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Phonemic Awareness Skill of Undergraduate and Graduate Students Relative to Speech-Language Pathologists and Other Educators

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It is well established that phonemic awareness,[1] the ability to analyze the sounds of speech, is an important component of early literacy abilities (Wagner & Torgesen, 1987). The *Report of the National Reading Panel* (National Institute of Child Health and Human Development, 2000) and the *Report of the National Early Literacy Panel* (National Institute for Literacy, 2008) identified phonological awareness as a key area of early literacy instruction. Explicit phonemic awareness instruction improves phonemic awareness and contributes to improved

ABSTRACT: **Purpose:** Phonemic awareness has been identified as a critical area of early literacy instruction. Evidence suggests that educators may not have sufficient phonemic awareness skill to provide effective phonemic awareness instruction. Speech-language pathologists (SLPs) demonstrate strong phonemic awareness skill relative to other educators (Spencer, Schuele, Guillot, & Lee, 2008). This study sought to identify components of speech-language pathology training that contribute to phonemic awareness skill and to examine the phonemic awareness skill of students in speech-language pathology training relative to practicing SLPs and other educators.
Method: Students in speech-language pathology (n = 196) completed a paper-and-pencil measure of phonemic awareness. A regression analysis examined the contributions of coursework to performance on the phonemic awareness measure. Performance of students with and without phonetics coursework was compared to that of SLPs (n = 158) and other educators (kindergarten and first-grade teachers, special education teachers, and reading teachers; n = 377). Patterns of performance on a phoneme segmentation task were examined.
Results: Phonetics coursework was a positive predictor of performance on the phonemic awareness measure. Students with phonetics coursework outperformed students without phonetics coursework and other educators but were less proficient than SLPs. Students without phonetics coursework performed somewhat similarly to the other educators.
Implications: Phonetics coursework contributes to explicit phonemic awareness skill in students who are enrolled in speech-language pathology coursework. But, clinical practice appears to lead to more proficient performance, beyond what is acquired in graduate training. Training that develops explicit phonemic awareness skill is recommended for preservice and inservice SLPs and educators.

KEY WORDS: phonemic awareness, student training, speech-language pathologist, literacy instruction

1092-5171/11/3802-0109

reading skill, specifically, word decoding (Bus & Van IJzendoorn, 1999).

To provide effective instruction, instructors rely on their knowledge and skills as they implement a well-designed curriculum. Recent educational policy with its focus on student outcomes, such as the No Child Left Behind Act of 2001, sets high standards for qualified instructors, drawing on evidence that teacher quality relates to student achievement (Bus & Van IJzendoorn, 1999; Marzano, Pickering, & Pollack, 2001). Highly qualified instructors appear to rely heavily on their content knowledge (e.g., in mathematics; Hill, Rowan, & Ball, 2005). For example, Piasta, Connor, Fishman, and Morrison (2009) found that students of knowledgeable teachers demonstrated increased word reading gains when more time was spent in explicit instruction. In contrast, increased time in explicit instruction by less knowledgeable teachers was associated with less gain in word reading. Thus, not only do teachers with strong content knowledge provide more effective instruction, but teachers with less content knowledge may provide instruction that has an adverse impact on student outcomes. Schuele and Boudreau (2008) argued that a conceptual understanding of phonological awareness is not enough; explicit phonemic awareness skill (i.e., proficient performance on phonemic awareness tasks) is critical to the provision of effective phonemic awareness instruction and intervention.

There is disconcerting evidence that many educators do not have sufficient explicit phonological awareness to provide effective instruction in this area; several studies have documented persistent knowledge deficits for teachers in the areas of language and speech structure (Cunningham, Perry, Stanovich, & Stanovich, 2004; McCutchen et al., 2002; Moats, 1994; Spencer, Schuele, Guillot, & Lee, 2008). Phoneme segmentation, a critical skill, often is assessed by asking children to count the number of sounds in a word. Moats (1994) reported that teachers were only 50% accurate when they were asked to do the same.

