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Over the past two decades, but particularly in the last 10 years, there has been a burgeoning consensus about the critical importance of phonemic awareness to beginning reading success, and about its role in specific reading disability or dyslexia (Hatcher, Hulme, & Ellis, 1994; National Reading Panel, 2000; Share, 1995; Stanovich, 1986). Various terms have been employed as synonyms, such as phonological awareness, acoustic awareness, phonetic awareness, auditory analysis, sound categorisation, phonemic segmentation, phonological sensitivity, and phonemic analysis. Some authors such as Goswami and Bryant (1990) reserve the term phonemic awareness to imply awareness of individual phonemes; whereas, phonological awareness is a more global term that includes the earlier stages, such as rhyme and syllable awareness.

There has been much discussion about how best to define phonemic awareness. Ball and Blachman (1991) refer to the ability to recognise that a spoken word consists of a sequence of individual sounds. Stanovich (1986) initially defined it as the "conscious access to the phonemic level of the speech stream and some ability to cognitively manipulate representations at this level" (p. 362). Later, he suggested (1992, 1993) that the terms "conscious" and "awareness" themselves have no acceptable definitions, and he subsequently recommended phonological sensitivity as a generic term to encompass a continuum from shallow to deep sensitivity. This term acknowledges the wide range of tasks used to assess levels of sensitivity. Read (1991) too was concerned about the term awareness, but because it implies a dichotomy rather than a continuum. He preferred the expression access to phonological structure. As these alternatives have not gained currency, phonemic awareness will continue to be used here, acknowledging that the definition has limitations.

What is clear is that phonemic awareness concerns the structure of words rather than their meaning. To understand the construction of our written code, readers need to be able to reflect upon the spelling-to-sound correspondences. To understand that the written word is composed of graphemes that correspond to phonemes (the alphabetic principle), beginning readers must first have some understanding that words are composed of sounds (phonemic awareness) rather than their conceiving of each word as a single indivisible sound stream. This awareness appears not to be a discrete state, but rather a sequence of development ranging from simple to complex, or as Stanovich (1992, 1993b) would prefer - from shallow to deep.

Although some authors suggest slight variations in the sequence (Ehri et al., 2001), the stages of phonological development toward deep phonemic awareness can be delineated as below.

Recognition that sentences are made up of words.

Recognition that words can rhyme - then production thereof

Recognition that words can be broken down into syllables - then production thereof

Recognition that words can be broken down into onsets and rimes - then production thereof

Recognition that words can begin with the same sound - then production of such words

Recognition that words can end with the same sound -then production of such words

Recognition that words can have the same medial sound(s) -then production of such words

Recognition that words can be broken down into individual phonemes - then production thereof

Recognition that sounds can be deleted from words to make new words - then production thereof

Ability to blend sounds to make words

Ability to segment words into constituent sounds

Phonemic awareness is more complex than auditory discrimination, which is the ability to perceive, for example, that cat and mat are different speech productions, or words. To be able to describe how they are similar but different, however, implies some level of phonemic awareness. Auditory discrimination entails hearing a difference; whereas, phonemic awareness entails a level of analysis of the constituent sounds. Young children are not normally called upon to consider words at a level other than their meaning, although experience with rhymes may be the first indication for children that they can play with the structure of words.

Prior to these finer intra-word discriminations, children need to appreciate that spoken sentences (a rather continuous stream of sound without clear pauses) are separable into discrete words (Lieberman & Liberman, 1990). Adams (1990) and Blachman (1984) warn that word consciousness (the awareness that spoken language is composed of words) should not be assumed even in children with several years schooling, although they report evidence that it may be taught easily enough, even at a pre-school level. That school age children can lack such fundamental knowledge may be difficult for adults to accept, but it highlights the need in education to assume little, and assess pre-requisite skills carefully. Their warning also challenges the view, held by some Whole Language advocates (Goodman, 1979, 1986; Smith, 1975, 1992), that speaking and reading involve equivalent "natural" processes for all children. The implications of the Whole Language view are that the same environmental conditions that occur during the development of speech are those best provided for children learning to read. Liberman and Liberman (1990) among others (Gough & Hillinger, 1980; Hirsch, 2001; Liberman, 1997) have provided a forceful rebuttal of this equivalence perspective.

