Predicting Difficulties in Learning Phonetic Transcription: Phonemic Awareness Screening for Beginning Speech-Language Pathology Students

Gregory C. Robinson
Stacey L. Mahurin
Barbara Justus
University of Arkansas at Little Rock and University of Arkansas for Medical Sciences

ABSTRACT: Purpose: This study aimed to determine if phonological awareness subtest scores collected at the beginning of a phonetics course could predict proficiency in phonetic transcription at the course’s conclusion. It further aimed to determine how phonological awareness tests might be used to identify students who are likely to have trouble learning phonetic transcription.

Method: Students enrolled in an undergraduate university phonetics course within a communication sciences and disorders program were given three subtests from the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999) at the beginning of the course: (a) Elision, (b) Phoneme Reversal, and (c) Segmenting Words. At the end of the course, students were given a phonetic transcription test of words from the Hodson Assessment of Phonological Processes—3rd Edition (Hodson, 2004).

Results: All three phonological awareness subtest scores were significantly correlated with the phonetic transcription test score. A regression analysis revealed that the Elision and Phonemic Reversal subtests were most predictive of the phonetic transcription test score. Various ways to use these scores to predict phonetic transcription abilities are explored.

Conclusion: Phonological awareness is related to the learning of phonetic transcription to an extent that one may be able to predict which students are likely to have difficulty learning to transcribe words phonetically.

KEY WORDS: phonetics, phonetic transcription, phonemic awareness, phonological awareness, speech-language pathology students
how different speech sounds are produced by the oral mechanism; and (c) understand the perceptual processes that go into understanding speech (Howard & Heselwood, 2002; Wigforss et al., 1997). Phonetic transcription requires students to listen to spoken language and categorize individual speech sounds into phonemic categories despite the fact that the articulation and acoustic nature of the individual speech sounds may vary across linguistic contexts. This requires a unique issue of speech perception.

The population of this study included students who were enrolled in a university phonetics course within a communication sciences and disorders (CSD) program. Although many college students study phonetics (e.g., students of theater, foreign languages, and linguistics), it is particularly important for CSD students who aspire to be speech-language pathologists (SLPs) to be able to transcribe speech into phonetic symbols (Singh & Singh, 2006). Phonetic transcription is a fundamental clinical skill for SLPs, as evidenced by the fact that formal training in phonetics is often one of the required courses in CSD programs used to meet Standard IIIB of the “Standards and Implementation Procedures for the Certificate of Clinical Competence in Speech-Language Pathology” (American Speech-Language-Hearing Association [ASHA], 2005): “The applicant must demonstrate knowledge of basic human communication and swallowing processes, including their biological, neurological, acoustic, psychological, developmental, and linguistic and cultural bases.”

Phonetic transcription skills, necessary for assessment and intervention, transcend across the SLP’s Scope of Practice to include diverse areas such as articulation, phonology, voice, fluency, and neurogenically based speech disorders. The ability of an SLP to phonetically transcribe speech is vital if he or she wishes to perform basic clinical tasks (Singh & Singh, 2006). Such clinical tasks include (a) analyzing speech production, (b) communicating speech-language production to other professionals, (c) differentially diagnosing and determining the etiology of speech disorders, (d) scoring articulation and phonological tests, (e) planning intervention focused on speech production, and (f) tracking progress during treatment. Being able to transcribe phonetically requires an SLP to think analytically about speech by deconstructing it into segmental units.

Phonetics is a course that is often taught early in the academic career of CSD students. However, if this course proves too difficult for some students, the risk is that otherwise promising students who have the potential in other areas to become competent SLPs may be driven away from the profession. Further, the inability to learn how to transcribe may have negative consequences throughout a CSD student’s academic career as it is a skill that is necessary for subsequent CSD course work. Finally, a CSD program itself may fail to realize its potential for vibrant growth because of students dropping from the program due to unnecessary academic disappointment.

Factors Contributing to Difficulty Learning Phonetic Transcription

Many factors are likely to contribute to the effort required to learn phonetics and the relative success attained. Some general factors such as an individual’s motivation, level of interest, and/or proficiency of instruction could influence the results achieved in any area of instruction. Beyond general factors, however, a student struggling with phonetic transcription may have inherent language-based and/or perceptually based difficulties that have far-reaching consequences on his or her success with phonetic transcription.

Phonological awareness, the ability to focus on units of sounds in spoken language rather than meaning, has long been recognized as a skill that is critical to reading success (Rack, Snowling, & Olson, 1992). Among the phonological awareness abilities required to read, phonemic awareness has been recognized as the most important (Birsh, 2005). Shaywitz (2003) defined phonemic awareness as “the ability to notice, identify and manipulate the individual sounds—phonemes—in spoken words” (2003, p. 49). Phonemic awareness problems are not typically “outgrown” and may persist into adulthood (Lyon, Shaywitz, & Shaywitz, 2003). Thus, a student who is having difficulty with perceiving and representing speech sounds phonetically might be experiencing a continuation of a lifelong struggle with phonemic awareness deficits.

