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DIFFERENTIAL DIAGNOSIS OF READING DISABILITIES

Contents

Abstract: This article describes a diagnostic procedure that attempts to relate diagnostic outcomes of reading disabilities to treatment procedures. Both the diagnostic procedure and the treatment approaches are based on the premise that reading contains several components and that weakness in any of these components could result in a distinct type of reading disability. To be effective, the treatment procedure should deal with the weak component. The theoretical and empirical basis for diagnosis and treatment is presented.

This article is written with the expectation that, in the future, the responsibilities of school psychologists are likely to extend beyond that of making eligibility determinations regarding learning disabilities and will include the role of instructional consultation. As a consultant, the school psychologist will be expected to work closely with the classroom teacher in identifying the reasons why some children fail to learn to read and making appropriate recommendations for interventions. The diagnostic approach described here is predicated on such a shift in the school psychologist's role and, consequently, departs from traditional methods used for making eligibility decisions. Furthermore, the diagnostic procedure is designed with the express purpose of relating diagnostic findings to remedial instruction.

The mechanics of relating diagnostic outcomes to instructional decisions is based on the premise that reading difficulties are caused by a variety of factors and, to be effective, treatment should address the cause of the reading problem. In order to identify the many potential causes of reading disabilities, a knowledge of the cognitive processes that underlie the reading process is essential. This knowledge enables the psychologist to recognize the process that operates at a suboptimal level and impedes the acquisition of reading skills. In cognitive psychology, these processes are traditionally described in terms of components. The diagnosis and treatment of reading disabilities are, there-fore, directly linked to the number of components that underlie the reading process. This naturally raises two questions: "What is the nature of a component?" and "What are the components of reading?"

THEORETICAL AND EMPIRICAL BASIS OF THE DIFFERENTIAL DIAGNOSTIC AND TREATMENT PROCEDURES

A component can be defined as an elementary information processing system that operates upon internal representation of objects and symbols (Sternberg, 1985). To be considered a component, the process should be demonstrably independent of other processes. An additional constraint placed on this definition, as it relates to reading disability, is the level of theorizing chosen by researchers, often dictated by practical considerations such as the ease of testability and relevance to remediation. The diagnostic procedure described in this article defines components at a general level and is based on practical considerations such as the time and instruments required to carry out the diagnostic procedure quickly and economically.

Available evidence indicates that skilled reading could be the product of at least five components. Even though all of these components may not be independent of each other, unequivocal evidence exists to show that skilled reading requires the proper functioning of at least two components, word recognition and comprehension. The remaining three putative components are: orthographic processing skill, reading speed, and vocabulary. In spite of the fact that the independent status of these three potential components has not been firmly established, they could, when not fully functional, disrupt the reading process. These three factors, therefore, can be tentatively recognized as subcomponents of reading. In the following section, these five components of reading are briefly described.

Word Recognition and Comprehension

The first component, word recognition, is the ability to recognize or pronounce the written word either overtly or covertly and is accomplished by using two strategies. The first strategy, called decoding, refers to an ability to transform graphemes into phonemes and is largely determined by the phonological skills of the reader. The second strategy

involves an ability to process simultaneously letter units that represent more than a single phoneme. Such letter units can be syllables, or recurrent sequences of letters such as onsets and rimes (e.g., str/ong; str/ing), or even entire words. This form of word processing is referred to as the lexical strategy of word recognition. In nontechnical language, this strategy can be referred to as "sight-word reading." It is thought that words with a consistent letter to pronunciation relationship are more amenable to processing by using the decoding strategy whereas words such as have and come whose spelling is inconsistent with their pronunciation are processed using the lexical strategy. Also it is believed that lexical processing enables the reader to process written words more rapidly than with the decoding strategy.

Comprehension, the second component, is a higher level information processing ability and is used here as a generic term to include both reading and listening comprehension. The proposition that comprehension is a process which includes both listening comprehension and reading comprehension is supported by the findings of numerous studies reporting high correlation coefficients between the two forms of comprehension. A typical finding is that of a study by Palmer, McCleod, Hunt, and Davidson (1985) in which a coefficient of .82 was obtained between reading comprehension and listening comprehension, leading the investigators to conclude that reading comprehension can be predicted almost perfectly by a listening measure (see Aaron & Joshi, 1992 for a review). The impressive correlation between the two forms of comprehension makes listening comprehension a potent predictor of rea comprehension.

Evidence for the validity of these two components of reading comes from four sources: developmental psychology, experimental psychology, neuropsychology, and genetic studies of dyslexia.

Developmental psychology. The existence of children with average or above-average IQ but experiencing difficulty in recognizing written words has been reported since the end of the last century (cf. Morgan, 1896). These children have been traditionally described as having developmental dyslexia or specific reading disability. However, the recognition that there are children who can decode the written language quite well but have difficulty in comprehending it has been slow in coming. Carr and colleagues (1990) reported that nearly 25% of poor readers can decode written passages fairly well but cannot comprehend them nearly as well. In a British study, Oakhill and Garnham (1988) found that nearly 10% of the children in early primary grades have this form of reading problem. Stothard and Hulme (1992) studied 147 children and identified 14 children who had difficulty in comprehension but not in decoding. Children who are said to have symptoms of hyperlexia represent an extreme form of this type of reading disability (e.g., Aaron, 1989; Aaron, Franz, & Manges, 1990; Healy, 1982). These children can recognize words and read aloud passages fluently without understanding them. These studies of children provide evidence that decoding and comprehension are separable processes.

Experimental psychology. In an experimental investigation, Jackson and McClelland (1979) studied undergraduate students and found that comprehension ability and reaction time in a letter-matching task accounted for nearly all of the variance seen in reading achievement. Investigations by Hunt, Lunneborg, and Lewis (1975) and by Palmer and colleagues (1985) also found that comprehension and speed of decoding the printed word are the two most importan components of reading. More recently, Levy and Carr (1990), after discussing the nature of the reading process, concluded that comprehension and word recognition are dissociable processes and, therefore, can be considered to be major components of reading.

