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Learning to Read:
The Importance of Assessing Phonological Decoding Skills and Sight Word Knowledge

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Fluent single-word reading is an essential element of reading and comprehending connected text. This paper discusses the importance of assessing two key components of single-word reading, phonological decoding and sight word recognition.

The *Scholastic Phonics Inventory (SPI)* is a research-based assessment that measures the ability to read nonwords and sight words accurately and efficiently. The *SPI* was created to identify 3rd-12th grade students who are poor decoders and/or unable to recognize sight words with fluency, and to differentiate these students from those who are adequate decoders and able to recognize sight words with fluency. Concurrent validity was established for the *SPI* using the Test of Word Reading Efficiency (TOWRE) (Torgesen, Wagner, & Rashotte, 1999), and the Woodcock-Johnson III Word Identification and Word Attack subtests (Woodcock, McGrew, & Mather, 2001). These results and others, as specified in the *SPI* Technical Guide (Scholastic Research and Evaluation, 2008), reveal that *SPI* is highly effective at identifying students with poor decoding skills and/or limited sight word knowledge.

The *SPI* reflects the research described in this paper about efficient assessment of phonological decoding and sight word reading. Thus, this computer-based, reliable and valid assessment is an effective tool for identifying students who need additional intervention directed at improving word-level reading skills before gains in reading comprehension can be achieved.

Contents

Introduction

Reading refers to understanding the written message of an author (Wagner, Piasta, & Torgesen, 2006; Snow, 2002). It involves a recursive process of extracting and constructing meaning that requires a reader, written material to be comprehended, and typically a purpose for reading. The complexity of this process is illustrated by Scarborough's (2002) model of skilled reading (Figure 1).

As Figure 1 shows, in order to comprehend the meaning of a *string of words* in a text, a reader must draw on his or her background knowledge and knowledge of vocabulary, language structures, verbal reasoning, and literacy concepts—all important elements of language comprehension. At the same time, the initial step in successful comprehension is recognizing *individual words*, whether by drawing on phonological decoding to sound out the word or by recognizing the word by sight. The more accurate and automatic readers become with these individual word recognition processes, the more cognitive space can be freed up for comprehending strings of text. In fact, for elementary-age students, word-level reading has been found to be the major determinant of reading comprehension (Jenkins et al., 2003; Stanovich, 1991). Consequently, assessment of word-level reading in the form of both phonological decoding skills and sight word knowledge is important even though the ultimate goal of reading is to comprehend the meaning of the text.

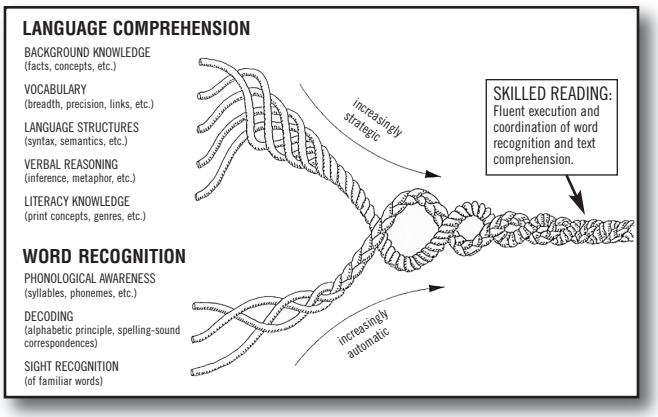

Figure 1: Strands of Early Literacy Development (Scarborough, 2002)

Difficulties with word-level reading become increasingly problematic as students get older. Problems with phonological decoding and sight word fluency result in poor comprehension and lower motivation (Snow, Burns, & Griffin, 1998), and as texts become increasingly advanced with each grade, poor readers fall farther behind. Although reports vary as to what percentage of older struggling readers have poor phonological decoding skills, Hock et al.'s (in press) study of struggling adolescent readers in urban schools found that a full 61% had problems with word-level reading. These results underscore the importance of reliable and efficient methods for assessing phonological decoding and sight word reading in the middle and upper grades, especially in light of the fact that word-level reading skills can be improved substantially with effective instruction and intervention for the vast majority of struggling readers.

