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Phonological Awareness and Reading: An Alternative Interpretation of the Literature from a Clinical Perspective

Many researchers have concluded that there is a strong causal relationship between phonological awareness and reading, and that deficiency in phonological awareness is a major factor in reading problems. This article provides an alternative interpretation based on a critical analysis of the research literature and three clinical case studies. On the basis of our results, we hypothesize that rather than phonemic awareness per se, what seems to be essential to learning to read is that children develop an understanding of the connections between oral and written language. At the macrolevel this involves an understanding that written words represent words in oral language. At the microlevel it involves understanding that letters in written words stand for phonemes in spoken words.

Plusieurs chercheurs s'entendent pour conclure d'une part, qu'il existe une forte relation de cause à effet entre l'éveil au phonème et la lecture et d'autre part, qu'une faiblesse en ce qui concerne cet éveil constitue un facteur important dans les troubles de lecture. Cet article présente une autre interprétation qui est basée sur une analyse critique de la documentation sur la recherche ainsi que sur trois études de cas cliniques. Les résultats que nous avons obtenus nous mènent à la conclusion que ce qui semble essentiel à l'apprentissage de la lecture n'est pas l'éveil au phonème comme tel mais plutôt la prise de conscience chez l'enfant des liens entre la langue orale et la langue écrite. Au niveau macrologique, cela implique la prise de conscience que les mots écrits représentent les mots du parlé. Au niveau micrologique, cela implique la prise de conscience que les lettres de l'écrit représentent les phonèmes de l'oral.

Over the last two decades there has been widespread agreement in the literature that phonological awareness is a crucial variable in learning to read. By 1987, Stanovich referred to research completed to that time as a "scientific success story." In 1990 Adams drew the following conclusion from her review of literature on beginning reading: "The evidence is compelling: Toward the goal of efficient and effective reading instruction, explicit training of phonemic awareness is invaluable" (p. 331).

Research in the 1990s has demonstrated that the relationship between phonological awareness and reading is both more complex and less direct than many initially believed. On the basis of this research and our clinical experience

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over nearly three decades, we agree with Muter and Snowling (1998) that, "an unresolved issue concerns the mechanism that accounts for the relationship of phonological skills to learning to read" (p. 320).

The purpose of this article is to provide an alternative interpretation of the relationship between phonological awareness and reading by (a) presenting a critical analysis of the literature, and (b) applying conclusions drawn from that analysis to three clinical case studies. First, however, it is important to clarify the nature of the construct of phonological awareness and to identify some problems encountered when reviewing literature in this area.

Phonological awareness is most commonly defined as awareness of the sound structure of one's oral language. The focus is on auditory input and on awareness of sound segments in that auditory input. Researchers have generally shown that phonological awareness is a constellation of abilities rather than a unitary ability, and some have hypothesized that different components of phonological awareness represent different levels of development (Adams, 1990; Ball, 1993). However, there is no clear consensus on which components are prerequisite to learning to read. Goswami and Bryant (1990), for example, proposed awareness of rhyming as a prerequisite, but more recent studies (Muter, Hulme, Snowling, & Taylor, 1997; Muter & Snowling, 1998; Nation & Hulme, 1997) have not found rhyming to be a significant predictor of success in learning to read. Overall, consensus is growing that phoneme segmentation (ability to hear separate phonemes in spoken words) is more highly related to reading achievement than are other aspects of phonological awareness (Høien, Lundberg, Stanovich, & Bjaalid, 1995; Nation & Hulme, 1997; Torgesen, Wagner, & Rashotte, 1994).

The range of components of phonological awareness and of instruments to measure it makes comparisons across studies in this area difficult. Add to this the range of age/grade levels of participants in studies, as well as differences in learning/reading abilities, and comparisons become even more problematic. In the following section we review literature reflecting the full range of instruments, levels, and abilities, recognizing that this makes it difficult to draw definitive conclusions.

