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Diagnosis and Treatment of Reading Disabilities Based on the Component Model of Reading

An Alternative to the Discrepancy Model of LD

P. G. Aaron

Indiana State University

R. Malatesha Joshi

Texas A&M University

Regina Gooden

St. Thomas University

Kwesi E. Bentum

Bi-County Special Education Cooperative, Sterling, Illinois

Currently, learning disabilities (LD) are diagnosed on the basis of the discrepancy between students' IQ and reading achievement scores. Students diagnosed with LD often receive remedial instruction in resource rooms. The available evidence suggests that the educational policy based on this discrepancy model has not yielded satisfactory results. This has led researchers to try other paradigms, such as the component model and response to intervention, for dealing with children with reading disabilities. The component model of reading (CMR) described in the present article identifies the reading component that is the source of reading difficulty and targets instruction at that component. Study 1 describes the CMR and reports on its validity. Study 2 describes the successful outcome of a 7-year CMR-based reading instruction program. Compared to the discrepancy model, the CMR has demonstrated several advantages.

Keywords: *component model of reading; discrepancy model of learning disability; cognitive domain; psychological domain; ecological domain; differential diagnosis; word-recognition training; comprehension strategy training*

Nearly 38% of the children in U.S. fourth-grade classrooms have been identified as reading below the basic reading level (National Center for Education Statistics, 1998). A substantial number of these children have been identified as having learning disabilities (LD) and receive special instruction in resource rooms. There is no uniform educational policy for teaching the remaining poor readers, who are said to fall through the cracks. Therefore, the LD construct, when applied in its present form, leads to many poor readers being "left behind."

In spite of the fact that schools have implemented the LD-based policy for nearly 40 years, many studies have shown that the existing diagnostic procedure is unreliable and that the instructional methods are ineffective. Because of this disappointing outcome, educators, researchers, and advocacy groups are trying to find better methods for the identification and treatment of reading problems. The *response to intervention model* is one such approach (Bradley, Danielson, & Doolittle, 2005;

D. Fuchs, Mock, Morgan, & Young, 2003), and the *component model of reading* presented in this article is yet another approach. Whereas simpler but effective ways of identification and remediation of reading difficulties may be possible than the ones that are used in today's schools, the present LD policy implementation appears to be unable to rid itself of its tradition due to the fact that it is ensnared in its past history.

The existence of the condition known today as LD was recognized almost 100 years ago when it was noticed that some children who apparently were intelligent experienced a great deal of difficulty in learning to read. During the early period of its history, this condition drew the attention of many investigators, many of whom were physicians, who described it by labels such as *word blindness* (Hinshelwood, 1895; Morgan, 1896), *strephosymbolia* (Orton, 1937), *dyslexia*, attributed to Dr. Rudolph Berlin, and finally, *learning disability* (Kirk, 1963). In general, physicians tended to describe reading difficulty in

neurological terms, but educators viewed it as an educational problem. In spite of these early differences in orientation, reading difficulty came to be recognized as a serious pedagogical problem that affected many children. This realization is evident from the wide acceptance of the term *learning disabilities*, which was introduced into the educational scene in 1963 by Samuel Kirk. The concept of LD gained official status in 1975 with the passing of the Education for All Handicapped Children Act. The official recognition that LD are a form of disability made the privileges and accommodations to which individuals with disabilities are entitled accessible to individuals with reading problems. It became necessary, therefore, to develop an objective means of identifying and diagnosing LD, particularly in children in the school systems. Because LD are defined in terms of average or above-average intelligence but below-average reading performance, it appeared that a logical means of diagnosing LD would be to assess the IQ of children who are suspected of having LD and compare their reading achievement scores with their IQ scores. If an individual's IQ was in the average range but the reading achievement score was noticeably lower, that individual was diagnosed as having LD. This way of identifying LD has, therefore, come to be referred to as the *discrepancy model*-based procedure. In many schools, children identified as having LD on the basis of this discrepancy are placed in resource rooms and receive special instruction, although recently there has been a move to teach children with LD in the general education classroom.

As the years passed, it became possible to take a closer look at the validity and utility of the discrepancy model and, as a result, it has come to be realized that the model, as it is used for diagnosing and treating reading problems, has failed to deliver the expected academic benefits (Aaron, 1997b). The disappointing outcome of the discrepancy model-based educational policy naturally impelled researchers to examine the potential reasons for its failure (e.g., Lyon et al., 2001). This scrutiny of the LD program identified many reasons for the disappointing outcome, but the most formidable problem faced by the discrepancy model is that children who are identified as having LD and provided with instruction in resource rooms have failed to show improvement in their reading skills, as documented by several researchers (Bentum & Aaron, 2003; Carlson, 1997; D. Fuchs & Fuchs, 1995; Haynes & Jenkins, 1986; Moody, Vaughn, Hughes, & Fischer, 1998; Wleklenski, 1993). In fact, the studies by Wleklenski (1993) and Bentum and Aaron (2003) found a significant decline in the verbal IQ and spelling scores of children taught in resource rooms—an instance of the “Matthew effect.”