Nenropsychology. Neuropsychological studies of patients with deep dyslexia and surface dyslexia also indicate that comprehension and word recognition can be independently affected (e.g., Marshall & New-combe, 1973). The oral reading of patients with deep dyslexia indicates that they can comprehend the general meaning of words, but cannot pronounce them correctly. For example, they tend to misread words such as girl and money as "she" and "dollar" but know what these words mean. Individuals who have surface dyslexia show the opposite pattern of behavior; they tend to pronounce words such as listen and sale as "liston" and "sally." When asked what these words mean, they are likely to answer, "That's the name of the boxer" and "That's the name of a girl," respectively. The reading deficits seen in cases of these two forms of acquired reading disorders indicate that decoding skills can be impaired leaving comprehension relatively intact, and vice versa.

Genetic studies. In a study of twins with reading disabilities, DeFries, Fulker, and LaBuda (1987) found significant heritability for word recognition, spelling, and WISC-R Digit-Span but not for reading comprehension. After investigating MZ and DZ twins with reading disabilities, Olson and his associates (cited in Pennington & Smith, 1988) found that nonword reading skill is highly heritable whereas comprehension is not. Commenting on these studies, Pennington and Smith (1988) conclude that in dyslexia, single-word reading, spelling, and digit span are genetically influenced but comprehension is not. Developme behavioral-genetic analyses also indicate that phonological decoding deficit is much inflUenced by genetic factors with heritability about .75 (Olson, Forsberg,

Wise, & Rack, 1994).

These studies suggest that decoding and comprehension are independent components of reading and thus have the potential to lead to three kinds of poor readers, namely, individuals with decoding deficits, comprehension deficit, and a combination of the two.

Orthographic Processing

Orthographic processing skill is believed to facilitate word recognition through the lexical processing strategy. If this is true, orthographic processing skill would be essential for rapid word recognition which is a prerequisite for proficient reading.

There is no universally accepted definition of orthography, but the one suggested by Henderson (1985) that "orthography is the visual pattern of the written language as it relates to the graphemic, phonological, and semantic features of the language" (p. 1) appears to be satisfactory. Orthographic processing ability is not the same as visual memory even though visual memory may play a role in it. Rather, in the case of alphabetic language, it refers to a knowledge of sequential patterns of letters in written words which occur with such regularity that they are predictable on a probability basis. Such patterns are constrained by phonological factors (e.g., consonants such as b and t do not occur at the beginning of words) as well as semantic factors (e.g., rehearsal is not pronounced "rehearsal" so that the morpheme hear is preserved in the spelling).

Some investigators doubt if orthographic knowledge makes a contribution to reading independent of phonology (e.g., Vellutino, Scanlon, & Tanzman, 1994). Other researchers, however, believe that orthographic skill is an independent component of reading and that weakness in this skill can interfere with reading and produce yet another category of reading disability (e.g., Berninger, 1990, 1994; Manis, Szelszulski, Holt, & Graves, 1990). In an unpublished study, we found that some children who were deficient neither in phonology nor in listening comprehension were, nevertheless, deficient in orthographic memory and reading speed. This led to the conclusion that orthographic processing skill can interact with speed of processing and affect skilled reading, particularly beyond the third and fourth grades.

Reading Speed

The possibility that reading speed can be an independent component of reading has been suggested by some investigators (e.g., Lovett, 1987; Wolf, 1991). Carver (1993) considered reading speed to be an important constituent of efficient reading. One of the difficulties of assigning an independent status to reading speed is the difficulty in disentangling speed from word recognition skills. That is, some children could be slow readers simply because they cannot recognize words quickly. Nevertheless, it should be recognized that, generally speaking, poor readers also are slow readers (see Compton & Carlisle, 1994; Greene & Royer, 1994 for reviews). As noted earlier, it is likely that poor orthographic processing skill can interact with slow reading speed to create a separate group of poor readers.

Vocabulary

Of the three putative components of reading, vocabulary is known to be highly correlated with reading comprehension with coefficients ranging from .60-.75 (Harris & Sipay, 1990). In one study, Meyzynski (1983) reported that vocabulary accounted for substantial variance in reading comprehension ranging from .41 to .93. In spite of this intimate relationship between reading comprehension and vocabulary, it is not clear whether vocabulary makes an independent contribution to reading. Doubts about the independent status of vocabulary as a component of reading come from the close relationship between vocabulary knowledge and cognitive ability which prevents positing a cause-effect relationship between vocabulary knowledge and reading comprehension.

In spite of these reservations, vocabulary assessment and vocabulary instruction should be part of the assessment-treatment program because a few studies indicate, when properly carried out, vocabulary instruction improves reading comprehension (Beck & McKeown, 1991).

The diagnostic-treatment program based on the component model of reading is influenced by these empirical evidences as well as by practical considerations. More importantly, the diagnostic procedure leads directly to recommendations regarding remedial instruction, an advantage the IQ-achievement discrepancy-based procedure cannot claim to have. The procedure described in this article is based on the reasoning that poor readers with a weakness in word recognition but adequate comprehension skills can be expected to do best when they receive remedial instruction focusing on improvi phonological skills; conversely, children with weak comprehension but adequate decoding ability are likely to become better readers when remediation focuses on comprehension skills; children who are weak in both these areas can be expected to improve when they receive a comprehensive remedial instruction. Similarly, children with adequate decoding and comprehension skills but slow in reading can be expected to improve their reading skills when remedial efforts attempt to improve the sight vocabulary of these children. Empirical evidence exists to justify these expectations (e.g., Oakhill & Garnham, 1988; Palincsar, 1986).

DIFFERENTIAL DIAGNOSTIC PROCEDURE

Rationale

The conventional diagnostic procedure used in the U.S. for identifying reading disability is based on a measure of the extent of discrepancy found between a child's potential for reading and his or her actual reading achievement. The discrepancy-based diagnostic procedure runs into several problems: one is th determination of the extent of discrepancy that marks reading disability and the other is that IQ, which is the measure adopted for estimating the child's reading potential, could itself be influenced by reading experience. An additional problem is that discrepancy-based diagnosis fails to discriminate among different sources of reading disabilities because many children, whether they have a discrepancy or not, display weakness in phonology (Stanovich & Siegel, 1994).