Learning to Read

Most scripts convey information about the pronunciation and the meaning of the words used to convey the message (Rayner et al., 2001). To translate print to language, the beginning reader needs to learn to connect the printed forms of words (orthography) to their pronunciations (phonology) and meanings (semantics and morphology).

Orthography

An orthography is a system of marks used to represent spoken language in writing. For example, the English orthography consists of the 26 upper- and lower-case letters, the numerals 0 through 9, punctuation marks, and some other symbols that have come to represent meaning (e.g., # for pound, @ for at, $ for dollars, and & for and). Although no writing system is completely pure and exceptions exist, writing systems in existence today can be divided into three primary types: alphabets, syllabaries, and morpho-syllabaries (Crowder & Wagner, 1992; DeFrancis, 1989; Gelb, 1952; Rayner et al., 2001; Rayner & Pollatsek, 1989).

Alphabetic writing systems such as English rely on a relatively small number of orthographic units or letters, many of which correspond roughly to individual speech sounds or phonemes (see below). Examples of alphabetic writing systems include the Chinese *pinyin* system, English, German, Italian, Korean, Finish, Spanish. Alphabets vary in the consistency of relations between letters and sounds (i.e., the number of sounds associated with a given letter). Alphabets with consistent mappings, which are referred to as shallow orthographies, include Italian and Dutch, with Finnish having the most consistent mappings of any alphabet. Alphabets with inconsistent mappings, which are referred to as deep orthographies, include English and French (Frost, Katz, & Bentin, 1987). Children learning shallow orthographies tend to master decoding more quickly than do children learning deep orthographies. In addition, poor readers of shallow orthographies such as Finnish tend to decode words relatively accurately but dysfluently; in contrast, poor readers of deep orthographies such as English tend to decode words inaccurately as well as dysfluently. This makes sense because it is possible to decode words in shallow orthographies merely by knowing the sounds of individual letters of the word. Accurate decoding of words in deep orthographies requires learning many words that cannot be fully decoded by knowing the sounds of the letters of the word.

Syllabaries, the second kind of writing system, have orthographic units that correspond to syllables. The Japanese Kana writing system is an example of a syllabary. The final kind of writing system, morpho-syllabaries, have orthographic units that represent syllables that also are morphemes. The Chinese character writing system and the Japanese Kanji writing system are examples of morpho-syllabaries.

Although most of what is known about learning to read is about learning to read alphabetic scripts in general, and English in particular, the amount of research on learning to read other scripts is increasing at a rapid pace. The emerging picture is that the major findings about learning to read English also apply to learning to read scripts associated with all European languages (Zeigler & Goswami, 2005). When Asian languages are included, differences are found in the relative importance of key underlying skills in learning to read, but the fact that some individuals fail to learn to read appears to be universal regardless of the nature of the written language to be mastered (McBride-Chang et al., 2005).

Phonology

Speech information can be conveyed at different levels (Crowder & Wagner, 1992). For the purpose of this paper, the two levels of most importance are the phonological and morphophonological levels.

At the phonological level, speech is represented by abstract phonemes, which refer to sound distinctions that signal changes in meaning in a given language. The sounds represented by the 'r' in 'ran' and the 'p' in 'pan' are different phonemes, which signal the different meanings associated with the words 'ran' and 'pan.' What makes phonemes abstract can be understood by comparing the pronunciations of the following three words. The actual speech sounds or phones represented by the sounds of the 'p' in 'top,' 'spot,' and 'pot' are different. You can verify this fact by holding your hand in front of your mouth while pronouncing 'top,', 'spot,' and 'pot.' You will notice a difference in the amount of air or acoustic energy that is released, with the most for the 'p' in 'pot, the least for the 'p' in 'spot,' and the 'p' in 'top' falling in the middle. All three phones are representations of the /p/ phoneme, and hence are referred to as allophones of the phoneme /p/. Phonemes are said to be abstract because they represent phones that are not pronounced identically but that are perceived as belonging to a single category as equivalent in a given oral language.