There could be many reasons for the lack of success of resource room LD instruction. Among these are the high pupil-teacher ratio and the placement of children

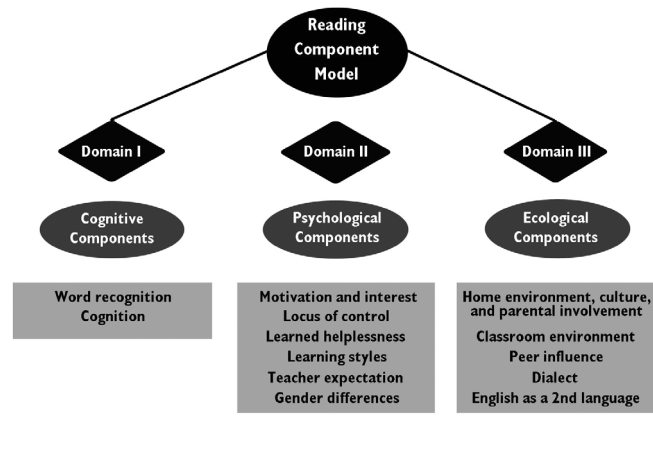
with behavioral and emotional problems as cohorts of children with LD in the resource room. The research reports mentioned earlier, however, have indicated that the primary reason for the poor outcome of LD instruction is the unsystematic way in which children are taught in many of the resource rooms. More specifically, there is a lack of uniformity in the instructional methods for teaching children with LD, as the discrepancy model does not provide the LD teachers with directions for instruction. In a review study, Vaughn, Levy, Coleman, and Bos (2002) synthesized studies conducted on students with LD and reported that the quality of reading instruction was poor, with excessive time allocated to seatwork and worksheets but limited time given to reading itself. After observing what went on in resource rooms, Haynes and Jenkins (1986) and Moody et al. (1998) noted that the quality of reading instruction provided was not based on a skills approach, but was driven by the whole-language philosophy and relied mainly on group work, which disregarded individual needs. These observations lead to the question, “What are the needs of poor readers, and which skills should be addressed in resource rooms?”

Several studies have shown that not all poor readers are alike and that reading difficulties are varied in origin (Aaron, Joshi, & Williams, 1999; Catts, Hogan, & Fey, 2003; Swanson, 1999; Swanson, Howard, & Saez, 2006). To be more specific, from a cognitive perspective, some children may have difficulty at the word recognition level, others at the comprehension level, and still others may be poor readers because of limited vocabulary. It is reasonable to expect instruction in word recognition to improve the performance of the first type of readers, comprehension instruction to help the second type of readers, and vocabulary instruction to help the third type of readers. Effective instruction, therefore, requires knowledge about what skills make up the reading process and how to identify the weak component that leads to reading difficulty. The component model of reading provides a tentative answer to these requirements (Aaron, 1997a; Aaron & Kotva, 1999; Joshi & Aaron, 2000). More specifically, the component model of reading identifies the weak component that underlies reading difficulties and focuses remedial efforts at this weak component. A *component* is defined as an elementary information processing system that operates on internal representations of objects and symbols. To be considered a component, the process should be demonstrably independent of other cognitive processes (Sternberg, 1985).

The Component Model of Reading

The literacy performance of children in the classroom is affected not only by cognitive factors, but also by

Figure 1
Overview of the Component Model of Reading



environmental and psychological factors (e.g., Berninger, Dunn, Lin, & Shimada, 2004; Dudley-Marling, 2004). The component model of reading is broadly conceptualized and takes this fact into account. Components that have an influence on the acquisition of literacy skills are organized into three domains and constitute the component model of reading (CMR). The three domains of the CMR are (a) the cognitive domain, (b) the psychological domain, and (c) the ecological domain.

The *cognitive domain* of the CMR has two components: word recognition and comprehension. The *psychological domain* includes components such as motivation and interest, locus of control, learned helplessness, learning styles, teacher expectation, and gender differences. The *ecological domain* includes the components of home environment and culture, parental involvement, classroom environment, dialect, and speaking English as a second language. It has to be added that the components of the cognitive domain can satisfy the condition of independence fairly well, whereas the components of the psychological and ecological domains do not satisfy this requirement nearly as well. Nevertheless, the CMR provides a framework for teachers and psychologists for navigating their course through the various assessment formats and determining remedial strategies for use in the classroom. The importance of these psychological and environmental factors has been recognized by educators for a long time and has been also empirically documented (Berninger et al., 2004; Dudley-Marling, 2004). The three domains of the CMR and their constituent components are shown in Figure 1.

