If they are to participate in contemporary society, it is critical that children become proficient readers, whether they are deaf or hearing, monolingual or bilingual, developing normally or experiencing cognitive or learning disabilities. Currently, most deaf students are educated in public schools (Moores, 1999) and are expected to comprehend and be critical readers of a variety of text types (textbooks, material from the Internet, resource books, newspapers, etc.) and to demonstrate the same proficiency on achievement tests shown by their hearing classmates. Such reading experiences prepare deaf students to pursue higher education and a multitude of careers, just as is true of their hearing peers. Unfortunately, most deaf students historically plateau at the third- or fourth-grade level in reading and writing achievement (see reviews by Moores, 1996; Paul, 1998).

Concern about the reading achievement of students in the United States and the need for all children to get off to a good start as readers is on the national educational agenda, and rightly so. The National Assessment of Educational Progress (NAEP), commonly known as the “nation’s report card,” evaluates the reading ability of thousands of 4th-, 8th-, and 12th-grade students every few years, and sets high standards for reading performance. The present time is widely understood as an era in which the ability to read and comprehend information is critical in all walks of life, so it is particularly disconcerting that a report of the 1998 NAEP findings indicated that only 31% of 4th graders, 33% of 8th graders, and 40% of 12th graders were reading at the proficient level or higher. Proficient performance is defined as “solid academic performance for each grade assessed. Students
reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter” (NAEP, 2001).

Similar NAEP findings in the past decade led to the commission of national studies related to reading. In 1990 Marilyn Adams, hired to investigate “what we know about basis processes and instructional priorities in words and letter identification and early reading” (Adams, 1999, p. vi), concluded that the acquisition of phonological awareness and English-language proficiency is essential if children are to be able to efficiently decipher words and to understand text without continual assistance. Two additional national studies were commissioned, one focusing on preventing reading difficulties (Snow, Burns, & Griffin, 1998) and the other on research-based reading instruction (National Reading Panel, 2000). A key finding of all three of these extensive national studies is that phonological awareness, particularly phonemic or sound-level awareness, plays an important role in later reading achievement.

It is possible that the lack of phonological awareness is a contributing factor to the reported low levels of reading achievement of many deaf children. Some teachers may reject this possibility, having had deaf children in their classes who appeared to read as capably as their hearing peers in the early primary grades because they could recognize written words as wholes or because they used rudimentary phonological skills. However, after completing a longitudinal study of first graders, Perfetti, Beck, Bell, and Hughes (1987) concluded that although children can rely on their visual memory of letters to “read” words initially, continued progress requires the development of phonological awareness.

So while the ultimate goal of reading is comprehension, readers must first “unlock” (or read) the words on the printed page and then develop a bank of words that they recognize quickly and efficiently (Ehri, 1995). Since English is an alphabetic language, readers must be able to map sounds to the letters and the letter sequences they represent. As the empirical evidence provided in the present article indicates, although deaf students may not hear sounds at all or may not hear them clearly, they still can and must develop phonological awareness if they are to read the sound-based printed words and phrases of English.

Unlocking a word allows a child to identify or read it. According to Peter V. Paul (1998), a researcher and educator who is deaf himself, word identification, in which a reader gradually becomes aware of the concept, pronunciation, cue, or sign for an unknown word, “is the foundation of the literacy process” (p. 34). There is a wealth of research with hearing children on the phonological awareness/word recognition connection (see reviews by Adams, 1990; National Reading Panel, 2000; Snow et al., 1998; Vellutino & Scanlon, 1987). Researchers have found that students who have acquired phonological awareness (i.e., sensitivity to sound patterns of the language), be they hearing or deaf, have an advantage in being able to identify unknown words. When the sub-skills of phonological awareness are taught, the reading achievement of children improves (see reviews by Adams, 1990; Bryen & Gerber, 1987; National Reading Panel, 2000; Snow et al., 1998).