Beyond impeding the acquisition of phonetic transcription skills, phonemic awareness deficits may pose other professional obstacles for CSD students aspiring to be SLPs. Many SLPs are called on to provide phonemic awareness instruction to struggling learners as part of early literacy intervention—an area that is now in the SLP’s Scope of Practice (ASHA, 2007). Yet, a recent study by Spencer, Schuele, Guillot, and Lee (2008) indicated that, although the SLPs in their study had greater expertise in phonemic awareness than other groups of educators with whom they were compared (e.g., reading specialists and classroom teachers), the SLPs did not exhibit expert skills in explicit phonemic awareness.

Recently, a few studies have been published examining the impact of phonological awareness deficits on students who are having difficulty learning phonetic transcription. Moran and Fitch (2001), for example, published a study in which they administered four phonological awareness tasks to 21 students enrolled in a university phonetics course. The four tasks were phoneme switching, phonetic reversal, phoneme counting, and vowel matching. Scores on the phonological awareness tasks were correlated with four measures of transcription skill taken at various points during the phonetics course and a subsequent articulation disorders course. Moran and Fitch found moderate to high correlations between overall performance of phonological awareness and phonetic transcription tasks. Poor transcribers showed particular difficulty with the phoneme switching (e.g., Stimulus: “Dit Sown”; Response: “Sit Down”) and phonetic reversal (e.g., Stimulus: “Kiss” backwards; Response: “Sick”) tasks.

The study by Moran and Fitch (2001) added important information to the small body of research on the correlation between phonological awareness and phonetic transcription skills; however, it had some limitations. First, the tasks administered to measure the phonological awareness skills were adaptations of other tests, and the adaptations were not specified. This fact limited accessibility of the assessments to others who might wish to use them with their own phonetics students. Second, although there were multiple

Factors Contributing to Difficulty Learning Phonetic Transcription

Many factors are likely to contribute to the effort required to learn phonetics and the relative success attained. Some general factors such as an individual’s motivation, level of interest, and/or proficiency of instruction could influence the results achieved in any area of instruction. Beyond general factors, however, a student struggling with phonetic transcription may have inherent language-based and/or perceptually based difficulties that have far-reaching consequences on his or her success with phonetic transcription.

Phonological awareness, the ability to focus on units of sounds in spoken language rather than meaning, has long been recognized as a skill that is critical to reading success (Rack, Snowling, & Olson, 1992). Among the phonological awareness abilities required to read, phonemic awareness has been recognized as the most important (Birsh, 2005). Shaywitz (2003) defined phonemic awareness as “the ability to notice, identify and manipulate the individual sounds—phonemes—in spoken words” (2003, p. 49). Phonemic awareness problems are not typically “outgrown” and may persist into adulthood (Lyon, Shaywitz, & Shaywitz, 2003). Thus, a student who is having difficulty with perceiving and representing speech sounds phonetically might be experiencing a continuation of a lifelong struggle with phonemic awareness deficits.

Beyond impeding the acquisition of phonetic transcription skills, phonemic awareness deficits may pose other professional obstacles for CSD students aspiring to be SLPs. Many SLPs are called on to provide phonemic awareness instruction to struggling learners as part of early literacy intervention—an area that is now in the SLP’s Scope of Practice (ASHA, 2007). Yet, a recent study by Spencer, Schuele, Guillot, and Lee (2008) indicated that, although the SLPs in their study had greater expertise in phonemic awareness than other groups of educators with whom they were compared (e.g., reading specialists and classroom teachers), the SLPs did not exhibit expert skills in explicit phonemic awareness.

Recently, a few studies have been published examining the impact of phonological awareness deficits on students who are having difficulty learning phonetic transcription. Moran and Fitch (2001), for example, published a study in which they administered four phonological awareness tasks to 21 students enrolled in a university phonetics course. The four tasks were phoneme switching, phonetic reversal, phoneme counting, and vowel matching. Scores on the phonological awareness tasks were correlated with four measures of transcription skill taken at various points during the phonetics course and a subsequent articulation disorders course. Moran and Fitch found moderate to high correlations between overall performance of phonological awareness and phonetic transcription tasks. Poor transcribers showed particular difficulty with the phoneme switching (e.g., Stimulus: “Dit Sown”; Response: “Sit Down”) and phonetic reversal (e.g., Stimulus: “Kiss” backwards; Response: “Sick”) tasks.

