

Phonemic Awareness Skill of Speech-Language Pathologists and Other Educators

Elizabeth J. Spencer
C. Melanie Schuele
Kathryn M. Guillot

Vanderbilt University, Nashville, TN

Marvin W. Lee

Tennessee State University, Nashville



urrent educational policy underscores the importance of reading achievement for all children, with an emphasis on the use of instructional practices that are rooted in scientifically based reading research (U.S. Department of Education, 2001). As educators increasingly are expected to implement evidence-based practice or scientifically based instruction in teaching children to read, a critical question arises: Do educators have sufficient knowledge and skill to implement the instructional and intervention practices that are likely to be effective with all learners, particularly those children who struggle to learn to read?

In the last 20 years, the importance of phonological awareness¹ in children's early reading achievement has been clearly established (Wagner & Torgesen, 1987). For children who have poor phonological awareness, systematic and explicit instruction improves

¹Phonological awareness is a broad term that relates to the ability to analyze the sound structure of language whereas phonemic awareness relates to those aspects of phonological awareness directly associated with the manipulation of individual sounds. In this report, we do not use the terms interchangeably. We restrict the use of phonemic awareness to indicate ability to analyze (e.g., segment) the individual sounds of words. See Schuele & Boudreau (2008) for further explanation.

ABSTRACT: Purpose: Educators rely on sufficient knowledge and skill to provide effective phonemic awareness instruction, an important component of early literacy instruction, particularly for children who experience difficulty learning to read. The purpose of this study was to evaluate and compare the phonemic awareness skill of several groups of educators, including speech-language pathologists (SLPs; $n = 160$), kindergarten teachers ($n = 109$), first-grade teachers ($n = 112$), reading teachers ($n = 100$), and special education teachers ($n = 60$).

Method: Participants completed a paper-pencil measure of phonemic awareness skill that included 3 tasks. The measure was designed to assess sophisticated explicit phonemic awareness skill within a print context, representing an advanced skill level that has been deemed critical to teaching.

Results: SLPs demonstrated superior performance on the measure of phonemic awareness skill when compared to other educators

($d = 1.54$). The performance of reading and special education teachers was comparable to that of kindergarten and first-grade teachers. Orthographic knowledge had an adverse impact on the performance of all groups. However, SLPs were far more proficient than other educators at segmenting words that had a complex relationship between speech and print (e.g., *box*, *use*).

Clinical Implications: SLPs have relative expertise in phonemic awareness, yet their performance may not be proficient. Three recommendations are discussed: (a) Increase the phonemic awareness skill of all educators, (b) revise instructional materials to enhance educators' efforts to provide accurate and effective phonemic awareness instruction, and (c) include SLPs as members of the team responsible for phonemic awareness instruction and intervention.

KEY WORDS: phonological awareness, phonemic awareness, speech-language pathologists, teachers

phonological awareness (Bus & Van IJzendoorn, 1999; Ehri et al., 2001; Troia, 1999). When coupled with adequate letter-sound instruction, phonological awareness training results in improved word decoding. In 2000, the National Reading Panel identified phonemic awareness as a key area of literacy instruction (National Institute of Child Health and Human Development, 2000). As a result, it is common now to find phonological awareness included in classroom instruction in preschool, kindergarten, and first grade (e.g., Farr, Strickland, & Beck, 2001; Schickedanz, Dickinson, & Schools, 2005; Smith et al., 2001). Although kindergarten and first-grade literacy curricula traditionally have included some phonological awareness activities (e.g., rhyme, beginning sound identification), curricula today include far more explicit and extensive phonological awareness instruction than in the past. The sequence of instructional activities moves from very simple phonological awareness activities (e.g., rhyme) to complex activities of explicit phoneme segmentation. In addition, for children who fail to make adequate progress in the classroom, targeted phonological awareness intervention may be provided to bolster these skills as a means to prevent reading disabilities (Justice & Schuele, 2003; O'Connor, Jenkins, Leicester, & Slocum, 1993; Schuele et al., in press; Torgesen, Morgan, & Davis, 1992).

Current educational legislation, the No Child Left Behind Act of 2001, sets out explicit requirements for highly qualified teachers and identifies content knowledge as critical to effective teaching (Paige, 2002; U.S. Department of Education, 2001). This legislation draws on evidence that teachers' content knowledge is significantly related to student achievement (e.g., in mathematics; see Hill, Rowan, & Ball, 2005). Although there is limited empirical evidence to link the phonological awareness knowledge and skill of educators to student outcomes (e.g., McCutchen, Abbott, et al., 2002; McCutchen, Harry, et al., 2002), Moats and Lyon (Lyon, 1996; Moats & Lyon, 1996) argued persuasively that effective phonological awareness instruction and intervention relies on educators having sufficient knowledge of language structure. In comparison to teachers with less knowledge and skill, those who have greater phonological awareness knowledge and skill spend more instructional time on word sound activities. This increased instructional time is associated with improved child performance in reading and writing as well as phonological awareness (McCutchen, Abbott, et al., 2002; McCutchen, Harry, et al., 2002).

