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# Phonological Awareness and Written Word Decoding

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Research has shown that explicit awareness of the speech sound structure of language—that is, phonological awareness—is related to early reading development. The purpose of this study was to assess the effectiveness of four measures of phonological awareness in predicting first grade decoding ability. Measures of phonological awareness at the beginning of first grade were found to be correlated with measures of decoding ability at the end of first grade. Correlations between decoding and phonological awareness were generally much higher than those obtained for measures of decoding and verbal and nonverbal intelligence. Discriminant analyses procedures indicated that several tasks identified good and poor decoders, with approximately 80% to 90% accuracy. The clinical implications of these data for the speech-language pathologist are discussed.

**KEY WORDS: phonological awareness, reading, decoding, language, screening**

Speech-language pathologists are playing a more active role in identifying and intervening in reading disabilities. A specific area in which speech-language pathologists may work effectively is the assessment of language abilities related to reading (Catts & Kamhi, 1986). A prerequisite for the speech-language pathologist in this area is a clear understanding of the relationship between reading acquisition and language abilities.

Reading is a complex behavior requiring acquisition of numerous cognitive and linguistic abilities. Recently, views concerning how these abilities are acquired have been strongly contested in the educational and psychological literature (Adams, 1990; Carbo, 1988; Edelsky, 1990; Goodman, 1967; McKenna, Robinson, & Miller, 1990; Vellutino & Denckla, 1991). Juel (1991) has encapsulated two opposing views of reading acquisition. One view suggests a *quantitative* growth in language and world knowledge as the primary factor that distinguishes skilled and beginning readers. It is argued that reading, after all, is the search for meaning. The search is best accomplished by using knowledge about language and the world to recognize and understand printed words. According to this view, the primary advantage of skilled readers is their increased knowledge of the world and language. It is argued that the skilled reader utilizes syntactic and semantic information and world knowledge to form hypotheses about the content of text, with limited reliance on word level or orthographic knowledge (Goodman, 1967; Goodman & Goodman, 1979). Reading development is thought to parallel language development, being a natural process that emerges because of the need to communicate (Juel, 1991).

The second view of reading is based on the belief that there are *qualitative* differences in the reading processes between beginning and experienced readers. Reading is seen as involving a variety of cognitive processes that vary in their importance as readers become more sophisticated. For example, it is argued that in the early stages of reading acquisition, advances are primarily the result of increases in orthographic knowledge, while in the later stages, improvements stem from gains in linguistic and world knowledge (Stanovich, 1988; Perfetti, 1985).

At present, a large body of converging research supports the qualitative view of reading development (Hoover & Gough, 1990; Juel, Griffith, & Gough, 1986; Vellutino & Denckla, 1991). This work suggests that, whereas reading is a complex process, it can be conceptualized as consisting of two primary components: decoding (i.e., word recognition) and comprehension.

Decoding involves the use of orthographic knowledge to recognize printed words. Comprehension processes, on the other hand, make use of linguistic and world knowledge to understand the meaning of printed words. Comprehension, thus, is the ultimate goal of reading. Research indicates that varying degrees of decoding and comprehension account for a large proportion of the variance in reading ability in school-age children (Catts, 1993; Curtis, 1980; Gough & Tunmer, 1986; Hoover & Gough, 1990; Juel, Griffith, & Gough, 1986; Vellutino & Scanlon, 1991).

Research further indicates that developmental change in the relative contributions of decoding and comprehension processes causes variance in reading. This work consistently shows that in the early school grades, decoding or orthographic knowledge accounts for more variance in

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reading ability than does language and world knowledge. In the later elementary school grades, however, individual differences in semantic and syntactic knowledge (and world knowledge) explain considerably more variance than decoding processes (Vellutino & Denckla, 1991).

The above research has obvious implications for the speech-language pathologist in differentially diagnosing language-based reading disorders. An understanding of how reading develops and the components of language that influence the acquisition of reading is necessary for effective diagnosis of a language-based reading disorder. The purpose of the current study was to look at one piece of the complex puzzle of language-based reading disorders. The qualitative view of reading acquisition describes decoding skills as a major component needed to achieve competent reading comprehension in the early school grades. Because decoding is a significant influence on reading comprehension in the early grades, it is critical to identify abilities that influence the development of decoding. One such ability is that of phonological awareness.