The study by Moran and Fitch (2001) added important information to the small body of research on the correlation between phonological awareness and phonetic transcription skills; however, it had some limitations. First, the tasks administered to measure the phonological awareness skills were adaptations of other tests, and the adaptations were not specified. This fact limited accessibility of the assessments to others who might wish to use them with their own phonetics students. Second, although there were multiple
The phonemic awareness skills tested in this study were taken by the students at the end of the phonetics course. The dependent variable was a phonetic transcription test Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999); subtests from the Comprehensive Test of Phonological awareness were three phonemic awareness skills that were tested using the students' scores on 10 transcription quizzes and administered a 10-item demographic questionnaire. They also ran a regression analysis to determine the relationships between variables. Hall-Mills et al. found that poor transcribers had trouble with the phoneme reversal task and the real-word spelling task.

Hall-Mills and Bourgeois (2008) followed up with a subsequent study looking at whether phonetic instruction increased phonological awareness and spelling performance of 55 students enrolled in a phonetics course. Hall-Mills and Bourgeois also sought to determine whether participation in supplemental enrichment sessions focusing on phonemic manipulation and grapheme-to-phoneme correspondence would impact the students’ phonetic transcription skills. They found that participation in the enrichment sessions predicted a significant and unique variance in transcription skill if the students attended 50% or more of the sessions. Further, they found that measures of phonological awareness and spelling tasks can be useful screening measures for early identification of students who are at risk for difficulty acquiring phonetic transcription skills. However, Hall-Mills et al. (2007) and the follow-up study (Hall-Mills & Bourgeois, 2008) both had the limitation of using assessments constructed by the authors, which might prove difficult for phonetics instructors to access.

Although phonological awareness may be the most likely factor influencing the learning of phonetic transcription, other perceptual skills have also been examined as having a potential effect on learning phonetic transcription. For example, Mackenzie-Beck (2003) and Dankovičová, House, Crooks, and Jones (2007) examined musical aptitude and training as predictors of specific phonetic transcription skills. Both discovered significant positive relationships between an individual’s musical abilities and his or her ability to successfully transcribe adult and child speech and speech prosody.

Purpose of Current Study

This study sought to identify screening procedures and criteria that could be used to predict success and lack of success with phonetic transcription. The independent variables were three phonemic awareness skills that were tested using subtests from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999); the dependent variable was a phonetic transcription test taken by the students at the end of the phonetics course. The phonemic awareness skills tested in this study were elision (phoneme deletion), phoneme reversal, and phoneme segmentation. These skills were chosen in part due to their similarity to those used by Moran and Fitch (2001) and Hall-Mills et al. (2007), but also because they represent the last and most difficult phonemic awareness skills to be acquired. Adams (1990) described the acquisition of phonemic awareness skills as a hierarchical progression through five levels of difficulty. The fourth level of difficulty is the ability to segment full phonemes (e.g., the spoken word cat is segmented as sounds /k/-/æ/-/t/). When a child is proficient at this level (usually about the time when formal education commences), he or she can make use of the alphabetic principle to figure out how to read unfamiliar words (Birsh, 2005). The fifth and most complex level is the ability to manipulate phonemes. At this level, children are able to reverse phonemes (e.g., reverse sounds in cat to say “tack”). They can also delete phonemes, which is a task known as elision. When a child is proficient at elision, he or she can intentionally delete a sound from one word to produce another word (e.g., say smile without the /s/—“mile”). It is significant to note that nonreaders rarely reach the fifth level of phoneme manipulation.

Although it was assumed that all of the university-level students in this study were fluent readers, some may still have had relatively low phonological awareness, especially with the high-level tasks used in this study. It was hypothesized that students with less phonemic awareness would have lower phonetic transcription accuracy on a test at the end of the course than would students with greater phonemic awareness. The specific questions under investigation were the following:

- Did the students’ phonemic awareness scores, obtained at the beginning of the course before transcription instruction, correlate with their scores on the phonetic transcription posttest?
- Which phonemic awareness subtest(s) best predicted the students’ phonetic transcription posttest scores?
- How can the phonemic awareness subtest scores be used to identify students who may have difficulty acquiring phonetic transcription skill?

METHOD

Participants

Participants in this study were 43 students, ages 20 to 39, who were enrolled in a junior-level phonetics course within a university CSD department. Half of the students were 20–23 years old. Two were male and 41 were female; 8 students were African American and 35 were Caucasian. Forty-two of the students had no previous exposure to phonetics; one student was retaking the course after withdrawing due to poor performance. All students failed the phonetics pretest, indicating no previous knowledge of the phonetic alphabet. Each student was given a bilateral hearing screening using 1000-, 2000-, and 4000-Hz pure tones presented over headphones at 20 dBHL in a soundproof booth by graduate students enrolled in a doctorate in
audiology program. The graduate students were supervised by a certified audiologist. One of the phonetics students failed the hearing screening. Her data were excluded from the study, and she was referred for further evaluation.