Phonological Awareness and Reading

Much research on the relationship between phonological awareness and reading has been correlational in nature. Researchers have interpreted significant correlations as indicating that phonological awareness is causally related to success in learning to read (Høien et al., 1995; Kirtley, Bryant, MacLean, & Bradley, 1989; Swank & Catts, 1994; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993). Support for this interpretation has been provided in predictive studies where researchers have generally found that scores on a wide range of phonological awareness instruments predict success in learning to read (Cormier & Dea, 1997; Griffith, Klesius, & Kromrey, 1992; Juel, Griffith, & Gough, 1986; Muter et al., 1997; Muter & Snowling, 1998; Nation & Hulme, 1997; Rohl & Pratt, 1996; Torgesen et al., 1994; Tunmer, Herriman, & Nesdale, 1988). Results also show that good and poor decoders can be identified on the basis of performance on phonological awareness measures (Swank & Catts, 1994). Finally, in training studies with average readers or normal distributions of

learners, researchers have found that phonological awareness can be trained and that this training makes a difference in reading achievement (Byrne & Fielding-Barnsley, 1993; Cunningham, 1990; Hurford et al., 1994; Lundberg, Frost, & Petersen, 1988; Tunmer & Hoover, 1993).

On the basis of these results several researchers have concluded that lack of or limited phonological awareness is a major factor in reading problems (Rack, Snowling, & Olson, 1992; Stanovich, Siegel, & Gottardo, 1997; Swank & Catts, 1994; Wagner, 1988). Results of studies with problem readers, however, have often been quite different than those with normal distributions of learners. Felton and Brown (1990), for example, evaluated at-risk children both in kindergarten and in grade 1 and found that when they controlled for IQ, none of the phonological awareness measures was predictive of success in learning to read. Vellutino et al. (1996) also found that the phonological abilities of some grade 1 children in the low reading group in their study were as good as or better than those of some children in the good and very good reading groups. Results of training studies with at-risk learners have also been disappointing. Torgesen et al. (1994) noted that results of their training studies with at-risk children generally showed that it is not as easy to improve significantly the phonological awareness of these children as studies with average children would suggest.

Even for average learners it is becoming increasingly clear that the relationship between phonological awareness and reading is reciprocal rather than unidirectional (Bentin & Leshem, 1993; Perfetti, Beck, Bell, & Hughes, 1987; Wagner, 1988). It is also becoming clear that the measure of phonological awareness most highly related to reading (phoneme segmentation) is also the one more likely to be an outcome of, rather than a causal factor in, learning to read (Bentin & Leshem, 1993; Byrne & Fielding-Barnsley, 1993; Høien et al., 1995; Perfetti et al., 1987; Wagner, 1988). Morais, Bertelson, Cary, and Alegria (1986), for example, found that illiterate adults had great difficulty with phoneme segmentation tasks, but that when provided with literacy instruction, their ability to segment phonemes improved. Young children also have great difficulty with tasks such as phoneme segmentation, but once they learn to read, these tasks become reasonably easy (Kirtley et al., 1989). One might be tempted to conclude from these results that phonological awareness is simply an outcome of learning to read. However, it may not be reading per se, but reading of an alphabetic language that is implicated in phoneme segmentation.

Read, Zhang, Nie, and Ding (1986) compared the phonological awareness of adults in China who had learned to read only nonalphabetic Chinese characters with that of adults who had also learned to read an alphabetic script. Results indicated that those who had learned the alphabetic script were able to add or delete single consonants at the beginning of spoken syllables, whereas those who had learned to read only Chinese characters could not. Read et al. concluded from these results that, "it is not literacy in general which leads to segmentation skill, but alphabetic literacy in particular" (p. 41). In a cross-cultural study of Japanese and American children, Mann (1986) also found that few grade 1 children who learned to read a syllabary rather than an alphabetic system were aware of phonemes. Although many Japanese children in the later grades had become aware of phonemes, this was probably a result of other

secondary language activities such as the learning of Kana (a phonological orthography) or exposure to signs in the Roman alphabet. The question raised by these studies is how reading an alphabetic language relates to phonological awareness.

In an early study related to this question, Tunmer et al. (1988) concluded that in the beginning stages of learning to read, some minimal level of phonological awareness may be necessary for children to profit from letter-name knowledge. In contrast, Stahl and Murray (1994) concluded that letter-name knowledge is a necessary prerequisite for segmentation of initial consonants, which in turn is necessary for both word reading and more complex levels of phonological awareness. In a study of 4-year-old nonreaders, Johnston, Anderson, and Holligan (1996) found that alphabet knowledge contributed unique variance to reading above that accounted for by phonemic awareness, whereas the reverse was not the case. They suggest that, "earlier studies which have examined the predictive power of preschool phonological awareness skills for later reading ability may be somewhat misleading, as they did not measure letter knowledge" (p. 230). Muter et al. (1997), in a longitudinal study of children during their first two years of learning to read, found letter-name knowledge predicted scores on both reading and spelling tests and showed an interactive effect with children's phonological awareness skills.