The method used for estimating the reading potential is to administer an intelligence test to the child and then project reading potential from the IQ obtained from the test. This practice is based on two assumptions: (a) the relationship between IQ and reading achievement is unidirectional (i.e., IQ determines reading ability and not vice versa), and (b) the correlation between IQ and reading achievement is sufficiently high to predict the latter from the former. The validity of both these assumptions has been often questioned. For example, it is known that poor readers spend less time reading than good readers do and, as a result, fail to develop sufficient language and vocabulary skills. It has been documented that these stunted language skills can, in turn, lower the verbal IQ of poor readers (Stanovich, 1986; van den Bos, 1989). This phenomenon labeled as the Matthew Effect (Gospel according to St. Matthew, 25:29) indicates that reading skill also can affect verbal IQ and, therefore, the IQ-reading relationship is not unidirectional but is reciprocal.

As for the second assumption, the correlation coefficients obtained between IQ and reading achievement scores generally fall in the vicinity of 0.4 or 0.5 (Stanovich, Cunningham, & Feeman, 1984). Interpreted statistically, this means that IQ can account for only about 16-25% of the variance seen in reading achievement scores.

Perhaps the most serious drawback in using IQ tests for identifying reading disability is that this procedure does not lead to decisions regarding remedial instructions. In essence, the discrepancy-based identification tells the teachers (and parents) that the child is a poor reader, nothing more. Teachers and parents already know this. If school psychologists have nothing more to offer, theft consultative aspirations can be seriously undermined. The procedure described here is expected to obviate some of these problems.

The diagnostic procedure described here is based on the following propositions: (a) reading ability is, ultimately, the ability to comprehend written language; (b) reading ability is composed of two major components, decoding and language comprehension and, very likely, three additional subcomponents; (c) apart from decoding and the differences attributable to modalities effects, reading comprehension and listening comprehension are mediated by the same cognitive mechanisms and, therefore, are highly correlated; (d) because of this intimate relationship between reading comprehension and listening comprehension, the best predictor of reading comprehension is listening comprehension; (e) development of decoding and comprehension skills can be arrested independent of each other resulting in the following three kinds reading disabilities: (i) specific reading disability or development dyslexia, associated with deficient decoding but adequate comprehension skills, (ii) nonspecific reading disability, associated with poor comprehension but adequate decoding skills, and (iii) generalized reading disability, associated with deficiencies in both decoding and comprehension; and yet another form of reading disability can be caused by a

combination of weak lexical-processing skill (i.e., poor sight vocabulary) and slow reading speed. In this article, this is referred to as orthographic processing disability.

It has to be noted that these typologies are used only for ease of communication and not for labeling poor readers.

Empirical evidence supports the proposition that there are poor readers characterized by weaknesses in these specific areas. The first group of individuals marked by adequate listening comprehension skills but poor decoding skills are classified as children with dyslexia or children with specific reading disability. Poor reading comprehension in these individuals is not a primary problem but is secondary to weak word recognition skill. For instance, Shankweiler, Crain, Brady, and Macaruso (1992) cite a number of studies indicating that when materials are presented in ways that lessen memory load, children with a specific reading disability perform as well as good readers on tasks of spoken language comprehension. Neuropsychological studies also indicate that patients with limited phono-logical memory who have difficulty retaining and repeating sentences verbatim can, nevertheless, comprehend the meaning of sentences and make judgments about their semantic and syntactic correctness (Martin, 1993).

The evidence for the existence of the second group -- those with adequate word recognition skills but poor comprehension -- was presented above (Carr et al., 1990; Cromer, 1970; Oakhill & Garnham, 1988; Stothard & Hulme, 1992). These children are described as having nonspecific reading disability. Following tradition, educators refer to these type of children as "word callers." As noted earlier, two British studies indicate that children with this type of reading disability constitute up to 10% of the elementary school population.

The third form of reading disability which arises out of deficits in both word recognition and comprehension skills is, perhaps, the most prevalent category of reading problem. Individuals placed in this category invariably have IQs in the low-average or borderline range. For this reason, individuals with decoding comprehension deficits are described as having generalized reading disability. A good deal of confusion exists in dyslexia research literature because of the failure to identify children belonging to this group and separating them from children with dyslexia.

The fourth type of reading disability marked by a combination of low sight vocabulary and slow reading speed has not been the focus of many research studies. Nevertheless, the few available studies suggest that this subtype is a genuine category of reading disability (e.g., Berninger, 1990; Manis et al., 1990). A study by Lovett (1987) was able to classify poor readers into two categories, "rate disabled" and "accuracy disabled." A case study which found dissociation between word recognition and listening comprehension on the one hand and reading speed on the other also has been reported (Aaron & Whitefield, 1990).

SYMPTOMS ASSOCIATED WITH DEVELOPMENTAL DYSLEXIA OR SPECIFIC READING DISABILITY

1. Poor Grapheme-Phoneme Transformational (decoding) skill

The most obvious deficit seen in people with dyslexia is poor word recognition skills. Not having a sizeable vocabulary, beginning readers tend to rely on the decoding strategy for recognizing printed words. Furthermore, in order to extract the meaning of long sentences, the string of words in the sentence has to be kept in a temporary memory store. Phonological memory appears to be well-suited for this purpose.

2. Slow Reading Speed

A number of studies show that the speed with which words are recognized is a major variable contributing to individual differences in reading skills. Even though some poor readers may be able to recognize some written words without resorting to phonological recoding, these children are held back when they encounter unfamiliar words and words that lack meaning. Slow reading is not limited to children; college students with dyslexia also are slow readers (Aaron & Phillips, 1986). It has to be noted that, in children with specific reading disability, slow reading does not occur as an isolated symptom but is part of the total syndrome.

3. Errors in Oral Reading

Although poor readers tend to make more errors than skilled readers, it is the type of oral reading errors that distinguishes readers with dyslexia from the

other types of poor readers. Substitution errors committed by readers with dyslexia indicate that they depend on context for recognizing words. These errors, however, generally do not radically alter the meaning of the sentence. Thus, a child with dyslexia may read the sentence, "This is the house that Jack built" as "This is the home that Jack bought." In contrast, poor readers with comprehension deficit (nonspecific and generalized reading disabilities) often produce words that alter the meaning of the sentence; occasionally, they also produce neologisms.

Individuals with specific reading disability also tend to omit an unusually large number of grammar words and word suffixes; also they frequently substitute one function word for another.

4. Poor Spelling

Many studies of developmental dyslexia suggest that poor spelling is a concomitant of reading disability. This should come as no surprise because spelling-to-sound relational rules are involved both in reading and spelling. Being weak in phonological skills, readers with dyslexia commit an usually large number of spelling errors.