Having discovered that sentences are composed of words, the next logical unit of analysis is intra-word, at the syllable level. However, syllables can be represented by any number of letters from one to eight. The word understand has three syllables, each of a different number of letters. Un has two, der has three, and stand has five letters. This variability makes the syllable unit of limited value in analysing the reading task (Bradley, 1990), and the catch is that one needs to have awareness at the level of the phoneme in order to determine where best to decide the syllable junctions. So, syllable awareness may have limited value as an early curriculum focus.

Rhyme and Alliteration

The recognition of rhyme may be the entry point to phonemic awareness development for many children (Bryant, 1990). To be aware that words can have a similar end-sound implies a critical step in metalinguistic understanding - that of ignoring the meaning of a word in order to attend to its internal structure. This leads to a new classification system, one in which words can be classified according to end-sound rather than meaning. Bryant (1990) points to the considerable amount of evidence indicating that children as young as three or four years can make judgments such as when words rhyme, and when they begin with the same sound (alliteration). He argues that sensitivity to rhyme makes both a direct and indirect contribution to reading. Directly, it helps students appreciate that words that share common sounds usually also share common letter sequences. The child's subsequent sensitivity to common letter sequences then makes a significant contribution to reading strategy development. Indirectly, the recognition of rhyme promotes the refining of word analysis from larger intra-word segments (such as rhyme) to analysis at the level of the phoneme (the critical requirement for reading).

Studies by Bryant, Bradley, McLean, and Crossland (1989) showed a very strong relationship between rhyming ability at age three years and performance at reading and spelling three years later. A number of such studies have reinforced the value of such early exposure to rhyming games (e.g., Kirtley, Bryant, Maclean, & Bradley, 1989). That rhyming and phoneme awareness are related (through their common characteristic of requiring listening for sound similarities and differences) was supported by an interesting finding of a study by Lamb and Gregory (1993). They showed that children who were capable of good discrimination of musical pitch also scored highly on tests of phonemic awareness. Since pitch change is an important source of information in the speech signal (Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967), it may be that sensitivity to small frequency changes, such as is involved in phoneme recognition, is an important aspect of successful initial reading. Lamb and Gregory (1993) raise the interesting possibility that musical training may represent one of those pre-reading, home-based experiences that contribute to the marked individual differences in phonemic awareness with which children commence school.

Just how valuable may be an instructional emphasis on rhyme has been questioned in several studies (Wood, 2000). Whereas Bryant (1990) asserted that rhyme makes a direct contribution to reading, others see rhyme subsumed under phonemic awareness, so that rhyme awareness is only a phonological step on the way towards phoneme awareness – a later state that certainly does influence reading development. Perhaps the ultimate role for rhyme will be as a predictor of progress towards reading success, as it has been shown to be a strong early predictor of reading ability in longitudinal studies (Bradley & Bryant, 1983; Bryant et al., 1989). This is not to suggest that rhyming activities are to be avoided, as they are enjoyable literacy activities. Engaging in rhyming activities with stories may also have strong motivational influences on children's attitudes to books and reading.

Onsets & Rimes

Treiman (1991) has suggested a further stage in the development of phoneme awareness - the intra-syllabic units of onset and rime. The onset of a syllable is its initial consonant(s), and the rime is its vowel and any subsequent consonants in the syllable. Thus, in the syllables sip-slip, the onsets are s and sl, and the common rime is ip. Treiman's research has argued for a stage between syllable awareness and phoneme awareness in which children are much more sensitive to the onset-rime distinction than the phoneme distinction. It has been asserted that this research holds promise for programs of educational intervention in reading disability because of the greater regularity of onset-rimes over individual letters (Felton, 1993). Thus, rime phonograms such as ing, ight, ain have much more regularity than the letters that form them. Knowing that strain and drain rhyme, may allow for reading main and brain by analogy.

This apparently generative strategy has led some researchers (Bowey, Cain, & Ryan, 1992; Hulme & Snowling, 1992) to suggest that an emphasis on onset-rime may be an especially valuable approach to teaching students with dyslexia, as they tend to have relatively weak phonological skills. Further, Bowey and Francis (1991) consider onset and rime the most effective focus for phonological activities intended to promote beginning reading and spelling for all children. They note that since most onsets in English are single consonants, an early emphasis on the intra-syllabic onset/rime distinction in the study of word structure is likely to hasten the development of awareness at the more difficult phoneme level. Treiman (1991) has argued that the onset/rime division is a natural one. Bradley (1990) agrees, and considers that it is because rhymes correspond to rimes that most children develop such facility with them at a relatively early age. The awareness of these larger sublexical skills are viewed by Bruck (1992), Goswami and Bryant (1990), and by Tunmer and Hoover (1993) as prerequisites to initial reading acquisition, their difficulty level lying between that of syllable awareness and phoneme awareness (Bowey et al., 1992; Bowey & Francis, 1991; Bruck & Treiman, 1990; Kirtley et al., 1989). Spector (1995) perceives onset/rime as a potentially useful stage in the development of oral segmentation skills. She recommends the strategy of breaking such words into onset/rime

as an intermediate step towards phonemic segmentation for children who have difficulty in segmenting complex syllables.