Phonological awareness may be defined as awareness or sensitivity to the sound structure of the language (Hakes, 1982; Stanovich, 1988). Phonological awareness develops in children from a level of implicit knowledge of speech sound units, such as recognition of rhyme patterns to explicit knowledge, such as segmentation of words into syllabic and phonemic units (i.e., but, but-ter, but-ter-fly, c-a-t). It is further proposed that the awareness of speech sounds plays an important role in learning to decode printed words (Catts, 1991a; Juel, 1991; Vellutino & Scanlon, 1991). Decoding requires an understanding of the association between the sounds in words and the orthographic symbols that represent these sounds. Phonological awareness is essential to learning this association. Numerous studies have demonstrated that phonological awareness is related to decoding ability (Bradley & Bryant, 1985; Bryant, 1991; Catts, 1991a, 1991b, 1991c; Catts, 1993; Lundberg, Olofsson, & Wall, 1980; MacLean, Bryant, & Bradley, 1987; Mann & Liberman, 1984; Scarborough, 1991). Comparative studies between good and poor readers reveal a close link between phonological awareness and reading ability. Good readers exhibit phonological awareness, whereas poor readers have difficulty performing well on tasks of phonological awareness (Bradley & Bryant, 1978; Fox & Routh, 1983; Katz, 1986). While comparative studies reveal a strong relationship between phonological awareness and reading ability, these studies alone do not establish a causal relationship between the two variables.

Predictive studies, on the other hand, are more supportive of a causal relationship between phonological awareness and decoding ability. In these studies phonological awareness is measured before formal reading instruction. Measures of reading then are taken after formal reading instruction has commenced. Performance on these earlier measures of phonological awareness has been found predictive of later decoding ability (Bradley & Bryant, 1983, 1985; Bryant, Bradley, MacLean, & Crossland, 1989; Bryant, Maclean, & Bradley, 1990; Share, Jorm, Maclean, & Mathews, 1984). For example, Maclean, Bryant, and Bradley (1987) found a strong relationship between children's early knowledge of nursery rhymes and their later development of phonological awareness, and they found that phonological awareness predicts early decoding ability.

Finally, training studies provide the most compelling evidence of the causal link between phonological awareness and reading. These studies show that improvement of phonological awareness in a training program results in the enhancement of decoding skills (Alexander, Anderson, Heilman, Voeller, & Torgesen, 1991; Ball & Blachman, 1988; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1989; Cunningham, 1990; Lie, 1991; Lundberg, Frost, & Peterson, 1988; Williams, 1980; Yopp, 1992).

The above studies suggest that the early identification of children who exhibit limited phonological awareness is important in providing early intervention for children at risk of having reading problems. Various experimental tasks of phonological awareness have been utilized in research; however, it remains unclear which measures of phonological awareness will be the most effective in clinical practice for identifying children who lack sufficient phonological awareness.

Only rarely have various measures of phonological awareness been employed in the investigation of the relationship between early reading ability and phonological awareness (Stanovich, Cunningham, & Cramer, 1984; Yopp, 1988). The current investigation gathered preliminary data on the effectiveness of four measures of phonological awareness in distinguishing between children with limited and competent phonological awareness, and the effectiveness of these measures in predicting decoding abilities in the first grade.

## METHOD

### *Subjects*

The subjects were 54 children (27 girls and 27 boys) drawn from first grade classes in a middle-class elementary school in a midwestern city. All children were in the first grade, and none had repeated a grade. At the beginning of the study, the average age of the subjects was 80.2 months, with a standard deviation of 4.3 months. Visual and audiometric examination indicated no hearing or uncorrected visual problems. Cognitive abilities were assessed utilizing the Test of Non-Verbal Intelligence (TONI) (Brown, Sherbenou, & Johnsen, 1982) and the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981). The group mean performance on the TONI was 101 ($SD$ = 15.6), and on the PPVT-R it was 95.4 ($SD$ = 12.5).

### *Procedures and Materials*

Four tasks were utilized to assess students' phonological awareness. Each task was an adaptation of tasks previously shown to be related to later reading ability (Bradley &

Bryant, 1983; Catts, 1993; Catts, Swank, McIntosh, & Stewart, 1989; Rosner, 1971; Stanovich, Cunningham, & Cramer, 1984). The deletion task (Catts, 1993), which was adapted from Rosner (1971), required subjects to delete the initial syllable or phoneme from a word and say the remaining sound sequence (see Appendix for complete instructions and stimuli for this and other tasks). The categorization task (Bradley & Bryant, 1983) required the subjects to identify which one of four words, presented auditorially, began with a different sound than that of the other words. The blending task (Catts, 1993) required subjects to blend and pronounce auditorially presented syllables and phonemes. The segmentation task (Catts et al., 1989) required subjects to count the number of syllables in an auditorially presented word.

