 (1.61) | 2.12 (1.51) | 2.66** | .28 |
| TRT | 0.31 (0.16) | 0.31 (0.17) | −0.30 | |
| Perception | (n = 199) | (n = 234) | | |
| Perceived PA | 2.55 (0.62) | 2.00 (0.61) | 9.23** | .89 |
| Perceived ImPhonics | 2.41 (0.57) | 1.91 (0.56) | 9.13* | .88 |
| Perceived ExPhonics | 2.55 (0.64) | 1.98 (0.61) | 9.47** | .91 |
| Perceived Children's Literature | 2.26 (.062) | 1.97 (0.53) | 5.29** | .51 |

| Credential Status | Other Mean (SD) | Full Mean (SD) | t | Effect Size (Cohen's d) |
|---|---|---|---|---|
| Knowledge | (n = 137) | (n = 485) | | |
| PA task | 4.16 (3.10) | 4.34 (3.11) | 0.58 | |
| ImPhonics task | 6.03 (3.42) | 6.49 (3.10) | 1.42 | |
| ExPhonics task | 2.36 (1.43) | 2.41 (1.54) | 0.32 | |
| TRT | 0.26 (0.16) | 0.35 (0.16) | 5.44** | .53 |
| Perception | (n = 155) | (n = 529) | | |
| Perceived PA | 2.52 (0.69) | 2.17 (0.60) | −6.28** | .57 |
| Perceived ImPhonics | 2.32 (0.60) | 2.05 (0.57) | −5.22** | .48 |
| Perceived ExPhonics | 2.54 (0.71) | 2.15 (0.59) | −6.89** | .63 |
| Perceived Children's Literature | 2.32 (0.63) | 2.09 (0.54) | −6.08** | .56 |

$*p > .05; **p > .01$

years of experience from 0 to 15 or more years. Teachers without a full and clear credential held significantly more positive perceptions of their knowledge across all three domains than did fully credentialed teachers. However, the actual knowledge of these two subgroups was different only for children's literature, where fully credentialed teachers knew more than teachers who were not fully credentialed. Lastly, when examining calibration, we found that teachers with more versus less experience were not substantially different in their ability to calibrate their knowledge. Similarly, teachers who were fully credentialed versus not fully credentialed were no different in their

calibrations. In sum, neither experience nor expertise alone appears to confer on teachers an accurate sense of what they do and do not know.

## DISCUSSION

This study focused on three distinct domains of teachers' reading related content knowledge that are considered to be critical to teaching beginning reading: children's literature, phonological awareness, and phonics. Although there is increasing interest in the disciplinary knowledge that teachers have in the area of literacy, the area remains relatively underinvestigated (c.f., Bos et al., 2001; McCutchen, Abbott, et al., 2002; McCutchen, Harry, et al., 2002; Moats, 1995; Moats & Foorman, 2003; Moats & Lyon, 1996) relative to its perceived importance in the policy world. There are strong theoretical reasons to suspect linkages between teacher knowledge and ability to teach reading effectively (e.g., being able to teach students phonemic awareness and choose good literature). Correspondingly, a stronger empirical base from which to set policy and develop professional development curricula is needed.

In our study, we sought to investigate the knowledge base of a large sample of teachers and measure their reading-related disciplinary knowledge at a deep level to offer a fine-grained assessment of teachers' reading related content knowledge. Moreover, our study provides new measures of these constructs that in all but one instance display stronger reliabilities than those used in previous investigations (Bos, et al., 2001; McCutchen, Abbott, et al., 2002; McCutchen, Harry, et al., 2002). In our large and ethnically diverse sample of kindergarten through third grade teachers who taught in a large, urban school district, we observed a notable lack of knowledge across several important domains that are theoretically linked to beginning reading instruction. In the area of literature, teachers demonstrated limited knowledge of children's book titles. Previous research has demonstrated that knowledge of book titles and authors' names is reflective of immersion in a literate environment (e.g., Cipielewski & Stanovich, 1992; Cunningham & Stanovich, 1990, 1991, 1997). Teachers can see a book in a bookstore, in the school library, read a review of the book in a professional magazine, or see an advertisement in the newspaper. All of these ways of gaining knowledge of literature are proxies for reading activities. However, in our sample, only a

small fraction of teachers demonstrated at least a moderate indication that they were engaged and focused on children's literature, even in any of these indirect ways.

Similarly, we observed that teachers knew relatively little about phonemic awareness (e.g., knowing how many sounds are in the word "stretch") or phonics (e.g., knowing that "what" is an irregular word or knowing the definition of a schwa). These findings support and extend previous research in this area (e.g., Moats, 1994). It is important to note that these findings in no way imply that the teachers in this sample were not literate individuals; rather, it points out that they lack a degree of technical knowledge that is relevant and that many consider fundamental to the teaching of reading.

The results of our study indicate that the knowledge base of many K-3 teachers is not aligned with the large and convergent body of research demonstrating the key role that component processes such as phoneme awareness and the alphabetic principle play in learning to read. The appropriate response to these findings would be to act to improve the level of knowledge of our teachers in these critical domains. We should continue to turn our attention toward improving teacher preparation and teacher development in the area of early literacy by highlighting the direction that reading education for both preservice and in-service teachers might take (e.g., American Federation of Teachers, 1999; Brady & Moats, 1997; Hoffman & Pearson, 2000; McCutchen & Berninger, 1999).