Many parents, teachers, and researchers involved in deaf education may be skeptical that deaf children can acquire phonological awareness. We reviewed the literature to see if a causal relationship between phonological awareness and reading achievement in deaf readers was evidenced. We were guided in this task by the work of Keith Stanovich (1986), a respected reading researcher, who suggested that several types of evidence must be obtained in order to document a causal relationship between either a particular skill and reading achievement, or between training in a particular skill and reading achievement. Such evidence includes longitudinal data demonstrating the predictive validity of the hypothesized skill; data from contrasts of readers of different skills and ages, matched for reading achievement; and data from studies demonstrating that training in critical skills improves reading performance.

While the results of such research with deaf students, particularly data training and longitudinal data, are not as amply available, we believe there is sufficient evidence to warrant attention to phonological awareness instruction for deaf children. Therefore, our purpose in the present article is to review the literature on the relationship between phonological awareness and reading proficiency, and to make suggestions for assessing and facilitating this proficiency. We focus on children with hearing loss, acknowledging that additional research would benefit the parents and professionals who seek ways to help deaf students become proficient readers. Clearly supported by the research, our position is that phonological awareness is necessary, but not sufficient, for the development of reading proficiency.

Phonological Awareness

Snow et al. (1998) defined phonological awareness as “sensitivity to the patterns of spoken language that recur and can be manipulated without respect to the meaning [that word parts or words] ordinarily convey” (p. 319). The phonological aspects of language as they relate empirically to independent word recognition also involve the awareness of sound(s) at the syllable, onset-rime, and phoneme levels (Goswami, 2000). Phonological awareness obviously is related to the phonology of English and training in speech articulation, as studied by teachers of the Deaf. The realization that such skills can be developed in deaf children.
is more likely when Hanson’s definition of phonological units (1989) is considered. She defines them as “meaningless primitives that are not actually sounds, but are related to movements articulated by the vocal tract of the speaker” (p. 73).

When phonological awareness skills are discussed at the “sound” level, they are referred to as phonemic awareness abilities. Phonemes are “smaller-than-syllable” speech sounds that roughly correspond to individual letters (Adams, 1990, p. 65). For example, the word cat is made up of three phonemes or sounds, as is the word cake. Adams added that it is neither the ability to hear the difference between phonemes nor the ability to distinctly articulate them that is significant. Instead, what is important is the awareness that phonemes exist as components, or “the building blocks of a language,” that can be manipulated and, when combined, form morphemes, the smallest meaningful units of language. (For example, the word cat is made up of one mor- pheme and the word cats of two.) Adams further reported that “developmentally, this awareness seems to depend upon the child’s inclination or encouragement to lend conscious attention to the sounds as distinct from the meaning of words” (p. 65).

Phonemic awareness is a type of metalinguistic awareness that involves understanding that words are composed of individual, distinct sounds that can be manipulated. Skills at this level that relate to reading achievement include matching words with the same initial sound, and isolating, segmenting, blending, deleting, and substituting phonemes (Jorm & Share, 1983; Share, Jorm, MacLean, & Matthews, 1984). For example, given the word ball, students might be asked to say only the first sound (/b/) [sound isolation], or to say all the sounds in the word (/b/.../a/.../l/) [sound segmentation]. Alternatively, students might be given the separate sounds of a word (/b/ /a/ /l/) and asked to blend them into the word (ball). More challenging phonemic manipulations include saying a word such as ball without the initial sound [letion] or substituting the /l/ sound for the /b/ sound to create a new word, tall [substitution] (Yopp, 1988).

Phonological Processes

Three primary phonological processes that relate to reading are phonics, phonological recoding, and rhyming (see review by LaSasso & Metzger, 1998). Each involves phonological representations that collectively have been termed “inner speech” (Paul & Jackson, 1993) or “inner code” (Kleiman, 1975). Kleiman wrote that inner code is “a transformation of printed words into any type of speech-based code, whether it be articulatory, acoustic, auditory imagery, or a more abstract code” (p. 323). Vygotsky (1934/1987) described inner code as “thought connected with words” (p. 249), a concept others have labeled “phonological recoding” (Jorm & Share, 1983), “phonemic recoding” (Raynor & Pollatsch, 1989), “speech recoding” (Kleiman, 1975), “silent speech” (Edelkott, 1960), “subvocal speech” (Locke, 1970), and “implicit speech” (Lepley, 1952). Besner (1987) also described internal phonological representations, avoiding the assumption that one has to hear and speak to possess them.