Likewise, Spencer et al. (2008) found that teachers (kindergarten and first-grade teachers, special education teachers, and reading specialists) were only 55% accurate on a phonemic segmentation task. In contrast, Spencer et al. reported that speech-language pathologists' (SLPs') segmentation performance far exceeded (75% accuracy) the performance of teachers. Effect sizes for the comparisons were large (d = .79–1.47), indicating substantial between-group differences. Examination of individual items on the phonemic segmentation task revealed that SLPs and teachers were comparable in the segmentation of words with transparent letter-sound relations (e.g., words with the same number of letters and sounds; SLPs 95%; teachers 83%). However, group performance was very different on words that had more opaque letter-sound relations (e.g., SLPs 54%; teachers 22%). Spencer et al. concluded that SLPs have strong phonemic awareness skill that supports their involvement in early literacy instruction.

At first glance, educators' lack of proficiency on phonemic awareness tasks is perplexing. The teachers were reported to be well-educated individuals (e.g., large proportion with master's degree; see Spencer et al., 2008). We surmise that they had sufficient phonological awareness to learn decoding and spelling years earlier. Our analysis of teacher responses on phonemic segmentation and our informal conversations with teachers suggest that when asked to analyze the speech structure of words, teachers' performance is highly influenced by orthography. For example, when asked to count speech sounds, teachers may count letters rather than sounds or allow letters to influence their calculation of the number of speech sounds. In addition, curricular materials may lead teachers to make incorrect judgments about speech sounds. For example, many basal reading series indicate that X represents the /ks/ sound, rather than two sounds (e.g., Storytown; Strickland, 2008). Given the apparent negative influence of orthography on the analysis of speech sounds, we concur with others who have suggested that teaching phonological awareness requires explicit phonological awareness—that is, the ability to think beyond print, to ignore orthography, in order to analyze the sound structure of spoken words.

For nearly 2 decades, researchers have responded to teachers' limited explicit phonemic awareness by calling for preservice teacher training to include instruction on language and speech structure. Moats (2009a), a strong advocate for this training, authored a textbook (initially published in 2000, now in its second edition) on oral and written language structure. Nevertheless, a skill deficit continues for recently credentialed teachers. In 2009, Cheesman, McGuire, Shankweiler, and Coyne reported that less than 50% (n = 223) of first-year teachers correctly counted the number of sounds in *grape*.

Joshi et al. (2009) provided a disturbing explanation for the continued knowledge deficit of recently trained teachers. In a study of 78 college and university instructors who taught reading coursework to preservice teachers, just 42% of participants correctly counted the number of sounds in *box*. Moats (2009b) maintained that the knowledge and skills deficit of educators continues to be of concern and called for further research on how to develop expertise in this area.

Efforts to improve the quality of phonemic awareness instruction have focused logically on classroom teachers, who provide the majority of reading and language arts instruction (Brady et al., 2009; McCutchen et al., 2002; Spear-Swerling & Brucker, 2004). However, with the current shift to viewing literacy instruction as well as student outcomes as the responsibility of all educators, educational teams increasingly are considering how best to employ the expertise of various team members, including SLPs, to optimize instruction and intervention, and thus to positively influence student outcomes.

With their relative strength in explicit phonological awareness, SLPs have unique knowledge and skills to contribute to educational efforts in this area. The American Speech-Language-Hearing Association (ASHA, 2001)

[1]*Phonological awareness* is a broad term that refers to the ability to analyze the sound structure of language. The term *phonemic awareness* refers to the manipulation of individual sounds. Thus, phonemic awareness is a part of the broader domain of phonological awareness. In this report, we use the term phonemic awareness to indicate the ability to analyze (e.g., segment) the individual sounds of words. See Schuele and Boudreau (2008) for further explanation.

describes the role of the SLP in literacy instruction as both "critical" and "direct" for children with speech and/or language impairments, but also indicates that SLPs share responsibility for the literacy development of all children. Knowledge and skills should encompass "knowledge of phonology, phonetics, English orthography, word roots and history of origin, the alphabetic principle (i.e., letters representing speech sounds); and how readers and writers use knowledge of such systems to decode and spell words" (ASHA, 2002, p. 3).