Unfortunately, Moats (1994) documented that educators performed poorly when asked to demonstrate language structure knowledge and skill. For example, educators were less than 50% accurate when asked to count the number of sounds in words, and few were able to define phonological awareness adequately. Moats noted that preservice teacher education in language structure has been limited, and inservice training and experiences do not sufficiently advance teachers' knowledge of language structure. Because effective classroom instruction requires that educators (a) present information in an organized and logical sequence, (b) select appropriate teaching examples, and (c) respond to student errors in a manner that furthers learning (Moats, 1994), the phonological awareness knowledge and skill of educators becomes a critical factor in successful phonological awareness instruction.

Subsequent to Moats (1994), several research groups have provided additional evidence that educators perform poorly on measures of phonological awareness knowledge and skill (Bos, Mather, Dickson, Podhajski, & Chard, 2001; Cunningham, Pery, Stanovich, & Stanovich, 2004; Mather, Bos, & Babur, 2001; McCutchen,

Abbott, et al., 2002; McCutchen, Harry, et al., 2002; Moats, 1994; Moats & Foorman, 2003). The educators included as participants in these studies were classroom teachers and reading teachers, and, to a limited extent, special education teachers and speech-language pathologists (SLPs). In these studies, educators were tested on their conceptual knowledge of phonological awareness (e.g., "Find the voiced consonant.") and orthography (e.g., "What is a digraph?"). In addition, they were asked to demonstrate skill in phonological awareness (e.g., "How many sounds in *box*?") and orthography (e.g., "Choose the word(s) with a consonant blend."). Across these studies, there is a general consensus that educators' knowledge and skill are insufficient for teaching phonological awareness.

Past studies indicate that educators rely heavily on orthographic knowledge (e.g., number of letters, orthographic rules) rather than on the sounds of speech when asked to identify phonemes in words (Cunningham et al., 2004; Moats, 1994; Moats & Foorman, 2003). Although early literacy curricula have increasingly included phonological awareness over the last two decades, there is little evidence that teachers' phonological awareness knowledge and skill have changed from what Moats (1994) reported.

Whether teaching experience relates to phonological awareness knowledge and skill remains an open question. Bos et al. (2001) reported that more experienced teachers were more proficient in phonological awareness than were less experienced teachers. Teachers with more than 11 years of experience had higher scores on tests of phonological awareness than did teachers with 1–5 years of experience ($d = .40$). In contrast, Cunningham et al. (2004) found that the least experienced teachers (≤ 3 years) had greater ability in phonological awareness and explicit phonics than did the most experienced teachers (> 15 years; $d = .60$). These disparate findings may reflect a difference in the type of assessment. Bos et al.'s measure involved skill (e.g., phoneme segmentation) and knowledge (e.g., definitions of key terms). In contrast, Cunningham et al. assessed only phonemic awareness skill. It is also possible that Cunningham et al. captured regional differences in preservice training. Her participants were all teachers in California. Nevertheless, the most important finding is that educators as a group have failed to demonstrate a level of phonological awareness competency or technical knowledge "that many consider fundamental to the teaching of reading" (Cunningham et al., 2004, p. 161).

It is widely recognized that addressing the literacy learning needs of all children requires the collaboration of teams of educators that include classroom teachers, reading teachers, special education teachers, and SLPs. The disciplinary training as well as professional experience of these individual team members likely leads to varying profiles of strength relative to language structure. Understanding the strengths of individual team members is important in maximizing team efforts to address the literacy learning needs of children, particularly those who are at risk for reading disabilities.

But research to date has not sufficiently differentiated the phonological awareness knowledge and skill of educators based on professional discipline. Bos et al. (2001) found special education teachers ($n = 157$) to outperform elementary education teachers ($n = 294$) on tests of phonological awareness; the group difference was much greater for preservice teachers ($d = .46$) than for inservice teachers ($d = .26$). McCutchen, Harry, et al.'s (2002) failure to find group differences may have been due to an insufficient number of participants (kindergarten teachers, $n = 24$; first- and second-grade teachers, $n = 27$; and special education teachers, $n = 8$). They

reported effect sizes similar to those in Bos et al. ($d = .31-.57$). Neither of these studies included reading teachers or SLPs.

The purpose of this study was to evaluate and compare the phonemic awareness skill of a diverse group of educators that included kindergarten teachers, first-grade teachers, special education teachers, reading teachers, and SLPs. Classroom teachers are responsible for reading instruction for most children, but SLPs, reading teachers, and special educators provide services to children with language and learning difficulties. Our measure did not address concepts or knowledge per se, but rather required participants to complete tasks that assessed phonemic awareness skill. We chose to focus on skill to the exclusion of knowledge because, at least hypothetically, one could have strong knowledge (e.g., be able to define phonological awareness) but nevertheless have insufficient skill (e.g., perform poorly on segmenting words). We believe that phonemic awareness *skill* is crucial to an educator's ability to provide scientifically based phonemic awareness instruction and intervention (Schuele & Boudreau, 2008).