Baddeley (1979) wrote that an internal code is essential in decoding printed words and recording them in memory, and in processing surface grammar to derive deep structure. Likewise, Paul (1998) noted that the use of a phonological code in short-term memory is most efficient for sentence comprehension because of the development of rapid, automatic, and fluent word-identification skills. The ability to quickly identify words allows readers to comprehend more text and to focus more energy on the comprehension task.

Results of a study by Conrad (1979) indicated that use of an internal code by deaf students correlated with hearing level, intelligence, and reading achievement.

Phonics

Phonics is the understanding of how sounds are mapped onto letters. While decoding is “obviously a difficult task for students with hearing loss” (Paul, 1998, p. 201), Leybaert (1993) found that deaf students raised orally, as well as those who signed, could acquire knowledge of sound-to-grapheme relationships or phonics. Neither sign nor fingerspelling were shown to interfere with the development of phonological awareness (Bebko, 1998; Harris & Beech, 1998; Lichtenstein, 1998; P. Miller, 1997). It is thus evident that signing and nonsigning deaf students use phonic knowledge both to distinguish possible letter combinations from implausible ones and to recognize words. Investigations by researchers such as Conrad (1979); Hanson, Liberman, and Shankweiler (1984); and Quennin (1982) gave support to this finding, which was later confirmed by Gibbs (1989), Hanson (1989), Hanson and Fowler (1987), Lichtenstein (1985), Marschark (1993), and Tzeng (1993). Recent studies involving deaf children have demonstrated that students exposed to Cued Speech have phonic abilities that more closely resemble those of hearing peers than those of deaf peers who are from noncuing backgrounds or who are in situations in which cueing is used only at school (e.g., Leybaert & Charlier, 1996).
are young or who are performing at below-average levels may need to store phonological representations, such as strings of letters or syllables, in working memory temporarily while phonologically assembling or sounding out a word. That is, phonological abilities enhance the working memory capacity of deaf students (see review by LaSasso & Metzger, 1998). Other researchers in deaf education (e.g., Conrad, 1970; 1973; Hanson, 1986; Hanson et al., 1984; J. Locke & V. Locke, 1971) have found that working memory capacity is a strong predictor of reading achievement for deaf readers, even stronger than degree of hearing loss.

Paul and Jackson (1993) reviewed the research on phonological recoding and deafness and found that “there is increasing evidence that speech recoding is important for reading comprehension to access the meaning of words” (p. 137). They referred to phonological recoding variously as “subvocalization” and “the movements of muscle and other body parts in the vocal tract” (p. 137), and distinguished the process from those of phonological coding, mental representations, and auditory imaging of speech. Based on a continual review of the literacy and deafness research (e.g., Paul & Quigley, 1994), Paul (1998) suggested that instruction and practice should be provided to children who can hear some speech sounds, and should include the discrimination and identification of sounds in relation to print.

The use of a speech-based code, unlike the use of a sign code, is related to reading achievement in most studies examining phonological recoding abilities (e.g., Conrad, 1979; Hanson et al., 1984; Lichtenstein, 1998; Wandel, 1989). Kelly (1995) found that deaf students benefit from instruction by general and special education teachers, as well as by speech-language pathologists who emphasize speechreading and expressive speech practices as means of improving these students’ access to and use of speech-recoding processing.