This interaction effect or interrelationship between phonological awareness and letter knowledge has been the focus of several training studies with beginning readers (Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1991, 1993; Hurford et al., 1994). The results of this research generally provide support for linking phonological awareness training with work on letter names and sounds. For example, Ball and Blachman (1991) concluded from their study with kindergarten children that, "phoneme segmentation training that closely resembles the task of early reading may have more immediate effect on reading ... than instruction that does not make this connection [between sounds and letters] explicit" (p. 64). However, Kerstholt, Van Bon, and Schreuder (1997) obtained quite different results in a recent study of Dutch kindergarten children. There was no difference in the effectiveness of training in phoneme segmentation with and without presentation of visual letters. Kerstholt et al. hypothesize that this might have been the result of the focus on phonological skills in preschool in the Netherlands. Preschoolers had already learned that "in printed words a particular speech sound corresponds to a letter or combination of letters" (p. 281). In these training studies, reading was measured by pseudoword decoding or word recognition tasks.

A small number of studies have explored the impact of training on reading comprehension as well as word recognition. One of the first and best known of these studies was conducted by Bradley and Bryant in 1983. They selected 65 children aged 4 and 5 years who scored low on rhyming and provided them with one of three programs spread over two years. One group was taught to categorize words by their constituent sounds, for example, *cat*, *rat*, *bat*. The second group was provided with this training, but also shown how to make the words using plastic letters, and the third group was taught to categorize words semantically. A control group received no training. When the children were reassessed at age 8-9 years, the second group had made greater progress than

the other groups on tests of both reading and spelling. Bradley and Bryant argued that this was a result of demonstrating to the children the connections between phonological and orthographic strategies.

In a follow-up study, Bradley (1988) again selected children aged 4-5 years. However, this time they did not have difficulties with rhyming and sound alliteration tasks, and programs were provided over four months instead of two years. Group 1 was taught to categorize words by their sounds and shown how to make the words using plastic letters. Group 2 received training in both categorizing words by sounds and making words using plastic letters, but the strategies were taught in separate sessions. Group 3 was taught sound categorization only, and Group 4 was taught to make words with plastic letters only. By the end of the first school year, Group 1 had made more reading progress than the other groups. Bradley concluded that, "It is making this explicit connection between the phonological and orthographic features of written language that helps children understand the alphabetic principle and improves reading comprehension as opposed to simple decoding" (p. 15). By the end of the third school year, there were no differences among any of the groups. She hypothesized that the advantage of Group 1 children was short-lived because the other children had good phonological skills and "got there" eventually by themselves. An alternative possibility is that the children made the connections through the reading instruction they received in their classrooms.

A study by Hatcher, Hulme, and Ellis (1994) provides support for this latter possibility. They investigated whether intervention involving a combination of phonological training and reading instruction would be more effective than intervention involving either phonological training or reading instruction alone. Their participants were 7-year-old poor readers. Results showed that the group receiving both phonological training and reading instruction made more progress than the other groups on measures of word recognition and comprehension.

Overall, results of training studies indicate that "highly intensive and sustained phonological awareness training *by itself* provides, at best, limited improvement in subsequent reading" (Wagner et al., 1993, p. 100). Whether phonological training results in reading progress depends on *what else* is done with the children while this training is being provided, and that what else seems to involve connections or linkages of some sort. Bradley (1988) hypothesized that children need to make two kinds of links or connections when learning to read:

The most essential one is to understand that the marks on the page represent the words they hear and use in speech. The next connection is a more subtle one. It is to understand the connection between speech and print, and to realize that the orthography embodies the linguistic characteristics of our spoken language. In the case of English the alphabetic orthography exploits the phonological structure of the language. (p. 3)

This latter connection involves understanding of the alphabetic principle: the principle that sequences of letters map onto sequences of sounds (Muter et al., 1997; Stahl & Murray, 1994; Tangel & Blachman, 1995).

There is controversy in the literature about how best to develop these connections. In studies conducted by Cunningham (1990) and Tunmer and Hoover (1993), explicit, systematic instruction was more effective than incidental instruction. However, Klesius, Griffith, and Zielonka (1991) found that development of the alphabetic principle can occur with minimal explicit instruction. In a longitudinal study of kindergarten children, Morris (1993) found that two types of instructional programs, one combining language experience and letter-sound instruction and the other emphasizing oral language and experiential play, helped children learn to match spoken with written words and to segment spoken words into phonemes. Informal reading experiences in the home have also been found to affect both phonological awareness and subsequent reading success (MacLean, Bryant, & Bradley, 1987; Mann, 1993).