The four tasks of phonological awareness were chosen because they represented the various types of sound awareness tasks that have been employed in previous research. These tasks involved sound blending (blending) and sound segmentation (deletion, categorization, and segmentation). In addition, both explicit (deletion and segmentation) and implicit (categorization) segmentation measures were employed.

Reading measures included the word identification and word attack subtests from the Woodcock Reading Mastery Tests–Revised (Woodcock, 1987). These subtests required subjects to read a list of words or pseudowords presented in isolation; as such, they served as measures of written word recognition or decoding ability. In addition, the Wide Range Achievement Test: Spelling 1 (WRAT-S) (Jastak & Wilkinson, 1984) and an invented spelling task were administered. The latter used phonetically predictable nonsense words to measure written orthographic knowledge (see Appendix for invented spelling task).

The phonological awareness tasks were administered individually in a quiet, private treatment room by a speech-language pathologist during the first 6 weeks of the school year. Following administration of the phonological awareness tasks, subjects were given the PPVT-R and the TONI. Measures of decoding were administered individually in a quiet, private treatment room by a speech-language pathologist during the last 6 weeks of the first grade year. Thus, there were approximately 6 months between the administration of the predictive measures (i.e., phonological awareness measures) and that of the outcome measures (i.e., decoding/spelling measures).

## RESULTS

Table 1 displays the mean scores (and standard deviations) of the subjects on each of the four phonological awareness measures. These results indicated that the blending and segmentation tasks were the easiest of the four phonological awareness tasks. Subjects responded correctly on the blending task 70% of the time and on the segmentation task 58% of the time. Percentage correct for the deletion task was 37%, and for the categorization task it was 32%.

To examine the relationship between measures of phonological awareness and cognition/language and decoding, Pearson product moment correlation coefficients were calculated. As shown in Table 2, the deletion, categorization, and blending tasks were moderately related to decoding measures. These tasks also were found to be more highly correlated with decoding measures than were the TONI and PPVT-R. In other words, phonological awareness tasks, which take less than 5 minutes each to administer, were more strongly related to measures of decoding than were indices of nonverbal and verbal intelligence. Stepwise regression analyses were utilized to assess the relative contributions of the phonological awareness measures and the measures of nonverbal and verbal intelligence in predicting decoding abilities in first grade children. The deletion task accounted for a significant portion of the variance of word identification ($r^2$ = .34) and word attack tasks ($r^2$ = .31). After deletion was entered into the equation, no other variable made a significant contribution in explaining the variance for word identification and word attack. The deletion task also accounted for a significant amount of the variance in the WRAT-S task ($r^2$ = .29). After the deletion task was entered into the regression model for WRAT-S, only the categorization task accounted for additional variance. Together deletion and categorization tasks accounted for 35% of the WRAT-S variance. The deletion task alone also accounted for a large amount of the variance on the invented spelling task ($r^2$ = .45).

Another way of examining the relationship between the phonological awareness tasks and decoding measures is to examine the relative performance on these tasks of children with differing decoding abilities. To do this, a discriminant analysis was performed. For the purpose of this analysis, good and poor decoders were selected from among the 54 subjects on the basis of their combined performances on the word identification and word attack measures. Poor decoders were defined as those subjects whose average scores were at or below the 33rd percentile

TABLE 1. Means, standard deviations, range, and total number of items for the four measures of phonological awareness.

| | *Deletion* | *Categorization* | *Blending* | *Segmenting* |
|---|---|---|---|---|
| Mean | 8.7 | 7.4 | 16.4 | 14.9 |
| *SD* | 5.4 | 2.7 | 4.3 | 4.2 |
| Range | 0–19 | 1–12 | 5–21 | 6–21 |
| Total items | 21 | 12 | 23 | 21 |

TABLE 2. Pearson product moment correlations between phonological awareness, cognitive, and literacy measures.

| *Tasks* | *WDID* | *WDATT* | *WRAT/SPL* | *INVEN/SPL* |
|---|---|---|---|---|
| Deletion | .58 | .54 | .54 | .67 |
| Categorization | .48 | .47 | .54 | .49 |
| Blending | .48 | .54 | .51 | .53 |
| Segmenting | .37 | .27 | .41 | .38 |
| TONI | .30 | .31 | .31 | NS |
| PPVT-R | .45 | .39 | .42 | .41 |

Note: Literacy measures include WDID (word identification), WDATT (word attack), WRAT/SPL (spelling), and INVEN/SPL (invented spelling). Cognitive measures include the TONI and PPVT-R. NS = not significant.