Materials
To assess the phonemic awareness skills of the students, the examiners used three subtests from the CTOPP: (a) Elision (EL), (b) Phone me Reversal (PR), and (c) Segmenting Words (SW). To assess the students’ phonetic transcription skills, the course instructor requested that the students transcribe 62 words that were presented auditorily in a classroom environment at a comfortable listening level. The 62 words included the 50 words from the Hodson Assessment of Phonological Processes—3rd Edition (HAPP–3; Hodson, 2004) “Comprehensive Phonological Evaluation” and the 12 words from the “Multisyllabic Word Screening.”

Wagner et al. (1999) provided evidence that the CTOPP demonstrates a high degree of reliability and possesses little test error. They also concluded that the CTOPP is a valid measure of phonological processes. Torgesen and Wagner (1998) reported that the CTOPP has more psychometric strength than other commercially available tests of phonological coding. In another review of the CTOPP, Hayward, Stewart, Phillips, Norris, and Lovell (2008, p. 9) recommended this test because of its “use of theory, task construction, and sound psychometric foundations.” Furthermore, it includes normative data up to 21 years of age. The fact that the CTOPP included normative data into the young adult range ensured that the tasks would be adequately challenging for the university students. Although the students in this study were not being compared to the normative population for the purpose of diagnosing a disorder, the standard scores were used as a way of conflating the scores into a simpler form in order to determine how phonemic awareness relates to the acquisition of phonetic transcription ability. For the purposes of this study, the raw scores associated with students who were older than 21 (N = 27) were converted to standard scores using the 21-year-old normative data.

The three phonemic awareness subtests measure phonemic awareness in the following ways. The 20-item EL subtest measures the extent to which a student can say a word, then say what is left after dropping out a designated sound (e.g., “Say mat without the /m/”). The 18-item PR task measures the extent to which a student can reorder speech sounds to form words. After listening to a tape recording of nonwords, the students are told to repeat the nonword, then to say it backward. In all cases in our study, repeating the nonword backward resulted in a real-word answer. The 20-item SW subtest tests each student’s ability to separate the phonemes that make up a word. The students are asked to repeat a word, then say it one sound at a time. The examiners in our study used the audiotape provided with the CTOPP test materials. Examiners played the tape using a Sony Cassette-Corder Model #TCM-929 in a quiet classroom.

The words from the HAPP–3 were used for the phonetic transcription posttest for two reasons: (a) According to the test manual, “all English consonants are included in the stimulus items, most English vowels and diphthongs are included, and the stimulus words contain common consonant clusters/sequences (e.g., /str/)” (Hodson, 2004, p. 3), and (b) the stimulus items have “real world” relevance; that is, these are phonemes and words that SLPs may be required to transcribe when giving a test such as the HAPPU–3.

Procedure
Approval for the methods and procedures of this study was obtained from the Institutional Review Board of the authors’ home institution before the study commenced. The Institutional Review Board granted the study “exempt” status.

To complete the phonetics course, all students were required to be screened for hearing and phonemic awareness and to complete the pre- and posttranscription tests. Performance on these screenings and tests did not affect the students’ course grades, but failure to complete them resulted in an “incomplete” for the course. Although participation in the activities involved in this study was compulsory, the students were not required to consent to have their data used in the study. Students who opted to have their data used in the study signed a consent form if they wished to have their data included. The choice to include one’s data in the study or not was not disclosed to the instructor until the course conclusion. All students consented to have their data included in the study.

This study used a double-blind design: The students’ data were identified by a number rather than by their names, and the phonemic awareness scores were not disclosed to the instructor or the students until all students had completed the course.

Phonemic Awareness Testing
The phonemic awareness subtests were administered to the students by the second author of this study and two graduate students who had received supervised training in administering the CTOPP. Testing occurred during the first 2 days of class in an environment free from variables such as noise or poor lighting, which could negatively impact the students’ performance. Further, examiners were trained to watch for physical and/or emotional factors that might impact the students’ performance (e.g., fatigue, nervousness, and/or wavering attention level). All phonetic students completed the subtests in the order they were presented in the CTOPP: (a) EL, (b) PR, and (c) SW.

Phonetic Transcription Pretest
The phonetic transcription pretest was administered to the students on the third day of class. The students listened to the 62 words from the HAPP–3 that had been read aloud and prerecorded by the instructor using a Logitech desktop microphone and Wavesurfer software (Sjolander & Beskow, 2003). The recordings were embedded into a PowerPoint presentation that was projected onto a classroom projector screen. The students viewed each word orthographically as well as heard it auditorily. They were allowed unlimited repetitions of the recordings. The students were told
to attempt to write each word in phonetics if they thought they could “guess.” Because the assumption was that most of the students did not have prior knowledge of phonetics, they were given the option of doing other tasks with the recordings to keep them engaged (e.g., identify how many sounds or syllables they heard in a word). None of the students attempted phonetic transcription on the pretest, indicating that they all had little or no knowledge of phonetics, including the student taking the course for the second time due to previous failure in the course resulting from poor academic performance.