## THE IMPORTANCE OF KNOWLEDGE CALIBRATION

The examination of the relation between perceived self-knowledge and actual knowledge is an area of investigation in social and cognitive psychology that has direct application to education. The implications of having an accurate perception of one's knowledge in a domain for learning (or teaching) are self-evident. In our study, we observed significant differences in teachers' ability to calibrate their knowledge across different domains of reading. Teachers tended to be more aware of the extent of their knowledge—that is, better calibrated—in the domain of children's literature. There was a significant difference in actual performance between those teachers who described themselves as an expert in this domain versus those who felt they had minimal knowledge with reported experts performing better on a proxy test of children's literature than reported novices. In contrast, in the domains of phonological awareness and phonics, we observed that teachers were very

poorly calibrated. Recall that the group that reported they were experts in phonological awareness in fact had a harder time perceiving and counting the sounds in words than those who indicated they possessed minimal skills.

A related issue with similar implications for professional development has to do with the role of teacher beliefs in predicting how one responds to learning opportunities. Smylie (1988) found that teachers with relatively high levels of personal teaching efficacy were more likely to seek innovations in their practice. In other words, those who perceived themselves as being most effective were the same ones most interested in finding out about new and more effective methods of teaching. Similarly, it may be the case that teachers who are better able to calibrate their knowledge are more likely to seek new knowledge.

Under the assumption that people learn better when they are relatively well calibrated as to their current level of knowledge—because they will then calibrate their knowledge acquisition accordingly—it can be assumed that we have much work to do in professional development in the domains of phonological awareness and phonics as compared to the domain of children's literature. This finding does not mean that some of these areas such as children's literature are not important; rather, it means that the lack of calibration in certain areas is a cause for concern. It is of concern because it is critical that people know what they do not know. The implications of these findings are readily apparent in the area of teacher professional development. Receptivity to new ideas and methods depends on good calibration of one's knowledge and experience. Reading experts agree by consensus that if teachers are poorly calibrated and significantly overestimate their knowledge of important reading related information, they will not seek to acquire or be open to new constructs presented in the context of professional development. Thus, while Nolan, McCutchen and Berninger (1990) have rightly maintained that "Teachers cannot teach what they do not know" (p. 70), it might also be the case that teachers do not always know what they do not know.

Address correspondence to: Anne E. Cunningham, 4511 Tolman Hall, Graduate School of Education, University of California, Berkeley, Berkeley, CA 94720, Telephone: 510-643-6871. E-mail: acunning@uclink.berkeley.edu.

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# APPENDIX A: PERCENTAGE OF TEACHERS WHO CORRECTLY IDENTIFIED CHILDREN'S BOOK TITLES (REAL AND FOIL).

| Title | Percentage | Title | Percentage |
|---|---|---|---|
| Caps For Sale | 62.52% | Biscuit | 10.35% |
| Goodnight Moon | 67.97% | If You Give a Pig a | |
| Follow the Drinking Gourd | 53.99% | Pancake | 40.42% |
| Brown Bear, Brown Bear, | | Eloise | 37.48% |
| What Do You See? | 70.63% | Jamberry | 29.65% |
| Oh, The Places You'll Go | 45.60% | Because I Love You | 11.57% |
| Where the Wild Things | | Chicka Chicka Boom Boom | 57.48% |
| Are | 75.10% | The Last of the Really | |
| Bartholomew and the | | Great Whangdoodles | 04.90% |
| Oobleck | 31.47% | Danny and the Dinosaur | 58.60% |
| Harold and the Purple | | Corduroy | 70.77% |
| Crayon | 48.67% | Gerald McBoing Boing | 09.51% |
| The Going to Bed Book | 04.76% | Chrysanthemum | 33.29% |
| Guess How Much I | | Runaway Bunny | 52.31% |
| Love You | 33.43% | Dog Heaven | 09.93% |
| Father Bear Comes Home | 14.83% | | |
| Moo, Baa, LA LA LA | 03.92% | **Foils:** | |
| Are You My Mother? | 67.83% | Down By the Sea (F) | 67.97% |
| Kofi and His Magic | 09.93% | The Blueberry Kazoo (F) | 96.92% |
| Bedtime for Frances | 59.72% | Open Up (F) | 99.30% |
| Flat Stanley | 16.78% | Grandmother's Surprise (F) | 81.40% |
| Click Clack Moo | 04.62% | Blame it on Billy (F) | 96.78% |
| The Fall of Freddie the Leaf | 06.71% | Wacky Wendell (F) | 97.20% |
| The Story of Ferdinand | 48.25% | Down by David's Pond (F) | 99.02% |
| The Adventures of | | My Friend the Mailman (F) | 94.69% |
| Chatterer the Squirrel | 02.38% | The Muffin Maker (F) | 91.89% |
| Cloudy With a Chance of | | Cootie Catchers (F) | 96.08% |
| Meatballs | 66.57% | Backyard Safari (F) | 91.61% |
| House on East Eighty- | 13.43% | The Colors of Me (F) | 78.74% |
| Eighth Street | | The Rabbit Acrobats (F) | 97.48% |
| | | What Rhymes With | |
| | | Orange?(F) | 82.66% |
| | | The Clock With No | |
| | | Hands (F) | 95.52% |