Rhyming

The ability to rhyme is also a word-level phonological awareness skill, and many researchers have found the ability to rhyme to be a predictor of reading achievement. According to Goswami and Bryant, as reported by Copeland, Winsor, and Osborn (1994), “children who are more sensitive to rhyme or who are taught about rhyming are more successful in reading” (p. 35). In Nielsen and Luetke-Stahlman (2002), we reported that a deaf child we studied from preschool through elementary school was confused initially about rhyming. She was often overreliant on visual cues (e.g., claiming that the word foot rhymed with toot), but later developed segmenting and blending abilities and was able to use sound-symbol correspondences to decode unknown words. Rhyming is associated with phonological awareness at the onset level, and many researchers have found the ability to rhyme to be a predictor of reading achievement. Bradley and Bryant (1983) and Bryant, MacClean, Bradley, and Crossland (1990) found a causal link between rhyming and reading, and other studies (e.g., Goswami & Mead, 1992) found that children relate rhyming categories to spelling categories as they begin to read and spell.

Phonological Awareness: The Link to Word Recognition

The development of understanding and the use of sound-to-print and print-to-sound associations in spelling and decoding new words was thoroughly researched by Ehri (1980, 1991, 1995), who described several stages of word learning. She found that children first develop awareness at the word level, then at the syllable level, and finally at the phoneme level.

Ehri (1980) and others (see review by Adams, 1990) found that as preschoolers and kindergartners experience print, they build an understanding of the orthography of words and begin to use this knowledge in conjunction with their knowledge of the linguistic properties of words. Beginning readers make sound-to-print and print-to-sound connections and develop proficiency in unlocking unknown words (Juel, 1988; Juel, Griffith, & Gough, 1986; Juel & Minden-Copp, 1999). They typically learn the sound-to-letter connections for dominant sounds with single-letter matches (e.g., b, d, and p). Shortly thereafter, beginning readers acquire an appreciation for blends (e.g., bl) and digraphs (e.g., th, sh), as well as an understanding of the multiple representations of vowel sounds (e.g., a, ae, ai). By the middle to end of first grade, a student who is engaged in age-appropriate reading tasks usually can spell simple short-vowel words. As children continue learning to read, they refine their comprehension of how the sounds of spoken words are mapped on to letters and letter combinations to create written words.

Adams (1990) explained that students who learn to read and write in English must learn how the sounds of spoken English map on to letters and letter sequences within words. This knowledge is referred to as the alphabetic principle, and involves the acquisition of an explicit awareness that vowels and letters from our alphabet form syllables, which in turn form words. However, the reading of English text is made difficult because each sound of the spoken language is not consistently represented by the same letter or group of letters. In learning to read an alphabetic script such as English, children must devote conscious attention to the manipulation of phonemes in words.

Thus, as both Reid (1983) and Adams (1990) made clear, children must learn that in English, in addition to basic sound-to-letter knowledge, a given letter may function as a part of a group (e.g., c, b, versus ch) and that individual letters and groups of letters may have more than one sound, depending on the position and sounds of neigh-
boring letters (e.g., cap, cape, canal, tail). The ability to “sound out” (segment and blend) in order to unlock unknown words is a critical word-recognition strategy and is clearly tied to phonemic awareness. It is developed by beginning readers, affects proficiency in word recognition, and continues to affect reading success as students move through the school years (Foorman, Francis, Shaywitz, & Fletcher, 1997).

In addition, Ehri (1995) found that beginning readers’ progress accelerates once they move beyond a focus on individual sound/letter matches and the use of segmenting and blending as an exclusive decoding strategy, to a focus on words’ orthographic features, or “chunks.” This transition becomes evident when readers begin to discern unknown words in text by making analogies between one word and another: for example, “If I know cat, this must be flat.” In this process, readers use their short-term memory, and skills of “word identification, classification, sequencing, and association” (Paul, 1998, p. 199). One can simulate this more efficient strategy for word recognition by considering that to read an unfamiliar name of a medication, an adult does not “sound out” each letter (e.g., /R/, /e/, /s/, /r/, /l/, /l/) but, rather, reads “parts” of the word: /Rest/ /or/ /il/. Two decades ago, Quenin (1982) detected evidence of this “chunking” strategy in profoundly deaf readers. More recently, Transler, Leybaert, and Gombert (1999) confirmed this finding.