Course Instruction

The phonetics course met for a total of 37.5 hr of in-class contact time. The actual course instruction the students received progressed as follows. First, they were taught 27 consonants that are commonly produced by English language speakers, organized by place, manner, and voicing. Next, they were taught 15 vowels and five diphthongs graphically represented on the vowel quadrilateral. This progressed to phonetic transcription of words and connected speech using the International Phonetic Alphabet (IPA) as well as the study of the linguistic parameters of syllable structure. The course concluded with instruction on how to phonetically transcribe developing speech as well as speech from different dialects.

Phonetic Transcription Posttest

At the course conclusion, students were given a posttest to measure their phonetic transcription skills. They were told that in addition to being a part of the study, if they opted, this test also would serve as practice for their final exam. It did not contribute to their final grade. The goal in administering this “practice” test was to test the students’ knowledge of phonetics near the conclusion of the course, unaffected by last-minute studying. The same HAPP–3 words that were recorded and played during the pretest were used. The instructor played each word three times, and then recordings were replayed as many times as needed on request. Thirty-three students took the posttest (3 students had withdrawn from the course and 8 were absent).

Reliability

After the course conclusion, the first author, who was also the instructor of the phonetics course, scored the phonetic transcription pre- and posttests. Reasonable transcriptions of the words were considered “correct.” To assess reliability, a random subset of 20% of the posttests was independently analyzed by the third author of this study.

Data Analysis

The phonetic transcription posttest results were graded for percentage correct, number of transcription errors, and type of transcription errors. In scoring percentage correct, a transcription was considered incorrect if there was at least one error.

A Pearson product–moment correlation test was used to determine the relationship between the phonemic awareness subtest scores and the phonetic transcription posttest scores. A stepwise, linear regression analysis was done to determine which of the subtest scores could best predict the phonetic transcription posttest scores. A cluster analysis of the phonetic transcription test scores was completed to determine how the students grouped in their phonetic transcription ability. This analysis was used to determine the false negative and false positive rates of various ways of using the phonemic awareness subtest scores to identify students in the various clusters.

RESULTS

Reliability

Twenty percent of the students were randomly sampled for interjudge reliability as described previously. Interjudge agreement was 95.7% (SD = 2.43 percentage points) for point-to-point scoring of the students’ transcriptions as correct/incorrect.

Overall Description of the Data

Phonemic awareness scores. Each student’s raw score was converted to a standard score that referred to that student’s performance in relation to the CTOPP normative sample of 20- and 21-year-olds (M = 10, SD = 3). The mean EL score for the phonetic students was 9 (SD = 2.57), the mean PR score was 8.49 (SD = 2.60), and the mean SW score was 8.28 (SD = 2.70). The skewness value was used to determine how symmetrical the distributions were. The standard error of the skewness for all three distributions was .361. Skewness values outside the range of two standard errors, hence ±622, should be considered significantly skewed (Brown, 1997). The distribution for the EL scores was significantly negatively skewed (−1.047), indicating that more students obtained high scores on the EL subtest than a normal distribution would have predicted. The distribution for the PR scores was significantly positively skewed (.683), indicating that more students obtained low scores on the PR subtest than a normal distribution would have predicted. The skewness for the SW subtest was negligible (−.083), indicating a symmetrical distribution.

Phonetic transcription posttest scores. Thirty-three of the students took the 62-question phonetic transcription posttest. The mean phonetic transcription posttest score was 44 (71%; SD = 13.45). The lowest phonetic transcription posttest score was 9 (14.5%), and the highest score was 62 (100%). The distribution was significantly negatively skewed (−1.047). The skewness value was used to determine how symmetrical the distribution was. Ninety-five percent of the students’ scores fell within the range of two standard errors, hence ±11.87, indicating a normal distribution.
skewed (–.931, SE skewness = .409, 2X = ±.818), indicating that the distribution of scores was asymmetrical, with a greater number of scores with high accuracy than would be predicted by a normal distribution (see Figure 1). An average of 21.21 transcription errors were made by the students (SD = 25.52, Min. = 0, Max. = 110). Vowel substitution (VS) errors were the most common error, with the average student making 13.42 VS errors. Consonant substitution (CS) errors were the second most common error (average of 7.58 errors per student). Consonant and vowel deletion (CD and VD) were the next most common errors (3.78 and 2.03 per student, respectively). The least common errors were consonant and vowel addition errors (CA and VA), with an average of only .84 and .75 times per student, respectively.