Of particular interest was the extent to which groups of educators varied in their phonemic awareness skill. We hypothesized that SLPs would have greater skill than other educators given their preservice training in speech science, phonetics, articulation, and phonology. Further, we hypothesized that special educators and reading teachers would have greater skill than classroom teachers. We expected that the preservice and inservice training of special education teachers and reading teachers focused specifically on meeting the needs of struggling readers (i.e., often those with poor phonemic awareness), as well as on-the-job experience, would yield stronger phonemic awareness skill for these professionals. To explore these hypotheses, we posed three research questions:

- Do SLPs outperform other educators on a measure of phonemic awareness skill?
- Do reading teachers and special education teachers outperform kindergarten and first-grade teachers on a measure of phonemic awareness skill?
- Are there patterns of performance on a phoneme segmentation task that explain group differences in phonemic awareness skill?

METHOD

Participants

Study participants included 541 professional educators who identified themselves as an (a) SLP, (b) classroom teacher in kindergarten,

(c) classroom teacher in first grade, (d) reading teacher, or (e) special education teacher. The participants' years of professional experience ranged from 0 to 38 years ($M = 16.59$; $SD = 9.68$), and the majority (74%) had a master's degree. Table 1 summarizes experience and educational level by participant group.

The data were gathered at six sites over a 5-year period in conjunction with professional education workshops that were provided by the second author. Participation in the workshop was mandated by the school district at three sites and was voluntary at three sites. With the exception of two sites, the data were collected to evaluate workshop participants' phonemic awareness skill for the purpose of program evaluation.

Procedure

Measure. A paper-pencil measure was used to assess participants' phonemic awareness skill. The measure included three tasks—phoneme segmentation, phoneme identification, and phoneme isolation—adapted from Moats (2000). A paper-pencil measure of phonemic awareness rather than an oral measure was chosen because it could be administered efficiently to large groups of educators. The measure was designed to provide participants with insight into their own skills and to allow for program evaluation. Use of the educators' responses to address the research questions in this study was a post hoc decision. Participants completed the phonemic awareness measure before the workshop. At four sites, participants also completed the phonemic awareness measure after the workshop; only pretest performance was analyzed in the present study.

The phonemic awareness measure was designed to challenge adults' phonemic awareness skill, recognizing that in order to teach children to link sounds and print, educators must have explicit awareness of the sound structure of words. To perform the three tasks competently, participants had "to think beyond print while analyzing speech" (Moats & Lyon, 1996, p. 83); that is, they needed to consider the phonological properties of words while viewing their printed forms. This level of awareness exceeds what is necessary for competent reading and writing (Moats & Lyon, 1996). Thus, the measure assessed sophisticated explicit phonemic awareness, which is an advanced skill level that is critical to effective teaching (Cunningham et al., 2004). Although a variety of tasks are used to measure phonological awareness, phonological awareness is considered a unitary construct (Anthony & Lonigan, 2004; Schatschneider, Francis, Foorman, Fletcher, & Mehta, 1999).

The first task, *phoneme segmentation*, included 21 items. Participants were asked to count the number of sounds in 21 words that varied (a) from two to five phonemes in length, (b) in syllable shape, and (c) in mapping of speech to print. For example, in the

Table 1. Characteristics of participant groups.

	<i>Speech-language pathologists</i> ($n = 160$)	<i>Kindergarten teachers</i> ($n = 109$)	<i>First-grade teachers</i> ($n = 112$)	<i>Reading teachers</i> ($n = 100$)	<i>Special education teachers</i> ($n = 60$)
Years of experience					
Mean	14.1	20.2	19.6	17.0	10.2
SD	9.5	7.9	8.9	10.3	8.3
Percentage with a master's degree	95.6	67.9	57.2	72.2	65.0

task item *cat*, sounds and letters have a close mapping, three sounds and three letters, whereas *sing* has a less transparent mapping, three sounds but four letters. Items with a less transparent sound–letter relation were expected to be more difficult to segment. For each word, a score of 0 or 1 point was possible, with a maximum score of 21 points.

The second task, *phoneme identification*, included five items. For each item, there was a target word and four additional words. Participants were given the instructions: “Read the first word in each line and note the sound that is represented by the underlined letter or letter cluster. Then select the word or words that contain the same sound.” For example, the first item included *pull* as the target word, and *sugar*, *tune*, *cup*, and *fuse* as the additional words. Although the additional words had the same letter(s) as the underlined letter(s) in the target word, the letter(s) in the additional words did not necessarily represent the same sound. Also, a different letter or combination of letters could have represented the same sound. For the five items in this task, each of the four additional words was scored as correct or incorrect. Words that were correctly identified as matching or not matching the target received 1 point. The maximum score was 20 points.