Traditionally, the ability to spell was thought to be primarily a visual process involving memorization of the sequence of letters in words. Drawing from the findings of developmental studies of others as well as her own research of children's acquisition of spelling skills, Treiman (1993), however, argued that, during early stages, spelling is more an attempt to represent a word's sound than it is an attempt to recall, from visual memory, the string of letters in a word. The high degree of correlation seen between spelling and decoding skill supports this view (Bruck & Waters, 1988; Ehri, 1983; Rohi & Tunmer, 1988).

It should be noted, however, that many words in the English language cannot be spelled correctly by using rules of pronunciation alone. Under these circumstances, some kind of nonphonological memory for orthographic units could play a role. Kreiner and Gough (1990) call this "word-specific memory" and have provided evidence which suggests that such a memory does play a role in spelling words.

Children's mastery of spelling skills appears, to proceed in stages that correspond to the development of a knowledge of grapheme-phoneme relationship and other linguistic skills. Treiman (1993) identified four stages of spelling development: (a) pre-communicative stage in which there is little evidence of correspondence between phonemes and graphemes; (b) semiphonetic stage (e.g., mail -- "mi"; carpet --"crpt"); (c) phonetic stage (e.g., city -"sity"; blue -- "bloo"); and finally (3) the morphophonemic stage in which phonemic, semantic, and syntactic information is used to achieve correct spelling. In this final stage of spelling acquisition, semantic knowledge as well as an awareness of recurring letter patterns also play a role in spelling. For example, the word separate is not spelled "seperate" in order to preserve the morpheme part. Similarly a phonemic awareness that words such as mate and cute that are pronounced with long vowel sound prevents misspelling them as "mut" and "cut." Understandably, the final stage is referred to as "morphophonemic." For this reason, a qualitative analysis of spelling errors provides information about the child's morphological as well as phonological competency.

I have gone into some detail about the acquisition of spelling skills because there have been attempts to classify dyslexia into subtypes on the basis of spelling errors. Perhaps the best known work in this regard is the one by Boder (1973) who classified spelling errors into three categories: dyseidetic (e.g., girl -- "gal"; blue -- "bloo"), dysphonetic (e.g., girl- "gril"; stop --"spot") and mixed. Sometimes dyseidetic and dys-phonetic subtypes are considered equivalent to visual dyslexia and auditory dyslexia, respectively. However, the developmental trends seen in the acquisition of spelling skills discussed above provide an alternative explanation. It appears that the different kinds of spelling errors, instead of representing different subtypes of dyslexia, represent two substages in spelling acquisition (see Aaron, 1989 for empirical support). Phonologically acceptable spelling errors (e.g., blue -- "bloo") do not indicate strength in phonology and an associated weakness in visual memory but show that the speller has reached Stage 3 of spelling acquisition but not the more linguistically complex Stage 4.

5. Errors of Syntax in Written Language

Errors of function word usage and word suffixes are often seen in the writings of people with dyslexia. Even though there may be a considerable amount of intersubject variation in this regard, errors of written syntax mirror those seen in the oral reading of these individuals. Experimental studies also show that when a printed word is read, the root morpheme is stripped of its suffix and is processed as a separate unit (Gibson & Guinet, 1971). It would be reasonable to expect that lacking semantic content, suffixes are handled by the phono-logical mechanisms. This would explain the large number of suffix omissions ar

substitutions seen in the oral reading and writing of subjects with dyslexia.

6. Excessive Reliance on Context for Word Recognition

A distinction should be maintained between utilizing context for comprehension of sentences and depending on context for word recognition. It is the latter sense "context dependency" is used here. A substantial number of studies show that subjects with weak word recognition skills depend more on context for recognizing written words than do good readers (e.g., Allington & Fleming, 1978; Mitchell, 1982). The word substitution error made when reading aloud is an indication of context dependency. Oral reading errors made by subjects with dyslexia often are context appropriate and do not drastically disrupt the meaning of the sentence.

7. Adequate Listening Comprehension

Even though an ability to listen and comprehend spoken language well cannot be considered a symptom of a problem, it is very useful for differentiating developmental dyslexia from the other two types of reading disabilities. As noted earlier, reading comprehension and listening comprehension are highly correlated and developmental dyslexia is indicated by poor reading comprehension in the presence of adequate listening comprehension. Poor reading comprehension of subjects with dyslexia, therefore, is not likely to be a primary deficit but could be secondary to word recognition problems.

SYMPTOMS ASSOCIATED WITH NONSPECIFIC READING DISABILITY

1. Adequate Grapheme-Phoneme Transformational Skills

Individuals considered to have nonspecific reading disability have adequate or even superior word recognition skills. This is particularly true of common words and high frequency grammar words. Unlike individuals who show symptoms of dyslexia, these subjects very seldom misread grammar words.

2. Adequate Reading Speed

The speed with which individuals read lists of words or familiar passages is within normal limits.

3. Errors in Oral Reading

The number of oral reading errors committed by individuals with nonspecific reading disability is strikingly smaller than that of individuals with specific reading disability. However, errors that are committed during oral reading are likely to be context inappropriate; occasionally, neologisms also can be seen in their reading. Weber (1970) noted that poor comprehenders not only produce inappropriate words but are not likely to correct those errors.

4. Spelling Errors

Reading involves the transformation of graphemes into phonemes and is a word recognition task; spelling involves the converse process and is a recall task. As a result, spelling is a more difficult skill to acquire than word reading. Individuals with nonspecific reading disability are reasonably good spellers. However, unlike individuals with dyslexia who misspell even common grammar words, they tend to misspell only uncommon words. Qualitative analysis of spelling errors also reflects a weakness in morphophonemic skills.

5. Errors of Syntax in Written Language

Errors involving the use of simple syntax are not frequently seen in the writings of these individuals. However, syntactically complex sentences (e.g., passive voice interrogative negative) and sentences with embedded clauses are not often seen in their writings; when they attempt to produce such sentences, errors occur. This frequently alters the meaning of sentences. The thematic quality of their writings also is poor.

6. Reliance on Context for Word Recognition.

Context is seldom used for word recognition by individuals with nonspecific reading disability. When individuals with non-specific reading disability encounter difficulty in recognizing words, they often guess the word which results in inappropriate words which can disrupt the meaning of the sentence.

7. Poor Listening Comprehension

Unlike individuals with dyslexia, the listening comprehension of individuals with nonspecific reading disability is almost always poor and matches the level of their reading comprehension.