Another question involves whether there is a developmental sequence in learning the two types of connections identified by Bradley (1988). Most of the kindergarten children in Morris' (1993) longitudinal study established awareness of the match between spoken and written words prior to developing awareness of phonemic units within words.

In summary, the relationship between phonological awareness and reading is neither simple nor direct (Wagner, 1988). Phoneme segmentation is more highly related to reading achievement than are other aspects of phonological awareness. However, only minimal awareness of phoneme segments is necessary for children to learn to read (Perfetti et al., 1987), and phoneme segmentation is more likely to be the result of learning to read than the cause. What seems to be essential is that children establish connections. In this article we use the term *macrolevel connections* to refer to children's understanding that written words represent words in oral language and the term *microlevel connections* to refer to children's understanding that speech maps onto letters (the alphabetic principle). Training in phonological awareness might help to establish connections at the microlevel, but only if it is combined with work on letters. Even this type of training has been insufficient for some at-risk learners such as those described by Weiner (1994) and Torgesen et al. (1994).

In the remainder of this article clinical case studies of three children experiencing difficulty with learning to read are presented to explore their understandings of both microlevel and macrolevel connections. Although case studies clearly do not lead to generalizations, they are ideal for exploring the nature of complex phenomena because multiple variables can be considered simultaneously. In this article children's understanding that written words represent words in oral language is explored by examination of results on interviews, oral reading passages, and writing. Their understanding of how speech maps onto letters is reflected in measures of word recognition and spelling. Results of listening, visual perceptual, and phonemic awareness tests are also included in the description of these clinical cases to provide support for interpretations and to explore the relationship between phonemic awareness and connections at the microlevel.

Three Clinical Cases

Three cases were selected for this study, not because they are representative of children with reading problems, but because they reflect some of the diversity

seen in a clinical population. One child had low scores on both phonemic awareness and reading, the second adequate scores on phonemic awareness but low scores on reading, and the third inadequate scores on both for his age but relatively higher scores on phonemic awareness than reading. All three children were found to be functioning within the average range of intellectual ability on the Wechsler Intelligence Scale for Children III (Wechsler, 1991), and all three had been referred for assessment because they had made negligible progress in learning to read. Typical of a clinical population, two of the children had an extensive history of developmental and/or behavioral problems in addition to their difficulties with reading.

Jillian was 7 years 1 month old and in a regular grade 1 classroom at the time of assessment. Although she had a history of allergies and was a quiet child, there was nothing atypical about her development

Willie, aged 7 years 8 months, was in a regular grade 2 classroom at the time of assessment and had a long history of language problems and therapy. He was diagnosed at 3 years as having severe expressive language problems and phonological delays. He received treatment initially in a parent-assisted program and then individually for two years. He was then placed for two further years in a special school for language development where he continued to receive speech therapy. On the basis of his perceived progress, he was placed in a regular grade 1 class where he made minimal progress in learning to read. He scored at the 1st to 21st percentile on the Woodcock Reading Mastery Tests-Revised (Woodcock, 1987) at the time he was referred for assessment.

David was 10 years 6 months old at the time of assessment and attending a special class. He had been delayed in learning to speak and had a history of ear infections. He was diagnosed as having Attention Deficit Hyperactivity Disorder at an early age and prescribed medication that he was still taking at the time of assessment. He had experienced academic and behavioral difficulties from the time he entered kindergarten. When he was 9 years old, he was diagnosed with Oppositional Defiant Disorder and placed in a behavior disorders class.

Instruments

The test battery consisted of core and optional instruments of both an informal and standardized nature to measure reading, writing, and related factors. Core instruments included informal reading inventories to assess both reading (Qualitative Reading Inventory-II, Leslie & Caldwell, 1995) and listening (Stieglitz Informal Reading Inventory, Stieglitz, 1992), an informal writing sample, and selected subtests from Clay's (1993a) Diagnostic Survey.

The Qualitative Reading Inventory-II (QRI II) and the Stieglitz Informal Reading Inventory consist of a series of word lists and passages of increasing difficulty. On the QRI II the children were asked to identify words on lists beginning at a preprimer level, and the examiner noted words that were identified immediately and those that required use of word identification strategies. The two boys were asked to read a passage orally at the preprimer level and answer questions on that passage. Jillian was unable to identify or attempt any words on the preprimer list, and hence no passages were administered. On the Stieglitz test, examiners read passages of increasing difficulty and asked comprehension questions.