There is a good chance that students who do not possess phonological awareness, a key to the development of efficient word recognition skills, as well as age-appropriate English vocabulary and grammar abilities, will experience difficulty with reading, writing, and spelling in the elementary grades, especially with expository text (Snow et al., 1998). This is in part because decoding facilitates comprehension and comprehension facilitates decoding (Adams, 1990).

A Review of Research on Phonological Awareness and Deafness

Ling, as reported by Waters and Doehring (1990), argued that while deaf children do not have complete access to auditory information, they seem able to use some cues derived from speechreading, “residual hearing, and/or articulatory training to discover the relationship between spelling and sounds of English, and that this information could be used in reading individual words” (p. 331).

Similarly, Hanson (1991) explained that although the development of phonological awareness may be delayed when children are deaf, it still resembles that of hearing peers (see also Hanson & Fowler, 1987; P. Miller, 1997). However, Dodd (1974, 1980) cautioned that deaf students’ phonological awareness is likely to be underspecified, because not all of the phonetic distinctions heard by a hearing student can be perceived by a deaf student. In the following sections of the present article we review much of the available research on phonological awareness and deafness, grouping it under three headings: general phonological awareness research, phonological awareness and hearing acuity, and phonological awareness and speech articulation ability.

General Phonological Awareness Research.


Extensive research reviews completed by deaf educators, such as those by King and Quigley (1985), Paul and Jackson (1993), Mayer and Wells (1996), and Paul (1998), as well as our own more recent review (Nielson & Luetke-Stahlman, 2002), concluded that phonological awareness is an important factor to consider when planning reading instruction for deaf students. Paul (1998) thoroughly reviewed the available empirical evidence regarding reading and deafness, bilingualism, and general education, and concluded that development of both (a) phonological awareness and (b) proficiency in comprehending and expressing English vocabulary and grammar are required if deaf children are to read as well as their hearing peers. Paul concluded that deaf children should receive phonics instruction.

Phonological Awareness and Hearing Acuity.

Studies by several researchers across 3 decades documented that the hearing acuity of deaf readers correlates with phonological awareness (Becker, as cited in D. Wood & H. Wood, 1992; Conrad, 1970, 1973, 1979; Hanson, 1991; Harris & Beech, 1998; Leybaert & Alegria, 1995; P. Miller, 1997). Yet, the aided hearing acuity of participating subjects was seldom reported, and was unanalyzed except in studies by Luetke-Stahlman (1988), Moores et al. (1987), and Moores and Sweet (1991). Likewise, the effects of digital hearing aids, cochlear implants, or FM systems on the acquisition and use of phonological awareness have seldom been analyzed.

Phonological Awareness and Speech Articulation Ability.

Waters and Doehring (1990) used two simplified phonics tasks to tap phono-
logical awareness and its relationship to reading and deafness. One required children to decide if strings of letters were plausible combinations; the other, if words were real. The study showed that speech intelligibility and English-language skills correlated with reading achievement. Phonological awareness correlated with reading achievement in studies by Conrad (1970), J. Locke and V. Locke (1971), and Reynolds (1986). However, Adams (1990) reviewed the reading research and determined that simply teaching children to pronounce words does not call enough attention to the individual phonemes that constitute them. Yet, phonemes may receive sufficient attention in deaf education programs because most young deaf children receive speech-articulation therapy, during which words are often reduced to series of phonemes so that their pronunciation can be practiced, and then blended together again into the original word. Thus, even if a deaf student cannot hear speech, that student might “learn about phonology from motor events involving speech production” (Hanson, 1989, p. 73), through visual and tactile explanations during speech therapy, or from speechreading. Indeed, Marschark (1995) found that speech articulation and phonological awareness ability correlated with reading proficiency when students were deaf or hard of hearing.