SYMPTOMS ASSOCIATED WITH GENERALIZED READING DISABILITY

Individuals with generalized reading disability have a combination of all the weaknesses of the other two groups of poor readers. In general, the symptoms displayed by individuals with generalized reading disability reflect a combination of both poor decoding and comprehension skills. Their reading problem, in fact, is one of the several manifestations of their weak cognitive skills.

SYMPTOMS ASSOCIATED WITH ORTHOGRAPHIC PROCESSING DISABILITY

As noted earlier, poor orthographic processing skill usually occurs in combination with slow reading speed. Thus, the two major symptoms are a poor sight vocabulary and slow reading.

1. Poor Sight Vocabulary

It is believed that, whereas words with consistent spelling-to-pronunciation relationship should be read aloud by exploring grapheme-phoneme relationships, words whose spelling-pronunciation are inconsistent are thought to be processed as sight vocabulary through the use of lexical strategy. Orthographic information contained in written words play an important role in lexical processing. For this reason, individuals who are weak in this subcomponent are likely to be more deficient in pronouncing irregular words than regular words.

2. Slow Reading Speed

An orthographic processing disability can be considered if the child reads very slowly in spite of having adequate decoding and listening comprehension skills.

THE DIFFERENTIAL DIAGNOSTIC PROCEDURE

The field of educational assessment is undergoing some major rethinking. Some educators have proposed to dispense with standardized tests altogether (see Joshi, this issue). Psychological diagnosis is an art and a science. Doing away with standardized tests will amount to throwing out the scientific component of the discipline. Fortunately, efforts are constantly being undertaken to improve the standardized testing procedures to make diagnostic procedures more valid and reliable than at present (see Lyon, 1994 for some recent trends in this direction).

The primary purpose of the diagnostic procedure presented in this article is not to classify poor readers into one of the many categories of reading disability but to identify the weak processes that contribute to their reading problems so that appropriate remedial procedures can be recommended.

Diagnosis involves two testing procedures, formal assessment and informal assessment. The formal procedure utilizes standardized tests and the informal procedure is based on locally developed tests as well as clinical observations.

The formal diagnostic procedure is based on the expectation that because reading comprehension and listening comprehension are highly correlated and that reading is made up of two independent components (comprehension and decoding) once the contribution of listening comprehension to reading is factored out, the remaining deficit could be attributed to decoding. This view is advocated by investigators who subscribe to the componential view of reading. For instance, according to Gough and Tunruer (1986), reading (R) equals the product of decoding (D) and comprehension (C). That is, R = D x C. It follows that if

D= 0, then R = 0; and if C = 0, than also R is 0. When this proposition is translated into pragmatic terms, it follows that the reading difficulty of a subject with good listening comprehension but lower reading comprehension can be attributed to poor word recognition skill. Conversely, the reading problems of children with poor listening comprehension skill can originate from comprehension deficits or a combination of comprehension and decoding deficits (see Aaron, 1991 for empirical support for this proposition). When a child is found to be a poor reader in spite of adequate decoding skills as well as listening comprehension skills, a weakness in orthographic processing skills can be suspected.

Formal Assessment

Reading comprehension can be assessed with the aid of a well-standardized diagnostic reading test. The use of two tests, an untimed test and a timed test is recommended. An untimed test suitable for individuals whose primary language is American English is Woodcock Language Proficiency Battery (WLPB; Woodcock, 1991). A timed test that can be used is the Stanford Diagnostic Reading Test (SDRT;, Karlsen, Madden, & Gardner, 1984). These two tests use different methods for assessing comprehension: the WLPB is in a Cloze format whereas the SDRT requires the subject to read a passage and then answer a set of questions. The difference in performance between a timed test and an untimed test could yield useful diagnostic information. In addition to the test of reading comprehension, the WLPB also has subtests that assess vocabulary and word-attack skills as well as listening comprehension. Listening comprehension can be assessed: (a) by administering the listening comprehension subtest of the WLPB and (b) by reading to the subject the alternate form of reading comprehension subtest of SDRT and then requiring the subject to answer questions. Even though assessing listening comprehension with the aid of a test intended for assessing reading comprehension is a departure from standard procedures, this form of assessment produces satisfactory results. The listening comprehension subtest of the Wechsler Individual Achievement Test (WIAT; Wechsler, 1991) is yet another useful standardized test.

The next step in the diagnostic procedure is to compare the reading comprehension scores of the student with his or her listening comprehension scores. The raw scores obtained on these tests are converted into standard scores for the purpose of this comparison. The logic involved in this comparison is that if the student has a listening comprehension score that is average or better and a reading comprehension score which is lower, his or her reading difficulty is due to poor decoding skill. In contrast, when below average scores in both forms of comprehension exist, the deficit is not limited to the written language but includes spoken language as well.

How large must be the discrepancy between the two comprehension scores to be considered indicative of genuine difference? At a very basic level, if there is no overlap between the confidence limits set up by +/- 1.96 standard error of measurement, then it can be inferred that a difference between these two scores exists and that such a difference is not due to errors of measurement. For instance, a college student obtains a standard score of 93 on reading comprehension and a score of 110 on listening comprehension on the Woodcock Language Proficiency Battery. When the 95% confidence range is computed by adding and subtracting 1.96 standard error of measurement to each of these standard scores, we obtain a range of 87-101 for reading comprehension and a range of 104-1.12 for listening comprehension. Given no overlap between these two estimates, we can conclude with 95% confidence that a true difference exists between reading comprehension and listening comprehension and that the source of this discrepancy is poor decoding skills. The utility of diagnosing the nature of children's reading problems based on the differences between their performances on tests of reading comprehension and listening comprehension has been empirically established (Aaron, 1991).

The IQ test is an optional instrument that can be useful as a backup tool. One of the robust findings that has emerged from our clinical studies is that the digit-span of individuals with dyslexia, regardless of their age, is always well below average. Individuals with other forms of reading disabilities also may perform poorly on the digit-span test; however, individuals with dyslexia get above average scores on many of the sub-tests of the Performance Scale of WISC or WAIS.

Informal Assessment

Informal assessment provides supporting evidence for the initial diagnosis made on the basis of the results of formal testing. In addition, because no standardized procedure is available for assessing orthographic processing skills and speed of reading, informal assessment has to be relied upon for this information.