The recently published *Roles and Responsibilities of Speech-Language Pathologists in Schools* (ASHA, 2010) describes the changing professional roles for SLPs in schools. However, empirical evidence is necessary to help SLPs understand how these changing professional roles play out in their particular job setting. The purpose of this study was to build on the findings of Spencer et al. (2008) to understand what contributes to the explicit phonemic awareness advantage of SLPs and to consider how this explicit awareness develops in formal training and in clinical practice. The current study in combination with Spencer et al. (2008) enables SLPs as well as students in speech-language pathology to understand their phonemic awareness skill relative to that of other professionals, to consider how they arrived at this superior skill, and to identify how they might improve their skill as well as use it to make unique and collaborative contributions to the literacy efforts in schools.

We hypothesized that preservice speech-language pathology training contributes to explicit phonemic awareness skill. In phonetics coursework, when learning to phonetically transcribe, speech-language pathology students learn to represent individual speech sounds in spoken words and connected text with phonetic symbols. This task requires focus on speech sounds, and proficient transcription requires that one not be swayed by the print representation of words. Thus, one would expect SLPs and SLPs-in-training to demonstrate greater explicit phonological awareness than other groups of adults. To explore explicit phonological awareness, we examined the phonemic awareness performance of undergraduate and graduate students enrolled in speech-language pathology coursework and compared it to the findings of Spencer et al. (2008).

First, we sought to identify variables in preservice speech-language pathology training that contribute to explicit phonemic awareness skill. We hypothesized that coursework in phonetics would positively predict student performance on a phonemic awareness measure but other coursework would not. Second, we compared the performance of students to that of other educators (i.e., teachers). If phonetics coursework is responsible for explicit phonemic awareness skill, then students with this coursework should demonstrate phonemic awareness skill superior to educators. Third, we compared the performance of students to SLPs. Because Spencer et al. (2008) did not find practicing SLPs to be at an expert level of proficiency (i.e., at ceiling on the measure), we wanted to know how students in speech-language pathology compared to practicing SLPs. We considered that students with phonetics coursework might have explicit phonemic awareness skill superior to practicing SLPs because practicing SLPs might lose proficiency as they move further in time from their formal phonetics training. On the other hand, students with phonetics coursework might be less proficient than practicing SLPs if clinical practice activities contribute to continued development of explicit phonological awareness skill beyond that acquired in a phonetics course.

Finally, as in Spencer et al. (2008), we examined patterns of performance on the segmentation task to explore group performance differences. We expected that speech-language pathology students would demonstrate a pattern of performance similar to practicing SLPs and be more proficient at segmenting words with transparent letter-sound relations than words with opaque letter-sound relations.

Four research questions were addressed.

- What preservice speech-language pathology coursework contributes to explicit phonemic awareness skill?
- How do students with phonetics coursework perform on a measure of explicit phonemic awareness relative to students without phonetics coursework?
- How do students with and without phonetics coursework perform on a measure of explicit phonemic awareness relative to SLPs and other educators?
- Are there patterns of performance on a phonemic segmentation task that explain group differences in phonemic awareness skill?

METHOD

Participants

Participants (N = 196) were students who were enrolled in a course of study in speech-language pathology at four colleges or universities. Efforts were made to recruit a sample that was representative of the population of students majoring in communication sciences and disorders by including two large state universities, a smaller state college, and a small private undergraduate college. Nonetheless, the participant sample should be considered a convenience sample rather than a random sample. Participant demographics (e.g., age, ethnicity, reading proficiency) were not collected. The participant group included 30 sophomores, 82 juniors, 27 seniors, 39 first-year graduate students, two second-year graduate students, and 16 students who identified their level as "other." Coursework experience varied substantially. The majority of students were enrolled in or had completed a course in phonetics (n = 164), language (n = 131), articulation or phonology (n = 132), or speech science (n = 159); few students were enrolled in or had completed a course in reading (n = 18).

SLPs (N = 158) and other educators (kindergarten and first-grade teachers, special education teachers, and reading specialists; N = 377) previously studied by Spencer et al. (2008) served as comparison groups. SLPs and other educators were participants in professional education workshops provided by the second author in several states east of the Mississippi River. The majority (74%) of SLPs and other educators had a master's degree; years of professional

experience ranged from 0 to 38 (M = 16.59; SD = 9.68). Other educators were not divided into subgroups for the current study because Spencer et al. found no differences in phonemic awareness skill across the subgroups of other educators (e.g., kindergarten and first-grade teachers relative to special education teachers). Spencer et al. did not collect additional demographic information, though we recognize that a myriad of demographic variables could explain variance in participants' performance.