At the highest, morphophonemic level, speech is represented by strings of phonemes that also represent morphemes or units of meaning. These strings are morphophonemes because they convey both morphological and phonological information. Analogous to the fact that allophones are phones associated with a single phoneme, allomorphs are associated with a given morpheme or meaning unit. The 'sign' part of the words 'sign' and 'signature' are examples of allomorphs. Written English is morphophonemic in that its spellings generally give priority to representing pronunciations but with compromises so as to convey meaning. For example, SIGN and SIGNATURE share the spelling SIGN despite the fact that the SIGN part of the two words is pronounced differently. HEAL and HEALTHY provide a second example.

Semantics and Morphology

Semantics refers to the meaning of words. Morphology refers to the composition of a word with respect to the morphemes or 'minimal meaningful elements' (Bloomfield, 1933). Morphemes include word roots, suffixes, prefixes, and inflections. Inflections refer to parts of words that indicate number, person, tense, or case, such as the 'ed' in 'painted' (Arnbak & Elbro, 2000). The suffix 'er' is a morpheme that denotes "one who does something," as in the words 'teacher,' 'preacher,' and 'bookmaker.' Morphological knowledge becomes particularly useful as children become skilled readers because they will encounter unfamiliar words that are related morphologically to words they know. For example, a child might encounter the unfamiliar word EVIDENTIARY and infer its meaning by referring to the known word EVIDENCE and the sentence context.

Failing to Learn to Read Fluently

The vast majority of poor readers have difficulty in decoding individual words (Adams, 1990; Ehri, 1997; Jenkins et al., 2003; Snow, Burns, & Griffin, 1998; Stanovich, 1982; Vellutino, 1979). Poor readers also are impaired in reading comprehension, but for most poor readers, their reading comprehension problems arise largely (directly and indirectly) because of their inability to decode the words (Aaron, 1989; Bruck, 1990; Juel, 1988). Poor word-level reading has its origins in the language rather than the visual system, and the problem often is compounded by ineffective instruction (Spear-Swerling & Sternberg, 1996; Wagner, 2005; Wagner & Garon, 1999; Wagner & Torgesen, 1987). When poor readers are compared to reading-level matched controls (i.e., younger normal readers whose absolute level of reading is comparable to that of older poor readers), the older, poor readers perform poorly on measures of phonological awareness and phonological decoding, and they have fewer words that can be decoded by sight (Bradley & Bryant, 1983; Bruck, 1992; Ehri, 1998; Fox, 1994; Siegel & Faux, 1989; Wagner, 1988; Wagner & Torgesen, 1987).

Phonological awareness refers to an individual's awareness and access to the sound structure of an oral language, especially the phonemic level (Wagner & Torgesen, 1987). Phonological decoding refers to decoding words or nonwords by sounding them out, as when one is asked to decode the nonword PLONE. The exact nature of the underlying language problem that is manifested as poor phonological awareness and phonological decoding is unknown at present but is under investigation. One candidate is a subtle problem in forming accurate phonological representations, which in turn leads to poor phonological awareness and phonological decoding. Once beginning readers fall behind, they are exposed to reading instruction designed for typical readers, which provides little assistance, until they finally are identified as having a reading problem and more appropriate instruction is provided.

Given the above, it should not be surprising that a hallmark feature of children who have difficulty learning to read is poor performance decoding pronounceable nonwords or pseudowords (see Rack, Snowling, & Olson, 1992 for review). Poor readers even continue to struggle to read nonwords after they have demonstrated knowledge of similar orthographic patterns in real words (Siegel & Faux, 1989). This limitation in decoding nonwords persists into adulthood (Bruck, 1990, 1992, 1993).