When applied to literacy acquisition, the CMR envisages that a child can fail to acquire satisfactory levels of literacy skills because of deficits in any component in any one of these three domains. The focus of the present article is the constructional and instructional validity of the

components of the cognitive domain of the CMR; it does not address the psychological and environmental domains.

In the first part of the article, the nature of the components of the cognitive domain of the CMR is described, along with supporting evidence that authenticates the validity of the model. In the second part of the article, the outcome of the implementation of instruction based on the CMR during the course of a 7-year period is compared with the outcome of LD resource room-based reading instruction.

The inspiration for the CMR comes from a report by Gough and Tunmer (1986) who presented a simple view of reading by noting that the two most important constituents of reading are the ability to decode words and the ability to comprehend text. Gough and Tunmer expressed this proposition in the form of a formula: $R = D \times L$, wherein R is reading comprehension, D is decoding, and L is linguistic comprehension, as assessed by a test of listening comprehension. They set the value of each variable to range from 0 to 1. It follows, then, if D is 0, then R is 0; if L is 0, then R is also 0. The validity of the formula was tested by Hoover and Gough (1990) by tracking and assessing 254 English-Spanish bilingual children from Grades 1 through 4. The investigators found that a substantial proportion of the variance in reading comprehension was accounted for by the product of decoding and listening comprehension (Grade 1, $r = .71$; Grade 2, $r = .72$; Grade 3, $r = .83$; Grade 4, $r = .82$).

The linguistic comprehension component, as used in the Gough-Tunmer formula, represents listening comprehension and is assessed by using a test of listening comprehension. However, it should be noted that the correlation between reading comprehension and listening comprehension is high, usually in the vicinity of .80, particularly for children in upper elementary grades and adolescents, so that listening comprehension can be used as a predictor of reading comprehension (Joshi, Williams, & Wood, 1998; Kintsch & Kozminsky, 1977; Palmer, McCleod, Hunt, & Davidson, 1985). The other component, word recognition, includes two processes: (a) the ability to decode written words, and (b) the ability to decode words instantly and automatically. Developmental studies of reading show that many children are slow in decoding written words until they reach the third grade or so, by which time most children have learned to decode written words instantly and automatically, a process traditionally referred to as *sight word reading*.

The simple view of reading, as is true of most psychological theories, has not gone unchallenged. Duke et al. (2006), for example, have faulted the simple view of reading by noting that it has left out many variables, including vocabulary knowledge, motivation, and the cultural background of the reader. Nevertheless, in defense of the

simple view of reading, it has to be noted that Gough and Tunmer (1986) did not imply that reading is a simple process but that the information-processing aspect of reading can be explained simply by the product of D and L. Of course, it is common knowledge that factors such as vocabulary knowledge, motivation, and the amount of reading that takes place at home are all factors that contribute to reading achievement.

Duke et al. (2006) also stressed that speed of processing is another important element left out of the simple view of reading. After the publication of the report of the National Reading Panel (2000), this aspect of reading, which is included in reading fluency, has received a considerable amount of research attention. There is unanimous agreement among educators and researchers that fluency is a hallmark of good readers. What is not agreed upon is whether speed of processing is a component that is independent of decoding skill. Studies by Adlof, Catts, Hogan, and Little (2005), Cho and McBride-Chang (2005), and Vukovic and Siegel (2006) have shown that speed of processing adds little variance to reading performance that is not explained by word recognition and comprehension skills. This conclusion can be backed up by the observation that all poor decoders are also slow readers and that slow readers, in general, are also poor decoders, thereby making room for accommodating fluency under the word recognition component. Therefore, speed of processing is included in the present study as a further test of its contribution to reading comprehension.

The CMR, as described in the present article, is an elaboration of the simple view of reading created by adding psychological and environmental factors to the simple view of reading. The present investigation, however, is limited only to the cognitive domain of reading and does not include the psychological and environmental factors. The motivation is to compare the effectiveness of the diagnostic and instructional practices based on the discrepancy model and the CMR.

Evidence for concluding that reading is made up of two cognitive components, word identification and comprehension, comes from three sources: experimental, developmental, and neuropsychological studies.