Procedure

Students completed a paper-and-pencil measure of phonemic awareness and a survey of coursework in phonetics, language, articulation or phonology, reading, and speech science. The phonemic awareness measure and survey were mailed to a faculty member at each participating university, who asked students to voluntarily complete the measure and survey. The faculty member returned the completed forms to the investigators. The Vanderbilt University Institutional Review Board approved the study procedures.

Phonemic awareness measure. The phonemic awareness measure, adapted from Moats (2000), was identical to the measure used in Spencer et al. (2008). The measure was designed to challenge adults' phonemic awareness skill and tap into an advanced skill level critical to effective early literacy instruction (Cunningham et al., 2004). To achieve success, 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 looking at printed words. This level of awareness exceeds what is necessary for competent reading and writing (Moats & Lyon, 1996).

The phonemic awareness measure included three subtests: Phoneme Segmentation, Phoneme Identification, and Phoneme Isolation. Sample items from each of the three subtests are provided in the Appendix. The first subtest, Phoneme Segmentation, included 21 items. Participants were asked to count the number of sounds in 21 words that varied in syllable shape, mapping of speech to print, and number of phonemes (2–5). For example, in the 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 subtest, Phoneme Identification, included five items. For each item, there was a target word and four comparison 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 contains the same sound*. For example, the first item included *p<u>u</u>ll* as the target word and *sugar, tune, cup,* and *fuse* as the comparison words. Although the comparison words had the same letter(s) as the underlined letter(s) in the target word, the letter(s) in the comparison words did not necessarily represent the same sound. Also, a different letter or combination of letters could have represented the same sound in these comparison words. For the five items in this task, each of the four comparison words was scored as correct or incorrect. Words correctly identified as matching or not matching the target received 1 point. The maximum score was 20 points.

The third subtest, 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 six points.

Internal consistency of the measure. The phonemic awareness measure was examined for internal consistency using Cronbach's alpha (Cronbach, 1951). The magnitude of Cronbach's alpha can be interpreted as an indication of the relation of tasks or items on a measure. High alpha values (e.g., > .70) indicate that tasks or items are highly related and that the measure is appropriate for group comparisons (Bland & Altman, 1997). Internal consistency for the three subtests, Phoneme Segmentation, Phoneme Identification, and Phoneme Isolation, was .60. Performance on the three subtests was significantly correlated (r = .36–.41, p < .01). Item-level data was available for the Phoneme Segmentation subtest; Cronbach's alpha was .93.

Scoring and reliability. Participants received a subscore for each of the three subtests as well as a total score (sum of three subscores); the maximum total score was 47 points. A master response form with the accepted response for each item was generated by author consensus. Word productions consistent with General American English (GAE) provided the basis for scoring. It is possible that some participants provided answers that were consistent with their regional or cultural dialect but differed from GAE. However, we believe this source of influence on performance was minimal, as overwhelmingly, GAE was the dialect in the areas we sampled. Response forms were scored by one of the authors or a research assistant and then reviewed by another author. Discrepancies involved exclusively mechanical errors (e.g., incorrect scoring of an item) and were resolved by verification of the correct scoring between two authors.

Data analysis. Standard multiple regression was conducted to examine the contribution of coursework in phonetics, language, articulation or phonology, reading, and speech science to performance on the phonemic awareness measure. A planned comparison was conducted to compare the performance of students with phonetics coursework and students without phonetics coursework. Where appropriate, effect size (Cohen's d; Cohen, 1988) was calculated using the pooled standard deviation and was interpreted by conventional standards as small, medium, or large (Vacha-Haase & Thompson, 2004). Analysis of variance (ANOVA) was used to conduct group comparisons of students, SLPs, and other educators. Dependent variables were total score

and three subscores. An alpha level of .05 was selected, and a Bonferroni correction factor was employed to reduce Type I error in multiple comparisons.