The results just reviewed suggest that deficits in phonological decoding skills play a causal role in failing to learn to read. The causal role of deficits in phonological skills is further supported by the multitude of intervention studies that have utilized phonological training and phonics instruction to produce gains in at-risk or dyslexic readers (e.g., Ball & Blachman, 1991; Brady, Fowler, Stone, & Winbury, 1994; Byrne & Fielding-Barnsley, 1989, 1991, 1993, 1995; Byrne, Fielding-Barnsley, & Ashley, 2000; Ehri, Nunes, Stahl, & Willows, 2001; Ehri et al., 2001; Foorman et al., 2003; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Foorman, Francis, Novy, & Liberman, 1991; Hatcher, Hulme, & Ellis, 1994; Lovett, Steinbach, & Frijters, 2000; Rashotte, MacPhee, & Torgesen, 2001; Schneider, Ennemoser, Roth, & Kuespert, 1999; Schneider, Roth, & Ennemoser, 2000; Torgesen et al., 2001; Torgesen et al., 1999; Vellutino, Scanlon, & Tanzman, 1998; Wise, Ring, & Olson, 1999; see also Adams, 1990; Bus & van Ijzendoorn, 1999; Chall, 1967/1983; National Reading Panel, 2000; Snow, Burns, & Griffin, 1998).

Although academic careers have been made debating seemingly subtle aspects of models that can account for a reader's performance when presented with words and nonwords, it is indisputable that phonological decoding is a basic building block upon which fluent single-word reading and fluent reading of connected text for comprehension are based. Efficient phonological decoding is essential for building good internal representations of words and spelling patterns. A combination of phonological translation and careful orthographic analysis eventually results in the development of a substantial sight word vocabulary, which makes fluent reading of connected text and comprehension possible. Thus, assessing phonological decoding at the word level represents an important focus of reading assessment.

Assessing Word-Level Reading

Nonword reading fluency has proven to be an effective measure for evaluating phonological decoding (Torgesen, Wagner, & Rashotte, 1999; Vanderwood, Linklater, & Healy, 2008). When presented with an unfamiliar word, readers must break it into parts, retrieve sounds associated with the parts, and string them together to pronounce the unfamiliar word. This process can be assessed by presenting examinees with pronounceable nonwords. It has been shown that skilled readers analyze unfamiliar words or nonwords more fully than do poor readers (McConkie & Zola, 1987). For example, some poor readers tend to use initial consonant cues to guess at the rest of the word (Vellutino & Scanlon, 1987). A full analysis of unfamiliar words contributes to their becoming sight words over time. Thus, the nonword assessment can reveal whether a student is decoding effectively by attending to all the letters and sounds that make up the unknown word.

An advantage of assessing nonwords is that these assessments prevent the reader from using context clues to identify the target word. Poor readers who have weak decoding skills tend to over-rely on context clues to try to make meaning of text (Nicholson, 1991; Stanovich, 1986). Although depending on context clues is an inefficient method of discerning meaning—it has been estimated that only one out of every four words (25%) can be predicted by using context (Gough, Alford, & Holley-Wilcox, 1981)—using context may help poor readers compensate for weak decoding skills, potentially masking this underlying problem.

Nonword reading fluency is predictive of reading performance (Speece, Mills, Ritchey, & Hillman, 2003). In a meta-analysis of correlational literature on measures of phonological awareness, reading, and related skills, Swanson, Trainin, Necoechea, and Hammill (2003) conclude that "[one of] the most important measures for predicting real-word reading ability across an array of ages and samples [is] nonword reading (word attack)" (p. 429). This holds true for English language learners as well as for native English speakers; Vanderwood, Linklater, and Healy (2008) found that first-grade nonsense word fluency for English language learners was strongly predictive of third-grade measures of reading proficiency.