A hierarchical cluster analysis using the between-groups linking method was used to determine the natural grouping of phonetic transcription posttest scores into four groups. Grouping the scores in this way was done to illuminate the natural cohorts of students according to their phonetic transcription abilities (e.g., the highest cluster includes those who have the strongest phonetic transcription abilities; the lowest cluster includes those with the weakest phonetic transcription skills). The first cluster included the top 21 scores (43–62 correct), the second cluster included those ranked 22–26 (34–40 correct), the third cluster included those ranked 27–31 (22–30 correct), and the fourth cluster included the lowest two scores ranked 32–33 (15 and 9 correct). For the purposes of this research, the 21 students in Cluster 1 will be considered to have adequate phonetic transcription skills; the 12 students in Clusters 2, 3, and 4 will be considered to have substandard phonetic transcription skills.

**Relationship Between Phonemic Awareness Scores and Phonetic Transcription Posttest Scores**

The first research question asked whether the students’ phonemic awareness scores correlated with their scores on the phonetic transcription posttest. The data in this study support the hypothesis that an individual’s phonemic awareness abilities are related to his or her phonetic transcription abilities (see Table 1). A Pearson product–moment correlation test was used to determine the relationship between phonemic awareness skills and phonetic transcription posttest scores.

To aid in interpretation, a Cohen’s effect-size indicator follows the in-text statistics, classifying each of the correlations as large, moderate-large, moderate, small-moderate, or small. All of the phonemic awareness subtest scores were significantly correlated with the phonetic transcription posttest scores. The EL subtest had the strongest correlation with the phonetic transcription posttest score, $r(33) = .672, p < .001$ (large effect); the PR subtest had the next strongest correlation with the phonetic transcription posttest score, $r(33) = .504, p = .003$ (moderate-large effect); and the SW subtest had the weakest correlation with the phonetic transcription posttest score, $r(33) = .454, p = .008$ (moderate effect).

The second research question asked which subtest(s) best predicted the students’ phonetic transcription posttest scores. A multiple linear, stepwise regression test revealed that the EL and PR subtests combined had the strongest predictability of phonetic transcription posttest scores, $F(1) = 25.56, p < .001, R^2 = .52$. The EL and PR subtests explained 52% of the total variance in the data.

The third research question asked how the phonemic awareness subtest scores can best be used to identify...
...phonemic awareness subtests revealed moderate to large phonetic transcription skills. Although all three dentists would complete the phonetics course with less than identical instruction.

The study of factors influencing the learning of phonetic transcription is an area of research in its infancy. For decades, phonetics instructors have pondered why some CSD students gain the knowledge so easily and others struggle with little success. It has been relatively recently that the SLP’s Scope of Practice was expanded to include the treatment of literacy disorders, and with that expansion, the concept of phonological awareness made its way into the profession. The data in this study support the conclusion of similar studies (Hall-Mills & Bourgeois, 2008; Hall-Mills et al., 2007; Moran & Fitch, 2001) that phonological awareness is a key factor responsible for the disparity of phonetic transcription abilities among students who received identical instruction.

Three phonemic awareness skills were assessed in this study using the CTOPP, a test that is widely available and has established validity and reliability. These subtest scores were used in a double-blind study to predict which students would complete the phonetics course with less than adequate phonetic transcription skills. Although all three phonemic awareness subtests revealed moderate to large correlation effects, the multiple linear regression revealed that only the EL and PR subtests were needed to predict a student’s phonetic transcription abilities. In fact, those students with average EL and PR scores < 9 were likely to be included among the students with the least accurate phonetic transcription posttests.

It is noteworthy that the screening criterion that best predicted poor phonetic transcription posttest scores would have failed a student with average phonological awareness. In other words, the mean scores for the EL and PR subtests were 9.03 and 8.52, respectively. The average of these two scores is 8.78 (< 9). This suggests that perhaps above-average phonological awareness is necessary to master phonetic transcription. It should be noted that the distributions of the EL and PR subtest scores and the phonetic transcription posttest scores were significantly skewed, which prohibits the assumption that most of the scores were clustered in the middle of the distribution.

Adams (1990) identified five levels of phonological awareness: (a) identifying rhymes, (b) sorting patterns of rhyme and alliteration, (c) phonemic blending and syllable splitting, (d) segmentation, and (e) manipulation. It is noteworthy that the two phonemic awareness tasks that predicted phonetic transcription abilities were those associated with the highest level of phonemic awareness. The act of phonetically transcribing a word may seem like it would only involve the skill of segmentation. The student hears the word, segments it, then writes the appropriate phonetic symbols in the appropriate order. However, on closer examination, phonetic transcription requires a more complex cognitive process.

After segmenting an auditorily represented word, the student must then choose the correct symbol. Often, students will go through a trial and error process to select the correct symbol. This trial and error process requires the student to manipulate the sounds in the word by substituting and deleting individual phonemes. In order to accurately test each trial, the student may attempt to repronounce the word to determine if it is correct or not. Segmentation is merely the first step. The steps that follow segmentation all require advanced metalinguistic skills that include phonemic matching, phonemic manipulation, and visual and auditory memory. Phonetic transcription offers no escape for those with weak phonemic awareness abilities. Individuals with weak phonemic awareness may have relied on memorized spellings and sight words to help them acquire functional reading and spelling skills (Shaywitz, 2003). They may have used the consistency of the spelling patterns to help them overcome their phonemic awareness deficits. However, when these students begin learning phonetic transcription, they have little recourse because the phonetic transcriptions may not be consistent across different speakers and situations.