Subtests administered from Clay's (1993a) Diagnostic Survey included Letter Identification, Writing Vocabulary, Sentence Dictation, and Running Records. On the Letter Identification task, children are shown both upper- and lower-case letters and asked to tell what they are. Credit is given for letter names, sounds, or words beginning with the letter. Children write all the words they know in 10 minutes on the Writing Vocabulary task and then identify the words they have written. Credit is given for all words both written and read correctly. On the sentence dictation task, children write sentences from dictation. Credit is given for all phonemes represented in the words dictated. Finally, running records were collected using different types of reading materials. All three children read predictable books, the two younger children also read language experience stories they had dictated, and the two boys also read unfamiliar material. In addition, the two younger children completed an informal Writing Sample on a topic of their choice; David refused to write in the diagnostic session.

For the optional instruments, each of the three children was administered the Developmental Test of Visual-Motor Integration—Third Edition (VMI, Beery, 1989) to assess visual perceptual abilities. To measure phonological awareness, the two younger children were administered the Test of Awareness of Language Segments (TALS, Sawyer, 1987), and David completed the Lindamood Auditory Conceptualization Test (LAC, Lindamood & Lindamood, 1971). These instruments were selected on the basis of age-appropriateness and because they each include a measure of phoneme segmentation. Children complete three tasks on the TALS. Using blocks, they indicate how many words they hear in sentences, how many syllables they hear in words, and how many phonemes they hear in words. This last task measures phoneme segmentation. On the first task on the LAC, children use blocks of different colors to discriminate similarities and differences among phonemes heard. On this task, the examiner presents phonemes as separate units (e.g., Show me /n/ /l/ /n/), and children use colored blocks to show which phonemes are the same and which are different. On the second task, children represent the sequence of phonemes heard in pseudowords with colored blocks. This task requires them to segment pseudowords into phonemes and to represent different phonemes with different colored blocks (e.g., If that says, /i/ /k/, show me /i/ /p/).

Tests were administered either by the Director of a university reading clinic or by students in a graduate course on clinical reading under the supervision of the Director. All testing sessions were tape-recorded and the tapes and completed record sheets used by the Director to determine accuracy of administration and scoring.

Results

Jillian

Jillian was aware that she was virtually a nonreader, commenting shortly after her 7th birthday, "Isn't this ridiculous, I'm 7 years old and I still can't read." That she was at an emergent stage of learning to read was confirmed by results on the QRI II where she was unable to identify any words on the preprimer list. She demonstrated well-developed listening comprehension, answering ques-

tions adequately on the grade 2 passage, and performed in the average range for her age level on the VMI.

On several tasks, Jillian demonstrated that she was just beginning to understand how oral and written language were related. When asked if telling and reading a story were the same, she answered in the affirmative; when asked if people can read with their eyes closed, she indicated they can't because they can't see the pictures. When asked to read a familiar, predictable book (*In a Dark Dark Wood*), Jillian was highly successful (92% accuracy), relying primarily on her memory of repetitive patterns and picture cues. When introduced to an unfamiliar repetitive book (*Climbing from Literacy 2000*), she was able to use her well-developed listening comprehension along with picture cues to "read" the book with a high degree of accuracy after only two or three readings. She was also able to reread a language experience story with 100% accuracy based on memory of what she had dictated. When asked what kinds of books she reads at school, Jillian proceeded to "read" a predictable book without the text in front of her. She used storybook language and maintained a high degree of accuracy to the text. At one point she even self-corrected her "reading," going back to insert a line she had not included. On the basis of these results it was clear that Jillian did not yet understand the connection between oral and written language.

Jillian did have some knowledge of sight words and of letter names and sounds, but made almost no use of this knowledge to identify words as she read and was just beginning to apply this knowledge to writing. Although Jillian was unable to identify any words on the preprimer word lists on the QRI II, she did demonstrate that she was beginning to develop a sight vocabulary on the Writing Vocabulary task from Clay's Diagnostic Survey. When asked to write all the words that she could, she produced and was able to identify seven words accurately (*Mom, Dad, red, to, from, her name, and her friend's name*) and attempted two others (her sister's name and the word *cat* spelled *cta*). The findings that Jillian included no invented spellings and that she included all of the letters in the words she did produce (in one word out of order) indicate reliance on memory rather than knowledge of letter sounds.