Informal assessment includes information obtained during interview, observations made during testing session, clinical impressions, as well as the results obtained by administering nonstandardized tests described in the following section. Teachers and clinicians can develop their own local norms in order to correctly interpret students' performance on these tests.

Decoding skills. The best way to assess decoding skills is to require the student to read a list of unfamiliar words. Familiar words would not serve the purpose because they could be read as sight words, without resorting to decoding. For this reason, decoding skill is almost always assessed by using a list of pronounceable nonwords. The intent of using a list of nonwords is to assess the reader's ability to convert graphemes into phonemes. It has to be noted, however, that even some nonwords could be read aloud by using yet another strategy, namely, analogy (Treiman, Goswami, & Bruck, 1990). For example, a nonword such as "dake" can be read by analogy because it has many neighbors such as "cake," "bake," "make," and so on. In order to preclude the use of analogy strategy in word recognition, the list should contain many words without neighbors. An example is the nonword "daik" which does not have many similar looking words. In addition to this criterion, the nonwords also should be selected on the basis of developmental trends seen in the acquisitior grapheme-phoneme relational skills and should, therefore, contain a selection of words which include complex digraphs, blends, and onsets (e.g., th, gh, ough, etc.).

Reading speed. As noted earlier, subjects with dyslexia typically are slow readers. Even though requiring subjects to read a passage and computing the time it takes to read would appear to be a straightforward method for assessing reading speed, this procedure runs into a peculiar problem. That is, even children who are proficient in reading tend to pause and ponder over words they have not encountered before. Consequently, two or three unfamiliar words in a passage can have a disproportionately large depressing effect on the reading speed and thus confound the results. For this reason, the use of a list of highly familiar function words and a list of matched content words is recommended (see Aaron & Joshi, 1992 for lists of words that can be used for determining reading speed).

Yet another way of evaluating the effect of reading speed is to administer the digit-span test. Even though digit-span is traditionally considered to be a measure of STM capacity, it also is closely associated with processing speed (Hulme & Tordoff, 1989).

Oral reading. Information about errors in oral reading can be obtained by selecting a passage from a textbook appropriate for the child's grade. It is preferable to select a passage which the child has not encountered before.

Spelling. Poor spelling is assessed by first requiring the child to read aloud a list of words and subsequently dictating only those words which the child successfully had read earlier. This is because even skilled readers tend to spell unfamiliar words phonetically. When a child is asked to spell unfamiliar words, he or she is likely to spell them phonetically. This can result in false positives.

Qualitative analysis of the written spelling invariably provides hints about the level of the child's mastery of phoneme-grapheme skills and linguistic maturity. As noted earlier, acquisition of spelling skill proceeds in stages. Consequently, the spelling test should contain words that can yield errors from which qualitative information regarding the stage the subject has reached can be extracted. Moats (1993) recommended the use of words representing three different orthographic patterns: (a) transparent (i.e., regular words) -- such as "him," "wet," and "cow" which have a relatively simple phoneme-grapheme relationship; (b) morphophonemic--words such as "rehearsal," "coming," "hopped," and "audition" whose spelling pattern is governed not only by phonology, but also by semantics, syntax, stress patterns, and etymology; (c) opaque--words such as "cough," "tongue," and "gnaw" whose spelling patterns are not governed by familiar linguistic factors and, therefore, have to be learned by rote. Spelling correctly words whose orthography is transparent reflects a mastery of phoneme-grapheme relational rules; spelling correctly words whose orthography is influenced by morphophonemic principles indicates the ability to utilize complex linguistic knowledge; spelling correctly words whose orthography is opaque indicates the successful utilization of lexical processing skills. Many of the currently available commercial tests of spelling are not based on these criteria.

Errors of syntax. Errors of syntax in written language are noted by asking the subject to write a paragraph or two on a topic specified by the examiner. The product is evaluated both for quality of writing as well as for errors of syntax and errors involving the use of grammar words.

Context dependency. Context dependency is assessed by asking the subject to read aloud a long list of words taken from the passage used for evaluating errors in oral reading (see above). The words on the list that are misread by the subject are noted and then his or her reading of the passage is examined to

see how many of the words missed in the list had been read correctly in context. The percentage of words read correctly in context but missed in the list provides a measure of context dependency.

Orthographic processing. It was noted earlier that poor orthographic processing often is accompanied by slow reading. Techniques for assessing reading speed had been described in the earlier part of this section. The ability to access lexicon and retrieve pronunciation as gestalts can be measured by asking children to read a list of "irregular" words. A list of such words used in experimental studies is provided by Castles and Coltheart (1993).

TREATMENT PROCEDURES

Improving Word-recognition Skills

A number of studies show that poor decoding skills are associated with poor phonological skills and that training in phonological awareness and phonological analysis improves word recognition skills (Bradley & Bryant, 1985; Hurford, 1990; Lundberg, Olofsson, & Wall, 1980). Once word recognition skills are well-developed, many children in early elementary grades show improvement in their reading comprehension also.

During the initial stages, phonological awareness training is entirely oral-aural. After the child has demonstrated an awareness of phonemes, graphemes are gradually introduced and subsequently, the relationship between graphemes and phonemes is taught. During later stages, the connection between larger units of graphemes such as syllables and words with recurring letter patterns and their pronunciation is taught (see Felton, this issue for details). Once phoneme awareness is established, phonics instruction could be introduced by switching over to Spalding's Writing Road to Reading Method (Spalding & Spalding, 1986). The Spalding method has a good track record as indicated by research findings. Furthermore, this method emphasizes writing from the very beginning.

Improving Comprehension Skills

Comprehension failure could occur for two reasons: (a) not having the required knowledge, and/or b) not knowing appropriate reading strategies or not being able to use them.

Not having the required knowledge could, in turn, be for two reasons: not having adequate vocabulary to comprehend the written passage, or not having the required schema or background knowledge for comprehending the written passage.