(i.e., a standard score of 94 or less). Good decoders were defined as those subjects whose decoding scores were at or above the 66th percentile (i.e., a standard score of 106 or better). From these procedures, 21 poor and 21 good reading decoders were identified. Each of the phonological awareness measures used in the previous analyses was entered separately in the discriminant analysis. Table 3 presents the *F* values and the percentages of correct classification of decoding group membership for each of the variables, showing significant differences between the good and poor decoding groups on each of the phonological awareness variables. All four phonological awareness measures were successful in differentiating good and poor decoders. The deletion task proved to be the most effective measure in discriminating good and poor decoders. This task alone correctly identified 37 of the 42 subjects as good or poor decoders.

## DISCUSSION

In this study, one aspect of language-based reading ability was examined. The intent of this investigation was to assess the effectiveness of measures of phonological awareness in predicting first grade decoding ability. Measures of phonological awareness at the beginning of first grade were correlated with measures of decoding ability at the end of first grade. These correlations were generally much higher than those obtained between measures of decoding and measures of verbal and nonverbal intelligence. Whereas moderate linear relationships were observed between measures of phonological awareness and decoding ability, discriminant analysis indicated that measures of phonological awareness were excellent predictors of good and poor decoders. The deletion and categorization tasks each were found to identify good and poor decoders with between 80% and 90% accuracy.

The present findings have some meaningful clinical implications. Perhaps the most important is evidence of the effectiveness of utilizing specific phonological awareness measures in predicting students' decoding ability in the first grade. Although decoding ability is only one aspect of reading ability, previous research indicates that it is critical in the early school years. Therefore, phonological awareness measures such as the ones used in this study might be employed in the schools to identify children at risk for decoding and reading disabilities. Implementation of such procedures, however, requires more specific information to evaluate children's performance on tasks of phonological awareness. Whereas these tasks have been shown in this research project to discriminate between good and poor decoders, it will be necessary to develop specific norms by which to identify those in an at-risk population. A careful and systematic implementation of procedures described in this article could be used to begin collecting data to establish such normative data.

Speech-language pathologists are in a favorable position to assist in the development of procedures and norms to identify children at risk for language-based reading disorders. Speech-language pathologists are trained in screening and assessment of language development and disorders. They also have an understanding of phonology and phonological awareness. Thus, this background should allow them to work independently or with other professional colleagues in the early identification of children with language-based reading disabilities. Further-

TABLE 3. *F* values and percentages of correct classification of reading group membership for each of the phonological awareness tasks.

| *Variable* | F *values* | *Percentage correct classification* |
|---|---|---|
| Deletion | 26.9* | 88.1 |
| Categorization | 18.9* | 81.2 |
| Blending | 17.1* | 76.4 |
| Segmenting | 9.4* | 71.3 |

$^*p < .01$

more, speech-language pathologists' knowledge of intervention techniques for phonological deficits should enable them to plan and support early intervention programs focusing on training of phonological awareness in preschool and primary grades (see Catts, 1991b).

Finally, it should be noted that contributions of speech-language pathologists to the identification and remediation of language-based reading disorders are not limited to the decoding level of reading. As discussed in the introduction, reading is a complex behavior requiring high-level linguistic abilities as well as decoding skills. Training in oral language assessment and remediation should allow speech-language pathologists to make valuable contributions in the intervention of the full range of reading disabilities (Catts & Kamhi, 1986; Kamhi & Catts, 1991).

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# APPENDIX

## PHONOLOGICAL AWARENESS MEASURES

**DELETION TASK** (Catts, 1993): The child is shown a picture of a cow and a boy's head and asked to "say cowboy." After the child responds, the examiner covers the picture of the cow and says: "Now say it again, but without the cow" (i.e., 'boy'). If a correct response is given, the examiner proceeds with the next example (picture of a tooth and a brush, "toothbrush," following the same procedure). The same procedure is followed for the third example, "cupcake" (a picture of a cup and a cake). If the child fails a practice item, the examiner provides corrective feedback to the child by saying "cowboy without cow is boy." The examiner then proceeds with the test items (no visual stimuli are used during testing). The first five correct responses are reinforced, and the first five errors are corrected. Testing is discontinued after eight consecutive failures

| | | |
|---|---|---|
| 1. Sunday | 8. fat | 15. scream |
| 2. sometime | 9. seat | 16. thread |
| 2. baseball | 10. shout | 17. cloud |
| 4. return | 11. jar | 18. twin |
| 5. baby | 12. tall | 19. /fjew/ |
| 6. monkey | 13. door | 20. spring |
| 7. person | 14. snow | 21. /skware/ |