Other studies showing a correlation between phonological awareness and speech articulation, speech movement, kinesthetic sensations, or speech training were conducted in the 1980s and 1990s (Campbell & Wright, 1988; Hanson, 1986; Hanson & Fowler, 1987; Harris & Beech, 1998; Leybaert & Alegría, 1995; P. Miller, 1997). We have suggested (Nielsen & Luetke-Stahlman, 2002) that when speech-language pathologists work with deaf children, the skills that are practiced will support reading development if the words’ spelling is written out and discussed in conjunction with the words’ articulation.

The Assessment of Phonological Awareness

A reading program for a deaf student should be based on assessed literacy skills, including phonological awareness. When this occurs, knowledge of undeveloped or underdeveloped phonological awareness subskills for a particular child can be identified by means of both formal and informal evaluation tools. In this section of the present article, we suggest several possible phonological awareness tests. (See Nielsen and Luetke-Stahlman, 2002, for suggested measures for evaluating other reading skills areas.)

If educational team members expressed an interest in knowing how well a deaf student was able to manipulate phonemes relative to other deaf students, they might elect to use a formal evaluation tool that had been standardized with deaf children. However, literacy measures such as the Test of Syntactic Abilities (Quigley, Steinkamp, Power, Montanelli, & Jones, 1978) and the Stanford Achievement Test (adapted version, Trybus & Karachmer, 1977), a commonly used instrument designed for the testing of deaf children, do not include subtests for the evaluation of phonological awareness. Therefore, we recommend such standardized measures as the Phonological Awareness Test (Robertson & Sattler, 1997), which includes subtests for segmentation, blending, substitution, rhyming, isolation, and deletion—skills that have been found to correlate empirically with reading. The word attack subtest of the Woodcock Reading Mastery Test, or WRM (Woodcock, 1998), is popular among special educators, but the measure is a decoding task, not a phonological awareness task. The word attack subtest requires that children pronounce nonsense words of one to four syllables (e.g., dice, white, than’t, gaked, monglistamer). Not only is this subtest not a measure of phonological awareness, but a deaf student with poor speech intelligibility may be unable to pronounce the nonsense words and yet be capable of segmenting and blending to discern unknown words, a skill that evinces the employment of phonemic awareness.

Informal assessment also could be used to address the questions asked by educational team members. Adams, Foorman, Lundberg, and Beeler (1998), Ericson and Juliebo (1998), and Zgonc (2000) offer examples of products that provide informal measures of phonological awareness skills.

Facilitating the Development of Phonological Awareness

According to Paul (1998), word identification, in which a reader gradually becomes aware of the concept, pronunciation, cue, or sign for an unknown word, “is the foundation of the literacy process” (p. 34). Researchers have found that students who have acquired phonological awareness have an advantage in being able to unlock unknown words. In addition, when children are trained in the subskills of phonological awareness, most attain higher levels of reading achievement (see reviews by Bryen & Gerber, 1987; National Reading Panel, 2000; Snow et al., 1998).

Experimental, longitudinal, and case studies have demonstrated that phonological awareness can be taught (Bradley & Bryant, 1983; Lundberg, Frost, & Peterson, 1988; Nielsen & Luetke-Stahlman, 2002; Perfetti et al., 1987; Strassman, 1997). This was clearly the finding of two recent meta-analyses of the phonemic training research (J. Miller, 1999; National Reading Panel, 2000). Also, Adams (1990) and Snow et al. (1998) have advocated that if a child lacks phonological awareness, it must be taught to that child.

Using gamelike activities, Lundberg et al. (1988) worked with preschool children to stimulate them to attend to the phonological structure of language. Analysis of the effect of this training on reading and spelling achievement in grades 1 and 2 showed small but significant differences between trained and untrained children on tasks in-
volving rhyming and word and syllable manipulation. However, the effect of phoneme segmentation ability on reading and spelling achievement through second grade was “dramatic” (p. 263). Lundberg et al. concluded that explicit instruction, particularly at the phoneme level, “seems to be required” (p. 263) if there is to be an impact on later reading and spelling achievement.