On the Sentence Dictation task, Jillian was able to represent 11 of the 37 phonemes in the words dictated. Most of the phonemes she correctly represented were in the initial word position. On the phoneme segmentation task on the TALS, Jillian again demonstrated ability to hear the first phoneme in most words, but she was unable to segment phonemes in the remainder of the word. For example, for the word *do*, she selected two blocks and said, "/d/-do"; similarly, for the word *pen*, she selected two blocks and said, "/p/-pen."

Overall, Jillian demonstrated that she was at the emergent stage of learning to read and that she had not yet figured out how oral and written language are connected either at the macro- or microlevels. Because of her strength in listening comprehension, she was often able to remember the texts of predictable books and hence did not need to rely on print to the same extent as most readers. She was somewhat more successful in making the links when writing than when reading, although even when writing she was just beginning to understand the connections between oral and written language. At the end of grade 1, Jillian was coded as eligible for special class placement.

Contrary to expectations, Jillian made rapid progress in learning to read in grade 2 in a regular class. Although we cannot be certain what led to this progress, one significant change in her instructional program involved writing. Rather than allowing Jillian to write only those words she knew how to spell as she had done in grade 1, her grade 2 teacher insisted that she write in a journal every day using invented spellings to encode her ideas. Jillian's journal reflected increasing understanding across the fall term of how to map letters onto sounds, and by the end of the year her teacher reported that she was reading at a level commensurate with expectations for her grade placement. It appears that once Jillian made the connection between speech and letters at the microlevel, she made rapid progress in learning to read.

Willie

After one month in grade 2, Willie performed at a level consistent with age and grade-level expectations on both listening comprehension and visual perceptual processing. He was able to give appropriate sound associations for all except five letters and indicated by his performance on the phoneme segmentation task on the TALS that he was generally able to hear separate phonemes in words. However, he was still at an emergent stage of literacy development. Although he made a few attempts to rely on his knowledge of letter sounds to decode words, he was frequently unsuccessful in doing so; for example, he responded, "said-/w/" for the word saw. In his writing sample he again made some use of letter-sound knowledge, but most correctly spelled words were either his friends' names or words in his sight vocabulary such as *play*, *my*, and *name*. He was somewhat more successful in using letter-sound knowledge on the Sentence Dictation task where he was able to represent 29 of 37 phonemes in words heard.

Although Willie was able to identify words adequately in isolation at the preprimer level on lists, both his accuracy and comprehension fell below acceptable levels on passages at this same level. Miscues frequently did not make sense in relation to passage context, and Willie included a considerable amount of erroneous and extraneous information in retellings of passages read. Only when reading familiar, highly predictable passages and on his language experience story were Willie's miscues meaningful in relation to passage context. When asked to write a story, his passage did convey a message, but he restricted word choice to those in his limited sight vocabulary. Correct spelling appeared to be more important to Willie than meaning.

Whereas Jillian's profile had been quite straightforward, Willie's was more complex. Although he demonstrated adequate phoneme segmentation on the TALS, he made few attempts to rely on knowledge of letter sounds when writing. Willie did make some attempt to use this knowledge when decoding words in isolation, but frequently had difficulty in systematically mapping sounds onto letters. In other words, he had developed phonemic awareness, but was only beginning to map letters onto sounds and sounds onto letters. These results were somewhat surprising in light of the findings in the literature that phoneme segmentation is generally an outcome of learning to read. The explanation was that Willie had been taught in an explicit and systematic way how to segment words into phonemes by a speech language pathologist. This

had not led to success in learning to read because *by itself* this instruction was insufficient to help him understand the connection between oral and written language at either the micro- or macrolevels. Although we recommended that Willie's instructional program be adapted to focus on connections, few adaptations were made, and by the end of grade 2, he had still made little progress in learning to read.

David

When we first met David he was nearly a nonreader. In October of his sixth year in school, his performance fell below the criteria for adequacy on both word lists and passages on the preprimer level on the QRI II, and he refused to attempt to write anything. On the listening comprehension test he performed at a level commensurate with grade level expectations, and on the VMI demonstrated real strength, scoring at the 91st percentile. He clearly had language and world knowledge as well as visual processing strengths to bring to reading and writing tasks.

David demonstrated knowledge of the names of all of the letters in the alphabet and of sounds for 22 letters. Although his word identification was inadequate even at the preprimer level on the QRI II, he was able to spell and correctly identify 23 words on the Writing Vocabulary task on Clay's Diagnostic Survey. These words were both spelled and identified primarily through reliance on memory; on the QRI II word lists David was able to identify only one word outside of his sight vocabulary. Although he refused to write anything on his own, he was able to represent 31 of the 37 phonemes in words on the Sentence Dictation task, suggesting that he was able to segment phonemes in words. This was confirmed on the LAC where he obtained the recommended minimum score for a child in the last half of grade 2, below expectations for his age, but well above his reading and writing levels.