The third task, *phoneme isolation*, included six items. Participants were asked, “What is the third speech sound in each of the following words? Give a letter that represents the third sound and an example word with the sound circled.” A sample item was provided to guide the participants; for *cat*, *t* was provided and *toy* was given as the example word with the *t* circled. Importantly, for each word, the third letter of the word did not necessarily correspond to the third sound in the word. Each item was scored as correct or incorrect based on the letter provided, with the example word used for clarification of the response. The maximum score was 6 points.

Each participant received a subscore for each of the three tasks as well as a total score, which was a sum of the raw subscores for the three tasks. The maximum total score was 47 points.

Scoring and reliability. A master response form with the correct response for each item was generated by consensus among the authors. Using the master response form, participant response forms were scored by one of the authors or a research assistant. A review of the scoring of all responses was conducted by another author. Discrepancies were exclusively mechanical errors and were resolved by verification between two authors.

Data analysis. An analysis of variance (ANOVA) was used to evaluate group differences. Dependent variables were total score and three subscores. Participant group was the between-subjects variable. Planned comparisons were conducted to test prestated hypotheses. Preliminary analyses indicated that there was no

significant correlation between performance on the measure and years of experience ($r = -.08, p = .06$) or education level ($r = .06, p = .16$); thus, these variables were not explored further. Effect size, Cohen’s (1998) d , was calculated using the pooled SD and was interpreted by conventional standards as small, medium, or large (Vacha-Haase & Thompson, 2004). A detailed analysis of participants’ responses on the first task, phoneme segmentation, was undertaken to clarify the quantitative group differences in phonemic awareness skill.

RESULTS

Performance of SLPs Compared to Other Educators

An overall ANOVA indicated a main effect of group on total score, $F(4, 534) = 62.39, p = .00$. See Table 2 for group means for the total score and subtest scores.

To test our hypothesis that the SLPs would have superior phonemic awareness skill relative to other educators, a planned comparison was conducted. This planned comparison indicated that the group of SLPs had superior performance relative to the group of other educators: kindergarten teachers, first-grade teachers, reading teachers, and special education teachers. For total score, there was a significant group difference, $F(1, 530) = 241.89, p = .00, d = 1.54$, such that the group mean of the SLPs ($M = 37.34, SD = 3.78$) was higher than the group mean of the other educators ($M = 30.25, SD = 5.30$). The effect size for this comparison indicates that the means for the two groups were approximately 1.5 SD s apart, with a 70% nonoverlap in scores between the two groups (Cohen, 1988). Thus, the performance of these two groups was quite disparate. There was also a significant group difference for each of the three tasks: phoneme segmentation, $F(1, 532) = 222.05, p = .00, d = 1.47$, phoneme identification, $F(1, 531) = 60.30, p = .00, d = .79$, and phoneme isolation, $F(1, 535) = 105.05, p = .00, d = .97$. On each task, the group mean of the SLPs was higher than the group mean of the other educators, and effect sizes were all large.

Performance of Reading Teachers and Special Education Teachers Compared to Kindergarten Teachers and First-Grade Teachers

To test our hypothesis that reading and special education teachers would outperform kindergarten and first-grade teachers, we

Table 2. Performance of speech-language pathologists (SLPs) and other educators on a measure of phonemic awareness skill.

Task	SLPs		Kindergarten teachers		First-grade teachers		Reading teachers		Special education teachers	
	M	SD	M	SD	M	SD	M	SD	M	SD
Phoneme segmentation (max 21)	15.86	2.53	11.36	3.21	11.83	3.38	11.71	3.42	10.56	3.63
Phoneme identification (max 20)	17.46	1.57	15.45	2.35	16.32	1.96	15.95	2.54	15.76	2.62
Phoneme isolation (max 6)	4.02	1.12	2.61	1.20	3.13	1.13	2.96	1.20	2.69	1.44
Total score (max 47)	37.34	3.78	29.47	5.05	31.29	4.85	30.62	5.64	29.05	5.61

conducted a planned comparison. There was no difference between the groups, $F(1, 530) = 1.10, p = .29$. The total score group mean for the reading and special education teachers was 30.04 ($SD = 5.66$) and for the kindergarten and first-grade teachers, the total score group mean was 30.40 ($SD = 5.02$). Thus, the performance of these groups was nearly identical.

Performance Patterns

Having identified a quantitative difference in performance between SLPs and other educators, we next addressed whether differential item difficulty on the phoneme segmentation task might clarify group differences, the third research question. Of the three tasks, phoneme segmentation was the most extensive task, and the nature of the items allowed for exploration of how features of speech and features of print might influence participants' segmentation accuracy. We hypothesized that, based on the complexity of the sound-letter relationship, individual words on this task differentially challenged participants' phonemic awareness skill (Cunningham et al., 2004). Some words on the task shared a close match of sounds and letters (e.g., *cat*); others did to a lesser extent (e.g., *use*, *quick*). We predicted that both groups (SLPs and other educators) would perform similarly when spoken words closely mapped to printed words. In contrast, we expected that the groups' performance would be differentiated on words that did not share a close match between sounds and letters.