Given that knowledge of actual words (i.e., lexical knowledge) can help readers decode unfamiliar words, care should be taken when choosing nonwords for an assessment of phonological decoding skill. For example, decoding PLONE might be facilitated by knowledge of the pronunciations of the related words PLANE and CLONE. The extent to which readers rely on their knowledge of real words when decoding the nonwords depends on the nature of the nonwords (Treiman, Goswami, & Bruck, 1990). The practice of creating nonwords by swapping a single phoneme in a real word (e.g., banana becomes panana) should be avoided because it encourages use of knowledge of real words rather than decoding.

In addition to measuring the accuracy of students' phonological decoding, it is essential to assess the speed, or automaticity, of their decoding. Fluent reading and, ultimately, comprehension depend on the ability to read both accurately and automatically; the more that decoding becomes automatic, the more cognitive resources remain that can be devoted to processing the meaning of text (Freedman & Calfee, 1984; LaBerge and Samuels, 1974). Rapid automatized naming (RAN) tasks, which require rapid naming of visual symbols such as pictures, letters, or words, are one method for evaluating automaticity of symbol-sound associations. In particular, RAN tasks that require use of letter-sound knowledge have been shown to be strong predictors of reading (Vanderwood, Linklater, & Healy, 2008). Timed nonword reading tests, like those included in the TOWRE and DIBELS reading assessments, involve both accurate and rapid responses and have proven to be strongly predictive of reading proficiency.

Another element that contributes to fluency is sight word knowledge. Skilled readers have a large vocabulary of sight words that can be recognized automatically. However, for most people, efficient decoding plays an important role in the development of a large sight word vocabulary. Repeated, accurate reading of the same word eventually leads to the word being stored in memory as a sight word—one that is identified automatically and without conscious thought. This store of automatically recognizable words is built through frequent reading, and therefore struggling readers often have difficulty building a large sight word vocabulary.

Assessing sight word reading and nonword reading provides important information about the nature of the student's reading difficulties. For example, an English language learner may be fluent at decoding nonwords yet dysfluent at reading sight words because he or she is not yet familiar with some English language vocabulary words. A student who struggles with nonwords more than sight words may have an underlying problem in phonological processing.

In the complex process of learning to read, problems with phonological decoding and sight word knowledge can have serious consequences as students are required to read increasingly challenging text with each new grade level. Many older struggling readers who never learned to "crack the code" eventually become alienated from school and demotivated by years of academic failure. It is therefore critical to effectively assess and identify those older students who continue to struggle with foundational phonological decoding skills. Nonword and sight word assessments efficiently isolate these skills, ensuring that older, struggling readers with decoding problems receive the targeted, intensive intervention they need to put them on the path toward successful comprehension.

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About the Author

Richard Wagner is a Distinguished Research Professor and the Binet Professor of Psychology at Florida State University, and Associate Director of the Florida Center for Reading Research. He earned a Ph.D. in cognitive psychology from Yale University in 1985. He previously earned a Master's Degree in School Psychology from the University of Akron and worked as a school psychologist.

His major area of research interest is the acquisition of complex cognitive knowledge and skills, which he has pursued in the domains of human intelligence and of reading. In the domain of reading, his research has focused on the role of reading-related phonological processing abilities in the normal and abnormal development of reading skills, in the prediction, prevention, and remediation of dyslexia, and in understanding the origins of individual and developmental differences in reading comprehension. His work has addressed a variety of measurement issues and practical considerations involving assessment of constructs in the domains of language, reading, and intelligence.

Wagner has coauthored tests of phonological processing (*Comprehensive Test of Phonological Processes in Reading*), reading (*Test of Word Reading Efficiency, Test of Silent Reading Efficiency and Comprehension*), and early literacy (*Test of Preschool Early Literacy*) published by PRO-Ed. He currently chairs the Advisory Board of the National Institute for Literacy, and is the principal investigator of a Multidisciplinary Learning Disability Center funded by the National Institute of Child Health and Human Development (NICHD).

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