**DISCUSSION**

The study of factors influencing the learning of phonetic transcription is an area of research in its infancy. For decades, phonetics instructors have pondered why some CSD students gain the knowledge so easily and others struggle with little success. It has been relatively recently that the SLP’s Scope of Practice was expanded to include the treatment of literacy disorders, and with that expansion, the concept of phonological awareness made its way into the profession. The data in this study support the conclusion of similar studies (Hall-Mills & Bourgeois, 2008; Hall-Mills et al., 2007; Moran & Fitch, 2001) that phonological awareness is a key factor responsible for the disparity of phonetic transcription abilities among students who received identical instruction.

Table 1. Pearson product–moment correlation coefficients associated with phonemic awareness subtest scores and phonetic transcription posttest scores.

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Correlation coefficient</th>
<th>Significance (p value)</th>
<th>Cohen’s effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elision</td>
<td>0.67</td>
<td>&lt;.001</td>
<td>Large</td>
</tr>
<tr>
<td>Phonemic Reversal</td>
<td>0.50</td>
<td>.003</td>
<td>Moderate-Large</td>
</tr>
<tr>
<td>Segmenting Words</td>
<td>0.45</td>
<td>.008</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

...students who may have difficulty acquiring phonetic transcription skills. Using the EL and PR subtests, seven different screening criteria were tested to determine the one that most accurately differentiated those students in the top cluster (21 students, 69.4% to 100% accuracy) from those in Clusters 2, 3, and 4 (12 students, 14.5% to 64.5% accuracy). The seven screening criteria were (a) an EL standard score < 7, (b) a PR standard score < 7, (c) either an EL or PR standard score < 7, (d) both EL and PR standard scores < 7, (e) an average EL and PR standard score < 7, (f) an average EL and PR standard score < 8, and (g) an average EL and PR standard score < 9. The data for this analysis are provided in Table 2. A false positive score was defined as a score that would not have passed the screening at the given criterion but was included in the top cluster of phonetic transcription posttest scores. A false negative score was defined as a score that would have passed the screening at the given criterion but was included in Clusters 2, 3, and 4 (associated with the 12 least accurate phonetic transcription posttests). The most accurate screening criterion was an average EL and PR score < 9. This criterion was successful in eliminating false negatives and reducing the false positive rate to 3.

**Limitations and Future Research**

This study involved only one undergraduate class in a CSD curriculum in one area of the country with one instructor. It is possible that different classes, different majors (e.g., linguistics or theatre), and different instructors would generate different data. The organization of the course content (e.g., teaching consonants before vowels vs. vowels before...
consonants) might also change the results. Additionally, the participants in this study may not be typical of most university students around the country. The age range of students in our study was 20 to 39, which included a significant cohort of older, nontraditional students. It is possible that the diverse use of various reading instructional approaches used in the students’ elementary schools throughout the years (phonics vs. whole language reading instruction) may have influenced their phonemic awareness later in their adult lives. Furthermore, previous course work at the postsecondary level or other life experiences could have affected their ability to acquire skill in the area of phonetic transcription. Further research needs to be conducted that examines other phonetics classes to determine how repeatable the current study is. Unlike some of the other studies (Hall-Mills et al., 2007; Mackenzie-Beck, 2003; Moran & Fitch, 2001), this study did not follow the students into different semesters to determine if the students might overcome their phonological awareness deficits to successfully learn phonetic transcription.

Although this study did suggest a screening procedure and criterion that could possibly identify students who are likely to have trouble with phonetic transcription, it did not offer any intervention for those students. Hall-Mills and Bourgeois (2008) did provide intervention for their phonetics students, and their data suggest that the intervention helped the students. However, future research needs to investigate various interventions and their impact on students with phonological awareness deficits who are enrolled in phonetics courses.

Future research in this area may also examine the effect in reverse (i.e., how a phonetics course influences phonemic awareness scores). It is logical to assume that a semester of learning to transcribe individual phonemes in connected speech may increase a student’s phonemic awareness.