Easy-to-segment and hard-to-segment words. We classified each of the 21 words on the phoneme segmentation task as (a) easy to segment (*easy*) or (b) hard to segment (*hard*) based on our examination of the complexity of the sound-letter relationship within each word. Words with clear sound-letter relations (e.g., *cat*, *run*, *ball*) were classified as easy. Words with commonly taught digraphs (*th*, *sh*, *wh*, taught as two letters with one sound), such as the word *thin*, were also classified as easy. Words with less clear sound-letter relations were classified as hard (e.g., *box*, *use*, where one letter represents two speech sounds). Overall, our clinical judgment classification was validated by examining the ranked accuracy score for all participants on each item (i.e., percentage of participants providing the correct response for each task item; see Table 3).

Performance of SLPs compared to other educators on easy and hard words. A planned comparison of SLPs to other educators was conducted; there was a significant group difference for both easy words, $F(1, 536) = 63.67, p = .00$, and hard words, $F(1, 536) = 289.81, p = .00$. The SLPs' mean was higher than the other educators' mean on easy words and on hard words; however, the between-groups difference was much larger on the hard words as compared to the easy words. On the easy words (max 11 points), both groups were highly accurate (SLPs: $M = 10.39, SD = .94$; other educators: $M = 9.04, SD = 2.17$), with performance approaching ceiling for the SLP group. The effect size of .81 is considered a large effect, with a 47% nonoverlap in scores (Cohen, 1988). In contrast, on the hard words, the effect size was almost twice as large at 1.52, indicating approximately 70% nonoverlap of scores across groups (Cohen, 1988). Notably, neither group was particularly proficient on the hard words (max. 11 points; SLPs: $M = 5.38, SD = 2.26$; other educators: $M = 2.34, SD = 1.70$). SLPs had an average of 54% accuracy, whereas other educators were only 22% accurate.

Table 3. Percentage of participants, by group, responding correctly to items on the phoneme segmentation task.

Word	All participants	SLPs	Other educators
	(N = 541)	(n = 160)	(n = 381)
Easy words			
cat	96	99	95
run	91	98	88
chirp	89	91	88
yes	88	96	85
does	87	96	84
teacher	86	96	83
show	85	92	83
sigh	88	89	83
ball	83	97	78
thin	82	97	77
stop	64	89	55
Hard words			
knuckle	77	90	73
sing	52	71	45
think	50	75	41
poison	41	60	34
squirrel	27	51	18
quick	26	70	11
box	23	61	10
start	12	31	6
fuse	8	21	3
use	7	17	3

DISCUSSION

In this study, the explicit phonemic awareness skill of five groups of educators was explored. Prior research has indicated that educators collectively have limited phonemic awareness skill. Given the varied disciplinary training of educators, however, it seemed important to explore the skill level of educators grouped by discipline. An ANOVA revealed a main effect of group.

In our first planned comparison, we found that SLPs had better phonemic awareness skill as compared to other educators. This finding supports our hypothesis that the professional training of SLPs, with an emphasis on the structure of speech and language, would be associated with better performance. However, contrary to our expectations, SLPs' mean performance was well below ceiling on the measure, at only 37.34 of a possible 47 points. As a group, SLPs did not exhibit expert skill in explicit phonemic awareness. Clearly, there is room for improvement.

In our second planned comparison, contrary to expectation, reading and special education teachers did not outperform kindergarten and first-grade teachers on the phonemic awareness measure; the group means were virtually identical. This finding is disconcerting. We had hypothesized that the specialized training and experience of reading and special education teachers would provide a skill advantage. If each group had a strong performance, we would not be concerned that there was no group difference. But, the groups' means were an average of 17 points below the maximum possible total score. Reading and special education teachers are designated with providing supplemental or specialized instruction and intervention to struggling learners. However, our findings suggest that they do not bring greater phonemic

awareness proficiency to their instructional efforts as compared to classroom teachers.

Moats (Lyon & Moats, 1996; Moats, 1994) has argued that proficiency in analyzing the sound structure of words is essential for effective early literacy instruction. Teachers with strong phonological awareness skill devote more instructional time to word sound activities (McCutchen, Abbott, et al., 2002); they also might provide more accurate instruction compared to teachers with limited phonological awareness skill. It is difficult to conceive how an instructor who is unable to proficiently segment words into sounds provides accurate instructional models of phonemic segmentation and identifies and corrects child errors. Many students need explicit instruction in the alphabetic principle and phoneme-grapheme correspondences. To provide this instruction, teachers need to have a clear and explicit ability to analyze speech sounds and relate speech sounds to print. Consider, for example, a lesson in which children are asked to segment *rocks* and then also to segment *box*. Based on our findings, we would expect most teachers to accurately segment *rocks* into four sounds, but nearly all teachers to inaccurately segment *box* into three sounds. Imagine the ensuing confusion for children. It might be argued that the teachers' instructional guides provide sufficient support to counter teachers' lack of skill. However, this may not be the case—a point that we touch on later in the discussion.