Vocabulary/instruction. Teaching vocabulary by presenting a list of words along with their dictionary meaning in a paired-associate format has been found to be an ineffective method. This is not an unexpected finding because it is easier to remember and recall meaningful information than pairs of words memorized in a rote fashion. Vocabulary instruction can be indirect or direct. Indirect instruction depends on providing opportunities for the reader to encounter words in the context of sentences by increasing the opportunities for reading. Many experts, however, believe that repeated encounters with novel words in text is fortuitous, and, therefore, cannot be relied upon as the only means of vocabulary acquisition. For this reason, many educators recommend direct instruction in the teaching of vocabulary which includes the following three techniques: semantic mapping, cluster analysis, and morphological analysis. Semantic mapping is a technique in which the relationship between a word and its semantic relatives such as antonyms and synonyms are portrayed in the form of a visual display. Cluster analysis is very similar to semantic mapping but includes the development of conceptually and thematically related words Morphological analysis involves analyzing words into root morphemes and their affixes, and tracing the etymological origins of words (see Aaron & Joshi, 1992 for more details).

Development of background knowledge and schema. A practical approach to the development of the schema necessary for comprehending a written passage is the language experience approach. Typically, language experience instruction may follow these steps. An opportunity is created for children to experience an event, such as watching a movie or visiting a hospital. After this experience, children sit in small groups and narrate their experiences. The

teacher writes these narratives on the chalkboard and children copy these on sheets of paper. Subsequently, the children are asked to read to the class the sentences they have on their sheets. These sheets of paper are eventually bound together to create the child's own book.

Strategy instruction. Many poor comprehenders either do not possess the strategies necessary for comprehending a passage or do not realize that they are not utilizing these strategies when they read. Thus, strategy instruction has two components: (a) teaching the strategies that are essential for reading comprehension, and (b) developing metacognitive skills which the reader can use to monitor his or her utilization of these strategies.

Reciprocal teaching (see Palincsar, this issue) combines training in the use of these strategies and the creation of metacognitive skills enabling the reader to monitor the extent to which he or she uses these strategies.

CONCLUSIONS

A framework for linking reading instructional procedures with diagnostic methods has been presented in this article. The recommended diagnostic and remedial procedures are developed on the basis of empirical findings from the disciplines of education, cognitive psychology, experimental psychology neuropsychology, and psycholinguistics. The rationale that underlies this diagnostic procedure is that reading is made up of several components and that the weak component of the poor reader should be identified first and, subsequently remedial methods be aimed at the weak area. This approach expects the school psychologist to go beyond making eligibility decisions regarding learning disabilities and be actively involved in decision making regarding remedial instruction. Even though this approach has not been tried on a large scale, it has been implemented in the School Psychology program at Indiana State University and both the diagnostic and the remedial methods have yielded satisfactory results. A large-scale field trial remains to be carried out.

The present article also shows that the cognitive aspect of reading, spelling, and writing is an actively researched area and that numerous findings are published every year. School psychologists should be sensitive to this fact and be ready to update testing as well as teaching procedures in light of these newly emerging developments.

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REFERENCES

Aaron, P. G. (1989). Dyslexia and hyperlexia. Boston, MA: Kluwer.

Aaron, P. G. (1991). Can reading disabilities be diagnosed without using intelligence tests. Journal of Learning Disabilities, 24(3), 178-186.

Aaron, P. G., Franz, S., & Manges, A. (1990). Dissociation between pronunciation and comprehension in reading disabilities. Reading and Writing: An Interdisciplinary Journal, 3, 1-22.

Aaron, P. G., & Phillips, S. (1986). A decade of research with dyslexic college students: A summary of findings. Annals of Dyslexia, 36, 44-66.

Aaron, P. G., & Joshi, M. R. (1992). Reading problems: Consultation and remediation. New York: The Guilford Press.

Aaron, P. G., & Whitefield, J. (1990). Dysfluency-fluency: Implications for a new cognitive style for reading consultation. Journal of Reading, Writing, and Learning Disabilities, 6, 395-411.

Allington, R., & Fleming, J. (1978). The misreading of high-frequency words. Journal of Special Education, 12, 417-421.

Beck, I., & McKeown, M. (1991). In R. Bart, M. Kamill, P. Mosenthal, & D. Pearson (Eds.), Handbook of Reading Research (Vol. 2; pp. 340-362). New York: Longman.

Berninger, V. (1990). Multiple orthographic codes: Key to alternative instructional methodologies for developing the orthographic phonological connections underlying word identification. ***School Psychology Review***, 9, 518-533.

Berninger, V. (1994). Reading and writing acquisition. Madison, WI: Brown & Benchmark.

Boder, E. (1973). A diagnostic approach based on three atypical reading-spelling patterns. Developmental Medicine and Child Neurology, 15, 663-687.

Bradley, L., & Bryant, P. (1985). Rhyme and reason in reading and spelling. Ann Arbor. University of Michigan Press.

Bruck, M., & Waters, G. (1988). An analysis of spelling errors of children who differ in their reading and spelling skills. Applied Psycholinguistics, 9, 77-92.

Carr. T., Brown, T., Vavrus, L., & Evans, M. (1990). Cognitive skill maps and cognitive skill profiles: Componential analysis of individual differences in children's reading efficiency. In T. H. Carr & B. A. Levy (Eds.), Reading and its development (pp. 1-55). New York: Academic Press.

Carver, R. E (1993). Merging the simple view of reading with rauding theory. Journal of Reading Behavior, 25, 439-455.

Castles, A., & Coltheart, M. (1993). Varieties of developmental dyslexia. Cognition, 47, 149-180.

Compton, D, & Carlisle, J. (1994). Speed of word recognition as a distinguishing characteristic of reading disabilities. Educational Psychology Review, 6(2), 115-139.

Cromer, W. (1970). The difference model: A new explanation for some reading difficulties. Journal of Educational Psychology, 61, 471-483.

DeFries, J., Fulker, D., & LaBuda, C. (1987). Evidence for a genetic aetiology in reading disability of twin Nature, 329, 537-539.

Ehri, L., C. (1983). A critique of five studies related to letter-name knowledge and learning to read. In L. M. Gentile, M. L. Kamil, & J. Blanchard (Eds.), Reading research revisited (pp. 143-153). Columbus, OH: Charles Merrill

Gibson, E. J., & Guinet, L. (1971). Perception of inflections in brief visual presentation of words. Journal of Verbal Learning and Verbal Behavior, 10, 182-189.

Gough, P., & Ttmmer, W. (1986). Decoding, reading, and reading disability. Remedial and Special Education, 7, 6-10.

Greene, B. A., & Royer, J. M. (1994). A developmental review of response time data that support cognitive components model of reading. Educational Psychology Review, 6, 141-172.