RESULTS

Coursework Experience and Student Performance

The first research question was: What preservice speech-language pathology coursework contributes to explicit phonemic awareness skill? A standard multiple regression was conducted. Each participant had a score of 1 (coursework experience, enrolled in or completed a course) or 0 (no experience) in each of five areas: phonetics, language, articulation or phonology, reading, and speech science. Coursework variables were entered in a single step as predictors of total score on the phonemic awareness measure. Table 1 displays a summary of the regression. R^2 for the overall model was .26, indicating that 26% of variance in performance was predicted by coursework, $F(5, 195) = 13.42$, $p < .01$. As hypothesized, phonetics coursework experience was a significant, positive predictor of total score on the phonemic awareness measure, $r = .48$, $p < .01$. Other coursework did not significantly contribute to the prediction of performance on the phonemic awareness measure. The regression analyses indicated that only phonetics coursework contributed substantially to variability in performance on the phonemic awareness measure.

The second research question was: How do students with phonetics coursework perform on a measure of explicit phonemic awareness relative to students without phonetics coursework? A series of planned comparisons was conducted. As hypothesized, students with phonetics coursework had higher total scores than students without phonetics, $F(1, 196) = 34.56$, $p < .01$, $d = 1.44$. Students with phonetics also had higher subscores than students without phonetics on each of the three subtests: Phoneme Segmentation, $F(1, 195) = 54.63$, $p < .01$, $d = 1.42$; Phoneme Identification, $F(1, 195) = 18.35$, $p < .01$, $d = .80$; and Phoneme Isolation, $F(1, 195) = 22.50$, $p < .01$, $d = .95$. Effect sizes for all comparisons were large.

The third research question was: How do students with and without phonetics coursework perform on a measure of explicit phonemic awareness relative to SLPs and other educators? A four-way ANOVA (Students With Phonetics × Students Without Phonetics × SLPs × Other Educators) of total score revealed a significant main effect of group, $F(1, 731) = 96.12$, $p < .01$ (see Table 2 for group means and standard deviations.) A series of comparisons was conducted to compare students' performance to SLPs' performance and to the performance of other educators. A Bonferroni correction factor was applied to the prestated alpha level of .05. Students without phonetics coursework had lower scores than the other educators, $p < .01$, $d = .71$, and lower scores than the SLPs, $p < .01$, $d = 2.16$. Students with phonetics had higher scores than the other educators, $p < .01$, with a large effect size of .84, but lower scores than the SLPs, $p < .01$, with a medium effect size of .46.

Table 1. Summary of regression analysis for coursework variables predicting student performance on the phonemic awareness measure.

Coursework	B	β	*Zero order correlations with total score*
Phonetics	5.53	.30*	.48
Language	2.51	.17	.39
Articulation	1.09	.07	.30
Reading	2.25	.09	.16
Speech science	2.34	.13	.46

Note. R^2 for regression model = .26, $p < .01$.

*$p = .01$.

Performance Patterns

The fourth research question was: Are there patterns of performance on a phonemic segmentation task that explain group differences in phonemic awareness skill? Spencer et al. (2008) compared easy-to-segment words to hard-to-segment words. Words with a clear phoneme–grapheme relationship (e.g., *cat, ball*) were classified as easy; words with a less clear phoneme–grapheme relationship (e.g., *box*, where one letter represents two speech sounds) were classified as hard.

Our hypothesis was not supported. See Table 3 for group means and standard deviations on easy words and hard words. Students with phonetics coursework had higher scores than students without phonetics on both the set of easy words, $F(1,195) = 40.88$, $p < .01$, $d = 1.13$, and the set of hard words, $F(1,195) = 38.11$, $p = <.01$, $d = 1.22$. Effect sizes for both comparisons were large. Student performance was also compared to the performance of SLPs and other educators. A Bonferroni correction factor was applied to the prestated alpha level of .05. On the set of easy words, students without phonetics coursework had lower scores than other educators, $p < .01$, $d = 1.01$, and SLPs, $p < .01$, $d = 1.78$. Students with phonetics coursework did not differ from other educators, $p = .128$, $d = .20$, but they had lower scores than SLPs, $p < .01$, $d = .55$. On the set of hard words, students without phonetics coursework did not differ from other educators, $p = 1.0$, $d = .03$, but they had lower scores than SLPs, $p < .01$, $d = 1.43$. Students with phonetics coursework had higher scores than other educators, $p < .01$, $d = 1.33$, but they did not differ from SLPs, $p = .69$, $d = .15$.