Although phonemic awareness seems to be one of the major contributors to the learning of phonetic

<table>
<thead>
<tr>
<th>Correct</th>
<th>EL</th>
<th>PR</th>
<th>EL, PR Avg.</th>
<th>EL &lt; 7</th>
<th>PR &lt; 7</th>
<th>EL or PR &lt; 7</th>
<th>EL &amp; PR &lt; 7</th>
<th>Avg &lt; 7</th>
<th>Avg &lt; 8</th>
<th>Avg &lt; 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.0%</td>
<td>11</td>
<td>6</td>
<td>8.5</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>96.8%</td>
<td>12</td>
<td>9</td>
<td>10.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>95.2%</td>
<td>10</td>
<td>12</td>
<td>11.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>93.5%</td>
<td>11</td>
<td>13</td>
<td>12.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>93.5%</td>
<td>11</td>
<td>13</td>
<td>12.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>90.3%</td>
<td>11</td>
<td>14</td>
<td>12.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>87.1%</td>
<td>10</td>
<td>10</td>
<td>10.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>87.1%</td>
<td>11</td>
<td>11</td>
<td>11.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>85.5%</td>
<td>11</td>
<td>9</td>
<td>10.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>83.9%</td>
<td>11</td>
<td>11</td>
<td>11.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>83.9%</td>
<td>8</td>
<td>10</td>
<td>9.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>82.3%</td>
<td>11</td>
<td>11</td>
<td>10.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>82.3%</td>
<td>11</td>
<td>12</td>
<td>11.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>80.6%</td>
<td>10</td>
<td>12</td>
<td>12.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>77.4%</td>
<td>11</td>
<td>9</td>
<td>9.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>75.8%</td>
<td>11</td>
<td>7</td>
<td>9.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>74.2%</td>
<td>11</td>
<td>7</td>
<td>9.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>74.2%</td>
<td>11</td>
<td>14</td>
<td>12.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>74.4%</td>
<td>9</td>
<td>10</td>
<td>9.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>64.5%</td>
<td>9</td>
<td>8</td>
<td>8.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>62.9%</td>
<td>9</td>
<td>6</td>
<td>6.5</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>61.3%</td>
<td>9</td>
<td>6</td>
<td>6.5</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>58.1%</td>
<td>8</td>
<td>7</td>
<td>7.5</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>54.8%</td>
<td>8</td>
<td>6</td>
<td>7.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>48.4%</td>
<td>8</td>
<td>6</td>
<td>7.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>48.4%</td>
<td>9</td>
<td>7</td>
<td>8.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>46.8%</td>
<td>8</td>
<td>6</td>
<td>7.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>40.3%</td>
<td>8</td>
<td>7</td>
<td>9.0</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>35.5%</td>
<td>6</td>
<td>6</td>
<td>6.0</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>24.2%</td>
<td>4</td>
<td>7</td>
<td>5.5</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>14.5%</td>
<td>3</td>
<td>5</td>
<td>4.0</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

False positive rate | 1 | 3 | 3 | 0 | 1 | 2 | 3
False negative rate | 7 | 2 | 1 | 8 | 7 | 3 | 0
Total identified incorrectly | 8 | 5 | 4 | 8 | 8 | 5 | 3

Note. EL = Elision standard score; PR = Phonemic Reversal standard score; EL < 7 = Elision standard score less than 7; PR < 7 = Phonemic Reversal standard score less than 7; EL or PR < 7 = Elision or Phonemic Reversal standard score less than 7; EL & PR < 7 = Elision and Phonemic Reversal standard score less than 7; Avg < 7 = Elision + Phonemic Reversal/2 < 7; Avg < 8 = Elision + Phonemic Reversal/2 < 8; Avg < 9 = Elision + Phonemic Reversal/2 < 9.)
transcription, it is unlikely that it is the only factor. One factor may be general academic proficiency. In future research, overall grade point average might be used as one measure of overall academic proficiency. Learning styles also may be a factor to consider. Students have different learning styles with every course, and phonetics is no exception. For example, some students may approach the course with a memorization mind-set; others may be more analytical. These different learning styles may work in concert or in opposition to the instructor’s style of instruction. Another factor to consider may be the student’s motivation to learn phonetics at all.

Recommendations and Conclusions

The data in this study suggest that obtaining an average of a student’s standard scores on the EL and PR subtests of the CTOPP and identifying those students with an average < 9 may help predict students who are likely to have difficulty learning phonetic transcription. Such information could be useful in alerting students concerning the amount of effort they may need to put forth before their grade is jeopardized. Hearing the speech sounds is perhaps the basic skill necessary for phonetic transcription, so it is also recommended that phonetic students receive hearing screenings at the beginning of each new semester.

The profession of speech-language pathology is focused on empowering people with communication disorders. It seems counterintuitive that students should be denied access to the field if they have a phonological awareness deficit. However, phonological awareness may be a necessary skill for an SLP to have in order to identify and describe speech errors and differences. Identifying CSD students with poor phonological awareness skill of speech-language pathologists and other educators. Language, Speech, and Hearing Services in Schools, 39, 512–520.

REFERENCES


Contact author: Gregory C. Robinson, University of Arkansas at Little Rock, Audiology and Speech Pathology, 2801 South University Avenue, Little Rock, AR 72204. E-mail: gcrobinson@ualr.edu.