When providing training in phonemic awareness, Fox and Routh (as reported in Copeland et al., 1994) found that both training and practice in segmenting and blending assisted kindergartener children on “tasks analogous to reading” (p. 32). That is, “training of only segmenting without blending is insufficient” (p. 32). In addition, when letters were included, sound-to-letter manipulation was found to be more effective than sound manipulation alone (Adams, 1999; Miller, 1999; National Reading Panel, 2000). Finally, the key finding of the National Reading Panel’s meta-analysis of 52 studies on phonemic awareness (2000) was that teaching phonemic awareness “helps many different students learn to read,” including “children from various SES [socio-economic status] levels,” “beginners who are low in PA [phonemic awareness] and thus at risk for developing reading problems in the future,” and “older disabled readers who have already developed reading problems” (p. 2-41). Paul (1998) agreed that, based on repeated reviews of the literacy and deafness research over the decades, instruction and practice involving the discrimination and identification of sounds in relation to print should be provided to deaf children.

The first explicit training in phonological awareness and phonics (sound/letters associations) with deaf children was probably conducted by Becker (as cited in D. Wood & H. Wood, 1992). Becker identified five children who read below grade level. They were fitted with appropriate amplification and given training at the phonemic level. They subsequently improved in their ability to identify sound/letter units, and transferred this knowledge to the reading of single words and connected text. Wandel (1989) found that Cued Speech facilitated the acquisition of phonemic awareness by making phonemes visually explicit. Her research showed that there was no difference in the reading scores of hearing and profoundly deaf students exposed to Cued Speech as assessed by the Stanford Achievement Test. Alegria, Dejean, Capouillez, and Leybaert (1990) found that Cued Speech assisted deaf students in decoding unknown words while reading. Both Quenin (1982) and LaSasso and Metzger (1998) found that Cued Speech manual cues facilitate phonological awareness.

Another system that makes phonemes explicit but also cues the sound/letter match is Visual Phonics. This system is used with deaf children in the model elementary school on the Gallaudet University campus in Washington, DC (Marshall, Nussbaum, & Waddy-Smith, 1999), the Illinois State School for the Deaf, and in public school programs for deaf students in Arizona, Kansas, and Texas (see, e.g., Zaccagnini & Antia, 1993). Use of Cued Speech and Visual Phonics occurs in classrooms in which students are orally educated, as well as those in which signs are paired with speech (Marshall et al., 1999; Zaccagnini & Antia, 1993). More information and research on both systems can be found on the Internet.

Marschark (1993) suggested that phonological awareness training for deaf students should be multidimensional, involving sound-to-grapheme skills, articulation-to-spelling skills, speechreading-to-spelling skills, and the writing of grammatically correct English words, phrases, and sentences. Annual standardized data from a longitudinal study revealed that the reading ability of one deaf child improved dramatically (i.e., to grade level) when phonological awareness abilities, in conjunction with English vocabulary and grammatical language skills, were taught from preschool to sixth grade (Nielsen & Luetke-Stahlman, 2002). Suggestions for such activities can be found in Nielsen and Luetke-Stahlman (2002) or can be adapted from resources typically used when in the teaching of hearing children (Adams et al., 1998; Ericson & Juliebo, 1998; Fitzpatrick, 1997; Zgonc, 2000).

Conclusion

On January 8, 2002, President George W. Bush signed into law the No Child Left Behind Act of 2001. In a press release issued that day Secretary of Education Rod Paige stated, “A year ago, President Bush set out to improve every public school in this country—to ensure that students of all races, all abilities, and all ages receive the education they need and deserve. . . . Today, with the stroke of his pen, President Bush changed the culture of education in America and kept his promise to leave no child behind” (U.S. Department of Education, 2002). The act is clear in directing that all children be taught using research-based methods. The research clearly calls for attention to the role of phonological awareness in giving deaf children the tools to break the code and to develop efficient word-recognition strategies. It is up to the profession to ensure that no deaf child is left behind.

References