Thus, there may be a typical developmental sequence of phonological awareness. It begins with awareness of words as a unit of analysis; then proceeds to the awareness that words can share certain ending properties that we call rhyme, to an awareness that words can be decomposed into syllables, then (possibly though not definitely) more finely into sub-syllabic units called onsets and rimes, to beginning, final, and medial properties, and then (and most importantly for reading) into awareness of individual phonemes, the smallest unit of sound analysis. A further developmental sequence involves the movement from a recognition of such properties to a capacity to produce examples of them. Thus, at one level one can nominate which pairs of words rhyme when presented orally; at a higher level one can produce examples. It should be noted that the description of the process as developmental does not imply spontaneous development – for many students it needs to be taught (Lindamood, 1994).

The issue of putting ages to stages is problematic partly because of the great variation in the experience of children. Some children play with word structure for several years before school, some have had no experience. The degree of emphasis placed on phonemic awareness in preschool and school adds additional variation, whilst the quality and explicitness of the instruction also make significant contributions (National Reading Panel, 2000). There appears also to be genetic predisposition toward ease or difficulty of acquisition among children (Olson, Wise, Conners, Rack, & Fulker, 1989; Rack, Hulme, & Snowling, 1993).

Thus, these stages may be better considered as markers on the road to skilled reading, rather than as a natural developmental sequence, and as susceptible to environmental manipulation, such as early experiences and instruction. Similarly, the rate with which students progress through the stages may vary, and some stages may even appear to be skipped.

If the stages represent a typical sequence, then approaches to teaching might benefit from taking it into account. There may be some theoretical justification for an interest in onset-rime, but it requires support from intervention research before becoming a suitable component of the curriculum. So, is an emphasis on teaching students to recognise onset-rime distinctions (rather than at the phoneme level) more productive in initial (and, perhaps, remedial) reading instruction than is teaching directly at the phoneme level. A computer program developed by Wise, Olson and Treiman (1990) focussed on onset-rimes in teaching beginning reading skills to normally-developing readers and children with dyslexia. In this and the Olson and Wise (1992) studies, the authors noted an advantage for the children taught in this manner over an approach that segmented words after the vowel. The effect however was ephemeral, and least pronounced in the more disabled students. Ehri and Robbins (1992) findings were similar in that the poorer readers did not use sub-syllabic units larger than the grapheme. This led them to suggest that the onset-rime distinction is really the province of the more skilled reader, and hence not a candidate for instruction prior to that at the phoneme level.

Goswami's research (Goswami & Bryant, 1990) had suggested that, for young children, words that share rimes are more readily decoded by analogy than are words that share onsets or vowels. Bruck and Treiman (1992) provided some support for that view, but as in the Wise et al. study, the measured advantage was lost within a day. In fact, a day later the rime group demonstrated poorer performance than the group taught onsets, and poorer than the group for which vowel analogy was emphasised.

A number of researchers now have questioned whether an onset-rime emphasis has any useful role to play in beginning reading instruction. Nation and Hulme (1997) express concern that such tasks are not predictive of reading and spelling success. McMillan (2002) argues that it is alphabet knowledge rather than rhyming ability that underpins any causal link to reading ability. Further, Nation, Allen, and Hulme (2001) have questioned the benefit of emphasising analogy as a worthwhile early strategy for reading unfamiliar words. The intent of analogy reading is to allow children to decode an unfamiliar printed word by observing that its spelling is

similar to that of a known word. In their study, however, children were not able to see such orthographic similarities at all, leading to a conclusion that the analogy technique is only able to be employed by those readers who already have attained more advanced phonemic awareness (Wood, 2000).