**CATEGORIZATION TASK** (Bradley & Bryant, 1983): The examiner says to the child: "Listen carefully. I am going to say four words. One of the words begins with a sound that is different from the other words. Here is an example. If I say *bag, nine, beach, bike,* the word that begins with a different sound is *nine.* Now you try one." Say to the child: "Which word begins with a sound that is different from the other words: *rat, roll, ring, pop?*" If the child succeeds, go to the next example. If the child fails, say: *"rat, roll, ring, pop.* The word that has a different beginning sound is *pop."* Repeat the first example. If the child succeeds, go to the next example. If the child fails, say: *"rat, roll, ring, pop.* The word that has a different beginning sound is *pop."* Go to the next example, which utilizes the same procedure with the target words of *nut, sun, sing, sort.* Begin the test items: the first five correct are given positive reinforcement, whereas the first five errors are given corrective feedback. There is no ceiling on this task.

| | |
|---|---|
| 1. not no son nice | 7. cat tan time ton |
| 2. ball bite dog beat | 8. luck like lip rag |
| 3. girl pat give go | 9. fill fork ear fire |
| 4. yes run rose round | 10. safe shirt same sail |
| 5. cap jar coat come | 11. bath doll duck done |
| 6. hand hut here fun | 12. mail miss make nap |

**BLENDING TASK** (Catts, 1993): The child is introduced to a puppet and told: "This puppet does not talk very well. He says words one sound at a time. Your job is to listen and say the words the right way. For example, if he says 'rein (pause) deer' you would say 'reindeer.' Let's try it." The child attempts the practice items. If the child is incorrect, feedback is given. The examiner then should move on to the test items. The first five correct responses are reinforced, and the first five errors are corrected. There is no ceiling on this task.

Practice Stimuli: bed room suit case snow man

| | | |
|---|---|---|
| 1. birth day | 9. s ing | 17. f ee t |
| 2. air plane | 10. sh irt | 18. m i ss |
| 3. pen cil | 11. m uch | 19. c oa t |
| 4. dol lar | 12. g ood | 20. p a ge |
| 5. mo ther | 13. t op | 21. tr u ck |
| 6. pa per | 14. b ug | 22. s m o ke |
| 7. for get | 15. f i sh | 23. s l i p |
| 8. f un | 16. s oa p | |

**SEGMENTATION** (Catts et al., 1989): The instructions are as follows: "Now we are going to play a tapping game. Listen and watch how I play it." Demonstrate the practice trial 1, saying the word first, then tapping it out. Then say: "Now it is your turn. I'll say a word, then you say it, and then you tap it out." All errors are corrected. Next, scramble the practice list (see Appendix), and have the child try again, correcting all errors. Follow the same procedure with the other practice items. Then proceed to the test items. The first five correct responses are reinforced, and the first five errors are corrected. This task has no ceiling.

| Practice Stimuli: | 1. but | 2. tell | 3. top |
|---|---|---|---|
| | butter | telling | water |
| | butterfly | telephone | elephant |

| | | |
|---|---|---|
| 1. dinner | 8. sunshine | 15. hamburger |
| 2. house | 9. remember | 16. morning |
| 3. together | 10. cheese | 17. anything |
| 4. apple | 11. Saturday | 18. call |
| 5. shoe | 12. open | 19. outside |
| 6. nobody | 13. building | 20. dog |
| 7. understand | 14. boat | 21. head |

**INVENTED SPELLING TASK:** Pronounce nonsense words two times in a clear, distinct voice. Scoring: count correct each sound represented by an appropriate written symbol. Also, "i" spelling also may be appropriate for "e." The number of correct phonemes/graphemes is listed in parentheses following each word.

Test Stimuli:

| | | | |
|---|---|---|---|
| 1. nad (3/3) | 6. bex (4/3) | 11. woi (2/3) | 16. ropt (4/4) |
| 2. jate (3/4) | 7. ob (2/3) | 12. thork (4/5) | 17. flade (4/5) |
| 3. heek (3/4) | 8. aft (3/3) | 13. quay (3/4) | 18. spong (4/5) |
| 4. moke (3/4) | 9. tush (3/40 | 14. ling (3/4) | 19. perven (5/6) |
| 5. chid (3/4) | 10. sipe (3/4) | 15. zelt (4/4) | 20. lemble (5/5) |