Because reading and special education teachers provide supplemental instruction and targeted intervention to children who have demonstrated insufficient educational progress, we might expect these teachers to have skill and content knowledge that surpass those of classroom teachers. Phonological awareness is an area in which struggling readers are particularly weak (Al Otaiba & Fuchs, 2002); thus, in this study, the limited performance of the reading and special education teachers is of notable concern. For typical learners, inaccurate instruction might not have a detectable adverse effect. The typical child may be able to rely on his or her own knowledge base and analytic skills to disregard inaccurate input (i.e., conclude that the instructor is wrong). However, with struggling learners who are particularly in need of and reliant on explicit, intensive instruction (Moats, 1994; Moats & Lyon, 1996; Smith, Simmons, & Kame'enui, 1998), inaccurate, contradictory instruction, such as the *rocks/box* example above, can create substantial obstacles to learning. A struggling learner's limited knowledge base may prevent any sort of independent correction or further analysis of inaccurate input. Thus, resulting misinformation and unclear concepts can impede the child's educational progress. We conclude that the phonemic skill level of the reading and special education teachers is not sufficient to provide accurate phonemic awareness intervention.

Beyond exploring disciplinary differences in skill level, our third research question explored patterns of performance that might clarify the identified group difference between SLPs and other educators and the less than proficient performance of the SLPs. By classifying the words in the phonemic segmentation task into *easy* or *hard*, based on each word's mapping of speech to print, we were able to consider the influence of print knowledge on participants' segmentation efforts. Moats (1994) argued that requiring literate adults to focus on the sound structure of words is very challenging because they "conceptualize words in their written rather than their spoken form unless they are taught to pay attention specifically to speech-sound structure" (p. 94).

For the easy words, conceptualization of the written form can lead the participant to an accurate analysis. For many of the easy

words, one could segment either sounds *or* letters to arrive at a correct answer. Admittedly, because our segmentation measure only required participants to indicate the number of sounds, we do not know if those participants who provided a correct response were indeed able to accurately segment the target words into speech sounds. In contrast, for the hard words (e.g., *sing*, three sounds and four letters), conceptualization of the written form had the potential to interfere with an analysis of the spoken word. We hypothesized that print would have a substantial influence on participants' segmentation skills, such that the hard words, with a less direct mapping of sounds to letters, would be more difficult to segment than the easy words. We hypothesized that SLPs, with training in phonetics and transcription, would be less influenced by print as compared to other educators.

As expected, participants were more accurate at identifying the number of sounds in the easy words (word mean of 86%) than in the hard words (word mean of 31%). Both groups were relatively proficient at segmenting easy words (SLPs, 95%; other educators, 83%). However, the groups' performance on the hard words was very different. SLPs accurately segmented approximately half of the words (54%), whereas other educators accurately segmented less than a quarter of the words (22%). A nontransparent written form had an adverse impact for SLPs; the impact was magnified greatly for the other educators. The disciplinary training in phonetics and phonetic transcription allowed SLPs, at least sometimes, to ignore the print form in order to analyze speech sounds. Thus, SLPs were more able than other educators to "think beyond print when analyzing speech" (Moats & Lyon, 1996, p. 83). In contrast, it is difficult to conclude that the other educators had much ability to analyze the speech sound structure of words independent of print. Rather, what they knew and believed about print guided their attempts to analyze speech and seemed to prevent the isolation of sounds in many words.

Discussion with the participants provided supporting evidence that what they may have memorized about spelling and decoding rules influenced their analysis of phonemes. Several examples illustrate this point. Accuracy on *chirp* was 89%; one learns in school that *ch* is a digraph, one sound for two letters, and *ir* is a vowel sound. *Knuckle* was relatively easy for participants (77% accuracy) because print rules introduced in grade school indicate that the *k* in *kn* at the beginning of words is silent, *ck* can represent the sound for the letter *k*, and the *e* at the end of words can be silent. Thus, most participants seemed to understand that two letters can represent one sound. They did not, however, appear to recognize that one letter can represent two sounds (e.g., *q*, *x*). Overall accuracy on *quick*, for example, was 26% and on *box* was 23%.