Thus, the results of research suggest caution regarding calls for introducing an initial emphasis on onset-rime distinctions for beginning readers. It would be judicious to ensure that beginners (and disabled readers) have, or develop, a grounding in grapheme-phoneme relationships, either before (or simultaneous with), such onset-rime emphasis (Munro, 1995). It is still unclear whether the generally accepted developmental sequence necessarily provides the optimum guidance for instruction. This question should be answered empirically, and a number of researchers have attempted more fine-grained analysis to assist in providing clearer instructional direction. Wise and Olson (1995) reported a study indicating that adequate phonemic awareness skill was necessary if children were to benefit from onset-rime instruction. When readers with dyslexia were provided with phonemic awareness training through Auditory Discrimination in Depth (Lindamood & Lindamood, 1969) simultaneously with onset-rime computer-based training, reading results were markedly improved by this addition of instruction at the level of the phoneme. The ADD program emphasises phonemic awareness through a variety of oral/aural tasks, and by teaching students awareness of kinaesthetic cues (mouth, tongue, lip position, breath usage).

Nation and Hulme (1997) and Hulme et al. (2002) also argue that it is likely to be more profitable to emphasise phoneme awareness even from the beginning reading stages. As is often the case, when several options are available and the evidence is not adequate to clearly support one or the other, the emphasis is most judiciously placed on the alternative that is most closely related to the reading process. Thus, studies up to this stage have raised more questions than answers about the instructional usefulness of onset-rime as a means of gently approaching the difficult phoneme concept.

Phoneme Awareness

Awareness at the level of the phoneme has particular significance for the acquisition of reading because of its role in the development of the alphabetic principle - that the written word is simply a means of codifying the sound properties of the spoken word. In order to decode the written word, the child needs to appreciate the logic of the writing system and, as a prerequisite, the logic of oral word production.

There are two requirements of beginning reading for which phonemic awareness becomes immediately relevant: phonemic analysis (segmentation) and phonemic synthesis (blending). For most children, the ability to produce the finer discrimination of phonemes begins in about Year I of their schooling (Ball, 1993). Individual phonemes are more difficult to specify because their acoustic values vary with the phonemes that precede and follow them in a word (a phenomenon called co-articulation); whereas, syllables have relatively constant values in a word and hence should be more readily recognised. The fact that consonants are "folded" into vowels can be understood by noting the different tongue positions for the beginning /d/ sound when it is followed by /oo/ and by /i/.

In most children the ability to synthesise (blend) sounds into words occurs earlier than analytic (segmentation) skills (Bryen & Gerber, 1987; Caravolas & Bruck, 1993; Solomons, 1992; Torgesen et al., 1992; Yopp, 1992). Thus, it is easier to respond with the word cat when presented with the sounds c - at or c-a-t, than it is to supply c-a-t when asked to tell what sounds you hear in cat.

Tasks used to assess beginning (or shallow) phonemic awareness tend to emphasise sensitivity to rhyme and alliteration; for example, finding a word that begins or ends with the same sound as the stimulus word. A more complex task would involve the manipulation, or separation of sounds in a word, for example, What is the first sound you hear in cat? What word is left if you remove the /t/ from "stand"? (Torgesen et al., 1994). Other

tasks used for assessment may include counting the sounds in words, adding, deleting or manipulating sounds, and categorising sounds at the beginning, middle, or end of words.

There are now numerous normed and unnormed tests available. Some are available from publishers, such as the Comprehensive Test of Phonological Processing (CTOPP) (Wagner, Torgesen, & Rashotte, 1999) whilst some are free from the Net, such as Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (University of Oregon, 2002a) or the Abecedarian Reading Assessment (Wren & Watts, 2002). A useful resource in making decisions about which test to employ is an extensive and thorough review by Kame'enui (2002).

As indicated above, deeper levels of awareness (i.e., at the phoneme level) tend to develop during first grade upon exposure to reading instruction. Some have argued then that phonemic awareness may be a consequence of learning to read rather than a causal factor in its development (Morais et al., 1987; Morais, 1991). There is increasing consensus that the data are best explained by considering the relationship between phonemic awareness and reading development as a reciprocal one (Stanovich, 1992). A threshold phonemic awareness level may be necessary (though not sufficient) for beginning reading development, but as reading develops - increasingly the student becomes more sensitive and better able to manipulate sounds at the phoneme level.