DISCUSSION

Previous research indicates that SLPs have strong phonemic awareness skill (Spencer et al., 2008). A purpose of this study was to identify components of preservice SLP training that contribute to explicit phonemic awareness skill. Within a group of students enrolled in speech-language pathology coursework, experience with phonetics coursework positively predicted performance on a measure of phonemic awareness skill: Students with phonetics coursework demonstrated

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

	Students with phonetics (164)		*Students without phonetics (32)*		*SLPs (158)*		*Other educators (377)*	
Subtest	*Mean*	SD	*Mean*	SD	*Mean*	SD	*Mean*	SD
Phoneme Segmentation (max 21)	14.62_{a}	3.91	9.00_{a}	4.03	15.86	2.53	11.47	3.40
Phoneme Identification (max 20)	16.46_{b}	2.26	14.56_{b}	2.48	17.46	1.57	15.90	2.35
Phoneme Isolation (max 6)	3.93_{c}	1.49	2.59_{c}	1.32	4.02	1.12	2.87	1.24
Total score (max 47)	35.01_{d}	6.05	26.16_{d}	6.25	37.34_{d}	3.78	30.25_{d}	5.30

Note. Means in a row with the same subscript are significantly different at $p < .01$.

much stronger phonemic awareness skill than students without phonetics coursework, with a large effect size of 1.44. As anticipated, we conclude that phonetics coursework is an important component of preservice speech-language pathology training that contributes to explicit phonemic awareness skill. However, phonetics coursework does not provide a complete explanation of phonemic awareness skill. Other potential contributions to the development of phonemic awareness skill warrant examination. Potential predictors of explicit phonemic awareness skill also include general intelligence, other aspects of phonological processing (e.g., phonological memory), or reading-related abilities such as oral language or spelling skill. Identification of predictors of phonemic awareness skill may be of theoretical interest. However, research that examines contributors to phonemic awareness skill that are potential instructional targets, such as knowledge of word structure or phonics, will best inform the design of preservice and inservice training.

To further describe the phonemic awareness skill of a group of students enrolled in speech-language pathology coursework, student performance was compared to that of practicing SLPs and other educators (kindergarten and first-grade teachers, special education teachers, and reading specialists). Students without phonetics coursework had the lowest scores. Other educators performed better than students without phonetics, with a medium-large effect size of .71. The difference between these two groups might be attributed to the preservice training and inservice experiences of educators; other educators may receive training that provides a basic level of explicit phonemic awareness skill.

Students with phonetics coursework had higher scores than other educators, with a medium-large effect size of .84. It appears that training in phonetics, which is a common component of speech-language pathology training, provides an advantage for explicit phonemic awareness beyond the training and experiences of other educators. However, students with phonetics coursework had lower scores than practicing SLPs, with a medium effect size of .46. Preservice training in phonetics cannot solely explain the explicit phonemic awareness skill of practicing SLPs. It is possible that practicing SLPs develop phonemic awareness skill beyond what is provided by preservice training through clinical activities (e.g., treatment of speech-sound disorders) or professional development.

This study contributes to existing support for the role of the SLP in phonemic awareness instruction (Catts, 1991; Roth & Troia, 2006; Spencer et al., 2008). It provides new evidence to suggest that even novice SLPs can contribute relative expertise in phonemic awareness. Although the students were not as proficient as practicing SLPs, students demonstrated phonemic awareness skill that exceeded that of other educators.

We hypothesize that the "active ingredient" in phonetics coursework that advances explicit phonological awareness

Table 3. Participant performance on the phoneme segmentation task.

	Students with phonetics (164)		*Students without phonetics (32)*		*SLPs (158)*		*Other educators (377)*	
Word set	*Mean*	SD	*Mean*	SD	*Mean*	SD	*Mean*	SD
Easy words (max 11)	9.48_{a}	2.14	$6.69_{a, b}$	2.78	$10.26_{a, b}$	1.49	8.99_{b}	2.26
Hard words (max 10)	5.10_{c}	2.36	$2.31_{c, d}$	2.19	5.38_{d}	2.26	2.34_{c}	1.70
Total score (max 21)	14.62	3.91	9.00	4.03	15.86	2.53	11.46	3.40

Note. Means in a row with the same subscript are significantly different at $p < .01$.