In addition, many teachers had specific misconceptions about speech and print, misconceptions that they attributed to their classroom instructional materials. Some teachers insisted that their basal reading series taught "consonant blend" as two letters that make one sound. This observation provided an explanation as to why only 55% of teachers indicated that *stop* has four sounds (89% for SLPs). We had expected *stop* to be a very easy word to segment. Our cursory review of a few basal reading series teachers' manuals did not substantiate the teachers' claim about blends. However, we did find some errors in the analyses of speech sounds (cf. Smith et al., 2001). For example, *ox* was identified as having two sounds, and *off*, *on*, *olive*, and *one* were identified as beginning with the sound for the letter *o*.

Performance on the phoneme isolation task also illustrated how easily participants let print derail their analysis of speech. When

asked to identify the third sound in *would*, a frequent error was to identify /l/ as the third sound. Although none of these participants would have pronounced an /l/ when saying *would* aloud, the print led them to believe otherwise. Similarly, in workshop conversations with participants, it was difficult to convince many of them that there is no /t/ in *catch*, and that *each* and *itch* have the same number of sounds. These observations all support Moats' (1994) contention that literate adults conceptualize words in written rather than spoken form.

Implications for Practice

In this section, we draw on our findings and observations as well as the current best evidence provided by other research groups to suggest three implications for practice. First, as many other researchers have pointed out, there is a need to increase the phonological awareness skill of educators. Second, revision of instructional materials and teacher's guides may be helpful to enhance educators' efforts to provide accurate and effective phonological awareness instruction. Third, SLPs' relative expertise in phonemic awareness provides strong support for their inclusion as team members in early literacy instruction and intervention.

Increase the phonological awareness skill of all educators.

Experts have suggested that effective phonological awareness intervention requires that educators have sufficient phonological awareness knowledge and skill (Moats, 1994; Moats & Lyon, 1996). The extant knowledge base does not explicitly define the level of phonological awareness skill that is sufficient for instructional effectiveness. However, we might reasonably assume that in order to provide effective instruction, educators should be able to accurately segment the sounds of words that would be found in a basal reader or spelling book.

The results of our study support existing recommendations for improved teacher training (cf. Cunningham et al., 2004; Moats, 1994; Moats & Lyon, 1996) at the preservice as well as inservice levels. All five groups of educators included in our study would benefit from increased phonemic awareness skill, but it is likely that the professional development needs of these groups differ. SLPs may simply need some review and practice to improve their performance. For most, this would require brushing up on skills and concepts that may have been clearer during their preservice training (e.g., Schuele, 2006). For many teachers, the skills and knowledge that underlie explicit phonemic awareness may not have been adequately addressed in their preservice preparation; this information may represent a substantially new body of information. Thus, the development of explicit phonemic awareness in educators will probably not result from a brief, 1-hr workshop, for example, but rather from sustained and explicit effort that includes repeated opportunities for practice in a supportive learning environment (McCutchen, Abbott, et al., 2002; Moats, 1994). Effective training must help educators to thoroughly understand that speech maps to print (and not the reverse), to analyze speech without reference to print, and ultimately, to think clearly about how speech maps to print. Increased knowledge and skill may enable educators to plan more effective instruction and intervention and to respond to the learning needs of individual children by critically analyzing children's progress (e.g., analyze errors). The purpose of increasing the explicit phonemic awareness skill of educators—to enhance children's literacy achievement—must remain in focus.

McCutchen, Abbot et al. (2002) described an extensive project that successfully enhanced teachers' content knowledge, including phonological awareness. Most educators will not have access to such extensive efforts. Fortunately, there are many readily accessible resources that can improve educators' phonological awareness skill. Moats' text, *Speech to Print* (2000), along with the accompanying workbook, can provide a basis for self- or small-group study. This text is currently used in many preservice courses. The *Language Essentials for Teachers of Reading and Spelling* professional development program (Moats, 2004) provides a multimedia approach (e.g., interactive CD) to learning that may be attractive to some teachers.

Design instructional and curricular materials to enhance educators' efforts to provide effective phonological awareness instruction. As a general rule, curricula and instructional materials should support and enhance educators' efforts to teach. This idea seems all the more important when current practice requires educators to engage in activities (i.e., teaching phonological awareness) for which many have had insufficient preparation.

Given the errors we identified in a cursory review of some basal reading series, along with the evidence provided by Smith et al. (2001), it is imperative that curricular materials be thoroughly examined to ensure that educators are provided with accurate information that supports their phonological awareness instruction and intervention. Perhaps publishers need to make a more concerted effort to include persons who are experts in the structure of speech and language on their basal reading series' advisory boards.

In addition, publishers and authors need to be sure that instructional materials provide sufficient guidance for effective phonological awareness instruction (Smith et al., 2001). Often, instructional materials offer little more than a listing of instructional activities. Instructors are not offered suggestions on how to model phonological awareness skills, how to scaffold children's responses, or how to respond to child errors (but see Schuele & Boudreau, 2008; Schuele & Dayton, 2000; Ukrainetz, 2006). The inclusion of audio recordings that demonstrate phonemic segmentation of instructional stimuli, for example, would provide excellent support for many educators.