Harris, A. J., & Sipay, E. R. (1990). How to increase reading ability. New York: Longman.

Healy, J. (1982). The enigma of hyperlexia. Reading Research Quarterly, 17, 319-338.

Henderson, L. (1984). Writing systems and reading processes. In L. Henderson (Ed.), Orthographies and reading (pp. 1-3). Hillsdale, NJ: Lawrence Erlbaum.

Hulme, C., & Totdoff, V. (1989). Working memory development: The effects of speech rate, word length, and acoustic similarity on serial recall. Journal of Experimental Child Psychology, 47, 72-87.

Hunt, E., Lunneborg, C., & Lewis, J. (1975). What does it mean to be high verbal? Cognitive Psychology, 7, 194-227.

Hurford, D. P. (1990). Training phonemic segmentation ability with a phonemic discrimination intervention task in second and third grade children. Journal of Learning Disabilities, 23(9), 564-569.

Jackson, M.D., & McClelland, J. L. (1979). Processing determinants of reading speed. Journal of Experimental Psychology (General), 108(2), 151-181.

Karlsen, B., Madden, R., & Gardner, E. (1984). Stanford Diagnostic Reading Test. New York: Harcourt, Brace, & Jovanovich.

Kreiner, D., & Gough, P. (1990). Two ideas about spelling: Rules and word-specific memory. Journal of Memory and Language, 29, 103-118.

Levy, B. A., & Carr, T. H. (1990). Component process analysis: Conclusions and challenges. In T. H. Carr & B. A. Levy (Eds.), Reading and its developmen Component skill approaches (pp. 423-438). New York: Academic Press.

Lovett, M. (1987). A developmental approach to reading disability: Accuracy and speed criteria of normal and deficient reading skill. Child Development, 58, 234-260.

Lundberg, I., Olofsson, A., & Wall, S. (1980). Reading and spelling skills in the first school years predicted from phonemic awareness skills in kindergarte Scandinavian Journal of Psychology, 21, 159-173.

Lyon, G. R. (1994). Frames of reference for the assessment of learning disabilities. Baltimore, MD: Paul Brookes.

Manis, E, Szelszulski, P., Holt, L., & Graves, L. (1990). Variation in component word recognition and spelling skills among dyslexic children, and normal readers. In T. H. Cart & B. A. Levy (Eds.), Reading and its development (pp. 207-259). New York: Academic Press.

Marshall, J. C., & Newcombe, F. (1973). Patterns of paralexia. Journal of Psycholinguistic Research, 2, 179-199.

Martin, R. (1993). Short-term memory and sentence processing: Evidence from neuropsychology. Memory and Cognition, 21(2), 176-183.

Mitchell, D.C. (1982). The process of reading. New York: John Wiley.

Mezynski, K. (1983). Issues concerning the acquisition of knowledge: Effects of vocabulary training on reading comprehension. Review of Educational Research, 53, 253-279.

Moats, L. C. (1993). Spelling error interpretation: Beyond the phonetic/dysphonetic dictionary. Annals of Dyslexia, 43, 174-185.

Morgan, W. P. (1896). A case of congenital word-blindness. British Medical Journal, 2, 1368.

Oakhill, J., & Garnham, A. (1988). Becoming a skilled reader. Oxford, UK: Blackwell

Olson, R., Forsberg, H., Wise, B., & Rack, J. (1994). Measurement of word recognition, orthographic, and phonological skills. In G. R. Lyon (Ed.), Frames of reference for the assessment of learning disabilities. Baltimore, MD: Paul Brookes.

Palincsar, A. (1986). Metacognitive strategy instruction. Exceptional Children, 33(2), 118-124.

Palmer, D., McCleod, C., Hunt, E., & Davidson, J. (1985). Information processing correlates of reading. Journal of Memory and Language, 24, 59-88.

Pennington, b. E, & Smith, S. D. (1988). Genetic influences on learning disabilities: An update. Journal of Consulting and Clinical Psychology, 56, 817-826.

Rohl, M., & Tunmer, W. (1988). Phonemic segmentation skill and spelling acquisition. Applied Psycholinguistics, 9, 335-350.

Shankweiler, D., Crain, S., Brady, S., & Macaruso, P. (1992). Identifying causes of reading disability. In P. Gough, L. Ehri, & R. Treiman (Eds.), Reading acquisition (pp. 145-177). Hillsdale, NJ: Lawrence Erlbaum.

Spalding, R. B., & Spalding, W. T. (1986). The writing road to read. New York: Morrow.

Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. Reading Research Quarterly, 21, 360-407.

Stanovich, K., & Siegel, L. (1994). Phenotypic profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. Journal of Educational Psychology, 86, 1, 24-53.

Sternberg, R. J. (1985). Beyond IQ: A triarchic theory of human intelligence. New York: Cambridge University Press.

Stothard, S. E., & Hulme, C. (1992). Reading difficulties in children: The role of language comprehension and working memory skills. Reading and Writing, 4, 245-256.

Treiman, R. (1993). Beginning to spell New York: Oxford University Press.

Treiman, R., Goswami, U., & Bruck, M. (1990). Not all nonwords are alike: Implications for reading development and theory. Memory and Cognition, 18(6), 559-567.

van den Bos, K. (1989). Relationship between cognitive development, decoding skill, and reading comprehension in learning-disabled Dutch children. In P. G. Aaron & R. M. Joshi (Eds.), Reading and writing disorders in different orthographic systems (pp. 75-86). Boston, MA: Kluwer Academics.

Vellutino, E R., Scanlon, D., & Tanzman, M. (1994). Components of reading ability: Issues and problems in operationalizing word identification, phonological coding, and orthographic coding. In G. R. Lyon (Ed.), Frames of reference.for the assessment of learning disabilities (pp. 279-329). Baltimore, MD: Paul Brookes.

Weber, R. (1970). A linguistic analysis of first-grade reading errors. Reading Research Quarterly, 5, 427-451.

Wechsler, D. (1991). Wechsler Individual Achievement Tests. San Antonio, TX: The Psychological Corporation.

Wolf, M. (1991). Naming speed and reading: The contribution of the cognitive neuroscience. Reading Research Quarterly, 26, 123-141.

Woodcock, R. W. (1991). Woodcock Language Proficiency Battery-Revised (English Form). Chicago, IL: The Riverside Publishing Company.

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