in adults is phonetic transcription training. In the process of learning to represent speech using the symbols of the International Phonetic Alphabet, a student's attention is focused on speech differently than before, such that individual phonemes become more obvious. We hypothesize that this focus on the sounds of speech promotes explicit phonemic awareness. Contrast the International Phonetic Alphabet to written English, in which a single letter may correspond to multiple sounds (e.g., the letter *x* corresponds to the two sounds /k/ and /s/) or a letter may correspond to no sound at all (e.g., the letter *l* in *would*). Many literate adults, lacking the explicit training such as that found in a phonetics course, have difficulty with explicit phonemic awareness tasks because they are distracted by the print representation of words (Moats & Lyon, 1996). Simply put, training in phonetics draws attention to the sounds of speech, allowing adults to ignore the distraction of print, that is, "to think beyond print" (Moats & Lyon, 1996, p. 86).

Performance on the phoneme segmentation task was of particular interest. Phoneme segmentation tasks are a common part of phonemic awareness instruction, and teaching children phonemic segmentation benefits later reading achievement. (For a summary, see National Institute of Child Health and Human Development, 2000.) Some words have a direct correspondence between phonemes and graphemes (e.g., three sounds in *cat* represented by three letters); others have a less clear phoneme–grapheme correspondence (e.g., a single letter that represents two sounds: the *u* in *fuse*). To provide effective instruction, teachers will need to be able to accurately segment both types of words.

We hypothesized that students with and without phonetics coursework would have sufficient explicit phonemic awareness skill to segment words with a clear phoneme–grapheme relation and thus would perform similarly on the set of easy words. Instead, group differences emerged on the set of easy words, with a large effect size of 1.13. Also, students without phonetics coursework had lower scores on the set of easy words than other educators, $d = 1.01$. Together, these findings indicate that some training in phonemic awareness may be necessary for explicit phoneme segmentation skill, even for words with a clear phoneme–grapheme relation.

Students with phonetics coursework also outperformed students without phonetics on the set of hard words, with a large effect size of 1.22. In fact, students with phonetics performed similarly to SLPs on the set of hard words. Although students with phonetics and SLPs were the most proficient in the study, it is important to note that both groups averaged ~50% accuracy on the set of hard words. Training in phonetics appears to provide some explicit phonemic awareness skill, but words with a less clear phoneme–grapheme relation still present a challenge.

In the next section, we make recommendations for preservice training of educators and SLPs. These recommendations complement the excellent recommendations made by other research groups for training of educators (Moats, 1994, 2009b; Neuman & Cunningham, 2009; Podhajski, Mather, Nathan, & Sammons, 2009). It is unrealistic, and likely unnecessary, to suggest that educational training programs would include an entire course in phonetics. Instead, we suggest that educator training include instruction that leads to an explicit understanding of the sounds of speech, especially those not simply represented by single graphemes in print. Training materials have been developed for preservice and provide professional development in this area (e.g., Moats, 2000; Moats, 2004); these materials or similar activities can be embedded in existing educator training programs. Specifically, training that includes instruction and practice in segmenting and blending the sounds of speech may improve teachers' ability to provide similar instruction to children.

We also suggest that phonetics training of preservice SLPs should emphasize explicit phonemic awareness to a greater degree and its application to early literacy development. Coursework in phonetics may lead to improved phonemic awareness skill. However, without an explicit connection to phonemic awareness and to written language, phonetics coursework appears to be insufficient to develop expert phonemic awareness skill. To develop the proficiency that is critical for effective phonemic awareness instruction, training in phonetics should be tied to early literacy development and instruction. Phonetics courses might include phonological awareness activities as part of instruction in transcription (Moran & Fitch, 2001). Course activities could provide explicit comparison of the print representation and phonetic transcription of words with indirect phoneme–grapheme correspondence. As well, phonetics instructors might collaborate with colleagues in the field of education to design course activities that call attention to the analysis of sounds of speech as a skill critical to early literacy instruction.

Clinical experiences of SLPs might also strengthen their phonemic awareness skill. The majority of the SLPs who participated in this study were engaged in school-based practice; school-based SLPs are frequently involved in the assessment and treatment of speech sound disorders. These activities might contribute to increased phonemic awareness skill by providing continued experience in thinking explicitly about the sounds of speech.