When reading predictable and familiar material, David demonstrated understanding that reading is a meaningful activity. Miscues tended to reflect use of both print cues and of passage meaning on these materials. However, when asked to read more difficult or less familiar materials, David tended to abandon these strategies and instead rely on initial letter cues. It would appear that David did understand the connection between oral and written language at the macrolevel although his ability to rely on this understanding appeared to depend on task difficulty.

Whereas Jillian relied too heavily on her strengths in listening comprehension, David appeared to be overrelying on his strengths in visual processing. One day when he was discussing reading with one of his teachers, he expressed surprise when she said that she and his classmates sometimes had to break words into parts to identify them. Although he knew most letter sounds and was able to segment speech into phonemes and map letters onto phonemes on the Sentence Dictation task, he had developed little understanding of the relevance of the alphabetic principle to "real" reading or writing.

Discussion

These three clinical case studies are consistent with the literature showing that the relationship between phonemic awareness and reading is neither simple nor direct. Two of the three children demonstrated that they were able to

segment phonemes in words and could associate sounds with most letters, but had still made minimal progress in learning to read. It is possible that the relationship between phonemic awareness and reading is different for children who experience reading difficulties than for other children. However, on the basis of our analysis of the literature, it is more likely that the construct of connections (Bradley, 1988) or linkages (Hatcher et al., 1994) provides an explanatory bridge between phonemic awareness and reading for most children. This construct appears to be a moderator variable in the sense indicated by Wagner (1988). Acknowledging the complexity of the reading process, he suggested that moderator variables might “ultimately play a role in shaping a theoretical account of causal relations between the development of phonological processing abilities and the acquisition of reading skills” (p. 275).

The construct of connections had greater utility in interpreting data for the three children described in this article than did phonological awareness per se. Neither Willie nor Jillian had developed a clear understanding that “marks on the page represent the words they hear and use in speech” (Bradley, 1988, p. 3). Jillian relied heavily on her memory of repetitive patterns and picture cues to reconstruct texts when reading, whereas Willie was unable to make systematic use of any strategies. In other words, neither had established the connection between oral and written language at the macrolevel. In contrast, David knew that print information is implicated in the reading process.

At the microlevel Jillian demonstrated minimal understanding of the connection between speech and print (Bradley, 1988). On the Sentence Dictation task she was able to use letters to represent phonemes only in the initial word position, and on a phoneme segmentation task she was able to segment only the first phoneme (onset). Awareness of onsets has been described by Stahl and Murray (1994) as a low level of phonemic awareness. The case was quite different for David and Willie. They demonstrated relatively well-developed phoneme segmentation and experienced considerably more success than Jillian in mapping letters onto sounds on the Sentence Dictation task. In other words, David and Willie performed well on precisely those measures of phonological awareness that have been found to be most highly related to learning to read (Høien et al., 1995; Nation & Hulme, 1997; Torgesen et al., 1994), and yet neither had made any appreciable progress in acquiring reading skills. In Willie’s case this appeared to be a result of his limited understanding of the relationship between oral and written language at the macrolevel. For David his conviction that reading and writing are essentially word memory tasks negatively affected his ability to exploit the alphabetic nature of the English language. Although he understood connections at both the macro- and microlevels, he had still made limited progress in learning to read. As hypothesized for phonological awareness (Ball, 1993; Tunmer et al., 1988), understanding of connections appears to be *necessary* but not *sufficient* for learning to read or write.

The relatively high scores obtained by Willie and David on measures of phonemic awareness are inconsistent with research that has demonstrated a reciprocal relationship between phoneme segmentation and learning to read (Bentin & Leshem, 1993; Perfetti et al., 1987; Wagner, 1988). They are also inconsistent with findings that phoneme segmentation is more likely to be a result of, than a prerequisite for, learning to read (Byrne & Fielding-Barnsley,

1993; Høien et al., 1995). This anomaly can be accounted for in Willie's case by a specific training program in phonemic awareness. Although this program led to increased phonemic awareness, it had minimal impact on his reading achievement. It is hypothesized that this was the result of the failure of the program to link phonemic awareness training with printed letters and words. As concluded by Wagner et al. (1993), training in phonological awareness *by itself* does not lead to success in learning to read. It is the combination of that training with a focus on the relationship between sound segments and letters that leads to reading success (Bradley, 1988; Bradley & Bryant, 1983; Hatcher et al., 1994). Jillian's progress in learning to read in grade 2 is consistent with this hypothesis.