Include the SLP in early literacy instruction and intervention.

The results of this study make a strong argument for inclusion of the SLP in educational teams' efforts to provide scientifically based phonological awareness instruction and intervention. SLPs bring a skill and knowledge set in phonemic awareness that is not repeated in the typical skill and knowledge set of other groups of educators. However, it is still imperative that SLPs improve their phonemic awareness skill. The role of individual SLPs in early literacy instruction and intervention will certainly vary from one school to the next (Schuele & Larrivee, 2004), but we offer some possible roles (cf. American Speech-Language-Hearing Association, 2001).

First, SLPs may be the team member who is best suited to providing targeted phonological awareness intervention to struggling learners, for example, in Tier 2 response-to-intervention programs (Catts, 1991; Schuele et al., in press). In many schools, SLPs are not in their schools sufficient numbers of days to be the sole provider of these interventions. But, a collaborative or coteaching effort between, for example, the reading teacher and the SLP, might provide improved intervention to children and simultaneously enhance the phonemic awareness skill set of the reading teacher. As in any collaborative partnership, both professionals are likely

to enhance their knowledge and skill set (Justice & Schuele, 2003).

Second, SLPs might lead study groups at their schools to enhance all educators' phonemic awareness knowledge and skill. There is not a validated knowledge and skill set necessary for effective phonemic awareness instruction, but the references mentioned previously provide a feasible curriculum to guide study groups.

Third, SLPs might work collaboratively with classroom teachers to minimize current barriers (beyond knowledge and skill) to effective phonological awareness instruction. Some activities might include (a) a review of the basal reading series to identify any errors in the lessons or the teacher's manual that need to be corrected; (b) a review of instructional stimuli to ensure that the classroom teacher can correctly segment words into sounds, group words with the same sounds, and so on; and (c) a review of the curricula to organize lessons into a logical sequence of instruction, select appropriate teaching examples, and generate additional practice items. Many kindergarten basal reading series adopt a letter-of-the-week framework that often does not translate to a developmentally guided sequence of phonological awareness instruction.

Fourth, coteaching of even a limited scope can provide an opportunity for teachers and SLPs to share strategies for modeling exemplars, scaffolding child success, and responding to child errors in order to enhance student learning. Coteaching might be effective in general classroom instruction as well as small-group teaching (e.g., remedial lessons, special education lessons). Moats (1994) outlined key aspects of effective instruction that might be enhanced by coteaching efforts: interpreting and responding to student errors, using an organized sequence of instruction, and selecting appropriate examples for teaching. Error patterns of beginning and struggling readers often reflect students' knowledge of the sounds of speech. But, teachers may be challenged to distinguish errors that demonstrate an understanding of the sounds of speech from those that do not. We have been surprised to find in our professional development workshops, for example, that many teachers do not realize that *sgat* is a reasonable way to spell *skate* and that *chuk* is a great error for a young child trying to spell *truck*.

In summary, all members of the educational team share responsibility for the early literacy instruction that is provided to students. SLPs appear to possess particular skill in phonemic awareness. This skill provides them with an important opportunity to collaborate with other educators to provide effective phonological awareness instruction and intervention that meets the needs of all learners.

Limitations

Three limitations of the present study warrant comment. Because phonemic awareness is increasingly part of early literacy instruction, the inclusion of phonemic awareness in preservice and inservice training likely will continue to increase. Further, because (pre)professional development is driven somewhat by state policy, there may be wide regional differences in educators' knowledge and skills. The data analyzed in this study were collected over a period of 6 years (2001–2006) from professionals in four states. Collapsing the data across these years may have obscured recent changes in educators' knowledge. However, the consistency of findings by various researchers across the past 20 years suggests a lack of substantial changes in educators' knowledge.

The phonemic awareness measure that was used in the present investigation was part of a longer measure that was designed

originally to document knowledge and skill changes following professional development at four sites. It was not designed a priori to answer our research questions, and psychometric characteristics of the measure were not addressed in its development. Further investigation of educators' phonological awareness knowledge and skills would benefit from development of measures that are demonstrated to be psychometrically adequate.

Finally, the present study cannot support a causal link between educators' phonemic awareness skill and teaching practices or student outcomes. Further study on teacher quality might address these considerations.

ACKNOWLEDGMENTS

Preliminary findings from this study were presented at the American Speech-Language-Hearing Association Schools Conference, Scottsdale, AZ, July 2006 and the American Speech-Language-Hearing Association Annual Convention, Miami, FL, November 2007. We thank the many professionals who willingly completed our measure.

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Received October 10, 2007

Accepted March 22, 2008

DOI: 10.1044/0161-1461(2008/07-0080)

Contact author: C. Melanie Schuele, Department of Hearing and Speech Sciences, Vanderbilt University, Nashville, TN 37232.
E-mail: melanie.schuele@vanderbilt.edu.