In addition to improving explicit phonemic awareness skill, preservice training of SLPs should also prepare SLPs to be members of an education team. Although collaboration is increasingly emphasized as an important responsibility for school-based SLPs (ASHA, 2010), Beck and Dennis (1997) found that SLPs reported a lack of training in collaborative models as a limitation to participation in classroom-based interventions. Guidance in forming and participating in effective collaborations (see, for example, Paul, Blosser, & Jakubowitz, 2006) can prepare SLPs to take an active role in early literacy instruction. Efforts to improve the explicit phonemic awareness skill of practicing SLPs and educators should continue.

Researchers have provided recommendations to increase the knowledge and skill level of educators who provide phonemic awareness instruction (Cunningham et al., 2004; Moats, 1994; Moats & Lyon, 1996). These recommendations have advised the creation of professional development programs for preservice and inservice teachers that

include instruction, supervised tutoring (Spear-Swerling & Brucker, 2004), intensive mentoring (Brady et al., 2009), or online training (Gormley & Ruhl, 2007). The findings of the current study indicate that training in explicit phonemic awareness, particularly instruction and practice on phonemic segmentation tasks, should be included in these training programs.

Limitations and Future Directions

Several limitations of the current study warrant discussion. First, phonetics coursework explained only 26% of the variance in student performance on the phonemic awareness measure. Many student characteristics were not directly measured; it is possible that unmeasured variables may have influenced performance in critical ways. Orthographic knowledge of participants was not assessed in the current study. In addition, no information was gathered from participants regarding their English language skills, learning abilities, or sensory difficulties. Dialect variation in speech production of participants may have influenced their performance on individual items. It is possible that individual differences contributed to unaccounted variance on the phonemic awareness measure. Spear-Swerling and Brucker (2006) found that word reading accuracy and spelling skills of preservice teachers predicted performance on a measure of word-structure knowledge. Other research groups have used measures of orthographic knowledge, phonics, and language structure to characterize participant knowledge and skill (Brady et al., 2009; Cunningham et al., 2004; McCutchen et al., 2002). Future research that includes direct assessment of participants' knowledge and skill in multiple domains of language and literacy can provide a more complete understanding of the contributors to phonemic awareness skill.

Second, the phonemic awareness measure used in the study was part of a measure that was designed to measure pre- and posttest performance as part of a professional development workshop in phonological awareness. The psychometric properties of the phonemic awareness measure were not addressed in its development. Thus, the measure was not specifically designed to discriminate between individuals with varying phonemic awareness skill.

Finally, although our findings indicate that training in phonetics relates to improved phonemic awareness skill, research is needed to directly examine the influence of phonetics training on phonemic awareness skill. Research groups have demonstrated that training of educators can result in improvement in phonemic awareness skill (see, for example, McCutchen et al., 2002).

Is there a benefit to including specific training in phonetics in these programs? For preservice SLPs, if phonetics courses are modified to emphasize phonemic awareness instruction, do students enrolled in these courses demonstrate improvement in phonemic awareness skill relative to traditional phonetics courses? If training in phonetics results in improved phonemic awareness of SLPs and other educators, is there a related improvement in the instruction provided? Studies that address these limitations can provide additional recommendations for practice.

CONCLUSION

Training in phonetics appears to contribute to phonemic awareness skill, perhaps by focusing attention on the sounds of speech rather than the print representation of words. Future research that directly examines training in phonetics as it relates to phonemic awareness instruction can advise the development of preservice and professional development programs in speech-language pathology and education.

ACKNOWLEDGMENT

Preliminary findings from this study were presented at the annual convention of the American Speech-Language-Hearing Association in Boston, MA, in November 2007. We thank the many professionals and students who willingly completed our measure.

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APPENDIX. SAMPLE ITEMS FROM THE PHONEMIC AWARENESS MEASURE

Phoneme Segmentation

Count the number of sounds you perceive in each of the following words:

cat 3 show 3 stop 4

Phoneme Identification

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 contains the same sound.

nose rays rice hiss face

Phoneme Isolation

What is the third speech sound in each of the following words?

Example: cat T as in TOY (give a letter that represents the third sound and an example word with the sound circled)

mission sh as in ship