Although Jillian had greater difficulty than Willie in phoneme segmentation at the time of assessment, one change in her instructional program in grade 2 was increased focus on writing for a purpose using invented spelling. The emphasis was on connections rather than on phoneme segmentation *per se*, and although there is no way to be certain that this program was directly responsible for Jillian's reading progress, she did learn to read to a level consistent with grade expectations by the end of grade 2. This raises a question about the nature of the relationship between invented spelling and reading acquisition. Does invented spelling develop phonemic awareness (Torgesen & Davis, 1996) and understanding of the alphabetic principle (Adams, 1990), or conversely, does phonemic training develop knowledge of the alphabetic principle that in turn fosters invented spelling (Eldredge & Baird, 1996)? Regardless of the direction of this relationship, connections at the microlevel might best be conceptualized as knowledge of the alphabetic principle. Children need to understand that letters in written words stand for sounds in spoken words and to be able to map sounds onto letters and letters onto sounds (Muter et al., 1997; Stahl, Duffy-Hester, & Stahl, 1998; Stahl & Murray, 1994; Tangel & Blachman, 1995).

Overall, both our analysis of the literature and our three case studies suggest that children need to develop an understanding of the connections between oral and written language in order to learn to read. However, no definitive generalizations can be drawn from this type of study, and further research is needed to explore the nature of the relationship between connections and learning to read, the developmental sequence of connections at the micro- and macrolevels, and the impact of different program models on the development of connections.

Implications

Theoretically, it might be tempting to propose connections as *the* explanation of reading difficulties. However, although this construct captures part of the complexity of learning to read, it still leaves considerable variance in reading achievement unexplained. Jillian had not made the linkage between oral and written language at either the macro- or microlevels. Neither had Willie, although he was attempting to link sounds and letters when dealing with isolated words. David clearly understood the connection between oral and written language at the macrolevel and was able to map letters to sounds on a Sentence Dictation task. That he did not make this connection when reading

and writing was more a reflection of his understanding of reading and writing as primarily visual tasks than his inability to map sounds onto letters or letters onto sounds. He was what Share and Stanovich (1995) refer to as a “logographic” reader. They liken learning to read logographically to learning slabs of the telephone directory where each string must be painstakingly committed to memory.

The construct of connections also has implications for instruction. Phonemic awareness as defined by most researchers is essentially an auditory phenomenon—being able to hear sound units in words. Hence phonemic awareness programs often focus exclusively on hearing sounds with no attention to the connection of these sounds with letters. Research clearly shows that programs are more effective when these connections are made explicit. For the three children described in this study, understanding how to map sounds onto letters was essential to learning to read.

Phonics programs focus on the relationships between letters and sounds, but this often involves work with letters in isolation. In many phonics programs children do not learn how to map letters onto sounds or sounds onto letters. Indeed, both Willie and David were able to associate sounds to most letters, but made minimal use of this knowledge to spell or identify unfamiliar words.

Although phonemic awareness and phonics are important to develop connections at the microlevel, these programs do little to develop connections at the macrolevel. Understanding that written words represent words in oral language is crucial for children to learn to read and write. Programs that provide instruction in the context of “real” reading and writing are necessary to develop these macrolevel connections. This is essentially the type of program we recommended for the three children in this study.

For both Jillian and Willie we recommended admission into the Reading Recovery program (Clay, 1993b) and when that was not possible, suggested implementation of some of the instructional strategies included in the program. For example, we recommended use of the sentence writing component in which children generate a sentence, writing all the words they know. The teacher then selects words to use for a “hearing sounds in words” activity using boxes to help children hear separate sounds in words. After the sentence has been written and read by the child, it is cut into separate words for the child to rearrange. This activity is ideal for developing connections at both the micro- and macrolevels while at the same time working with the child’s own language. We also recommended use of the language experience approach with a variety of activities focused on connections, for example, pointing during reading, rearranging cut-up sentences, and finding words beginning with the same sound.

Overall, this research supports the need for programs that draw on the work of both psychologists, who have focused on phonemic awareness, and whole language enthusiasts, who have immersed children in “real” reading and writing experiences. With the current backlash against whole language, however, there is a danger that programs will focus too heavily on the code and not enough on meaning. What we need are balanced literacy programs (Frep-

pon & Dahl, 1998) to help children learn how written language works at both the macro- and microlevels.

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