The acquisition of phonemic awareness is not guaranteed simply through maturation; in fact, about a third of students require varying degrees of assistance to promote its development (Adams, 1990). So, what do you teach? Do you purchase one of the many available texts such as the classroom curriculum by Adams, Foorman, Lundberg, and Beeler (1998), and work your way through the oral activities or do you contrive your own? Is the developmental sequence important? Should you gently guide students through the sequence, using only activities related to that level, or can you provide students with a richer range of activities at any one time? Should you focus directly on phoneme awareness (rather than on less sophisticated phonological processes like rhymes) from the beginning (Foorman et al., 2003)? Should you include letters (graphemes) in your otherwise oral curriculum (Byrne & Fielding-Barnsley, 1993; National Reading Panel, 2000)? If so, when? Perhaps you should bypass the oral phonemic awareness activities, and move directly to the phonic processes of segmenting and blending (using letters) because they are activities more directly salient to reading? Maybe phonemic awareness is best considered as a consequence of reading development? And what about the student who is resistant to the activity-based curriculum, perhaps with other phonological problems such as slow naming speed (Al Otaiba & Fuchs, 2002)? Do you introduce more formal direct instruction procedures over an extended period of time (Lyon, 2001; Wright & Jacobs, 2003)? There are many questions not entirely resolved, but for a detailed and helpful resource the University of Oregon (2002b) site Big Ideas in Beginning Reading should be examined.

The National Reading Panel Report (2000) indicated that large effect sizes were possible when instruction was directed systematically and explicitly at one or two types of phonemic awareness activities provided to small groups, and involved associating phonemes with letters (such as segmenting and blending). As to who might require more intensive and extended assistance, Torgesen (1998) recommends an identification procedure involving administration of a test of knowledge of letter names or sounds and a measure of phonemic awareness. Students who do not do well on these tests are likely to struggle with reading unless additional support is provided. The Panel's view was that this focus was so important that all students should have the opportunity to benefit from phonemic awareness activities in their first year of school. Those studies that provided activities for less than a half hour per day to a total of about 20 hours were effective and efficient.

The issue of when to introduce phonemic awareness activities/instruction has also been investigated. Byrne, Fielding-Barnsley, and Ashley (2000) report that it is not only the attainment of phonemic awareness that is important in learning to read, but also its speed of acquisition. In a longitudinal study, they noted that poor readers in grade 5 were those who, though they eventually achieved reasonable levels of phonemic awareness, were slow to grasp it. Perhaps there is a window of opportunity when phonological processes can become the driving force behind initial reading development. If reading development is not phonologically informed then

students may adopt less viable strategies, such as guessing and memorisation of shapes. If that occurs, phonemic awareness may subsequently develop, but will not necessarily be employed by the student whose strategies have become entrenched. Perhaps this is the reason why it can take four times as much intervention to improve a child's reading skills if help is delayed until grade 4 than if it is begun in the first year of school (Hall & Moats, 1999).

The role of fluency in promoting reading comprehension was brought to the attention of many because of its status in the report of the National Reading Panel (2000). Less well known is an increasing interest in promoting fluency across a range of curriculum areas (Binder, Haughton, & Bateman, 2002; Lindsley, 1996). Binder et al. suggest that while mastery is important, real expertise in phonemic awareness skills is not present until students can effortlessly and quickly perform the tasks. Thus, they suggest students should aim to be able to blend sounds to form words at a minimum of 10 per minute, segment words into sounds by moving colored blocks to indicate the sounds at a rate of at least 40 per minute, and construct new words through substituting one phoneme for another at a minimum rate of 15 per minute. This suggestion certainly offers another dimension for teachers wishing to ensure all their students develop a strong phonological basis for literacy.

Of course, a classroom emphasis on phonological processes assumes that teachers already have the necessary deep understanding of phonemic awareness required to teach it effectively. This assumption may not be warranted, as research has indicated that many teachers do not themselves have a solid foundation in their own phonemic awareness, and few have received the level of training that produces the supra-skill level important in awakening children's fine-grained sensitivity to the sound structure of words (Lindamood, 1994; Mather, Bos, & Babur, 2001; Moats, 1994). For example, in one study (Mather et al.) only 2% of teachers-in-training and 19% of working teachers knew that the word box is constructed from four speech sounds. It is not easy for adults to ignore entrenched spelling patterns when confronted with phonemic tasks (Labov, 2003). Students whose teacher themselves have phonological deficiencies display lower levels of reading skills as a consequence (Lindamood, 1994). In many teacher-training facilities, pre-service instruction in these areas is not among the priorities in developing a teacher education curriculum on literacy. Hence, many teachers are likely to need retraining if the results of phonemic awareness research into beginning reading are to be put into practice successfully.

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