Experimental Studies of Reading Components

In a study of undergraduate students, Jackson and McClelland (1979) found that reaction time and comprehension in a letter-matching task accounted for nearly all of the variance seen in reading ability. Similar results were reported by Palmer et al. (1985). More recently, Catts et al. (2003), in a longitudinal study of children in early elementary grades, reported a low correlation of .16 between word

recognition and listening comprehension, indicating their relative independence. The independent nature of word recognition and comprehension was also reported by Carver (1998), Catts and Kamhi (1999), and de Jong and van der Leij (2002). Other investigators have described word recognition skills and comprehension skills as lower level and higher level processing skills, respectively (Hannon & Daneman, 2001; Pressley, 2000). The verbal efficiency theory (Perfetti, 1988) captures the essence of the bicomponential nature of reading by stressing the independent role of verbal efficiency and text comprehension.

Neuropsychological Studies of Reading Components

Neuropsychological studies have indicated that some patients could comprehend individually presented words much better than they could pronounce them, whereas some other patients could decode such words but had diminished ability to comprehend them. These instances of reading failures, which have been labeled *deep dyslexia* and *surface dyslexia*, respectively, indicate that word recognition and comprehension are independent components of reading (Coltheart, Patterson, & Marshall, 1980; Patterson, Marshall, & Coltheart, 1985). This conclusion is further supported by recent neuroimaging studies. For instance, Poldrack and Wagner (2004), using neuroimaging techniques, have shown that different cortical structures are involved in the retention of phonological information and semantic information in working memory. Using the functional magnetic resonance imaging (fMRI) technique, McDermott, Watson, and Ojemann (2006) reported robust semantic and phonological processing differences in underlying frontal and temporal language networks.

Developmental Studies of Reading Components

Frith and Snowling (1983) reported that some children with autism can read aloud much better than they can comprehend, whereas children with dyslexia can comprehend sentences better than they can decode nonwords. Studies on children with dyslexia and hyperlexia also showed that comprehension and decoding skills are dissociable (Aaron, Franz, & Manges, 1990; Healy, 1982). It has also been reported that a substantial number of poor readers have deficits in decoding skills but have better comprehension skills, as determined by their performance on tests of listening comprehension (Crain, 1989; Shankweiler et al., 1995). The existence of children who can decode written words fairly well but cannot comprehend what they have read is less well publicized, even though educators have recognized the existence of this

Table 1
Number of Children Participating
in Study 1 by Grade and Gender

Gender	Grade			
	2	3	4	5
Boys	24	29	30	26
Girls	26	35	25	19
Total	50	54	55	45

type of poor readers for a long time and have described them as “word callers.” Research has indicated that about 10% of poor readers fall into this category (Stothard, 1994; Yuill & Oakhill, 1991). According to Mirak, Scarborough, and Rescorla (2003), some children who had average word-level processing skills in earlier grades turned out to have deficits in reading comprehension when they reached fourth and fifth grades, probably because the ability to comprehend what is read emerges later in development. This study further indicated that the two components of reading show different developmental trajectories and, therefore, it is important to diagnose which of the two components is lagging behind, so that appropriate remedial instruction can be provided.

This brief survey of studies indicates that word recognition and comprehension are separable component skills of the cognitive domain of reading. The independent nature of components, therefore, carries with it the potential for resulting in poor readers of more than one type. Study 1 was conducted to ascertain the validity of this bicomponential nature of reading in elementary school children and to estimate the relative contribution of word recognition and comprehension skills to the reading process. It was noted earlier that speed of processing has also been suggested by some researchers to be a major contributor to reading performance. For this reason, the contribution of speed of processing was also investigated in Study 1.

Study 1: Validation of the CMR

Method

Participants

Teachers of children from Grades 2 through 5 from seven different schools in the southwestern part of the United States were asked to identify children in their classrooms who were willing to participate in a testing project. Subsequently, reading-related tests were administered to a total of 204 children. These children came from

families that can be broadly defined as middle class. About 10% of the children were from minorities, but all children used English as their language of communication at home. Demographic details regarding these children are shown in Table 1.

Procedure

All the children completed the Reading Comprehension subtest from the *Gates-MacGinitie Test of Reading* (MacGinitie & MacGinitie, 1989). Their Listening Comprehension and Word Attack skills were assessed by using subtests from the *Woodcock Language Proficiency Battery* (Woodcock, 1991). Moreover, an informal letter naming task was also administered to these children as a measure of processing speed. The letter naming task was constructed by typing 40 lowercase letters of the alphabet, which were printed in 16-point font size. The children were asked to name the letters as fast as they could without making mistakes. They were asked to ignore any error they thought they made and to move on to the next letter. Their responses were taped, and later the time they took was computed. During data analysis, errors of omission and commission were disregarded, and only the naming time was taken into account. Letter naming was used instead of word naming to minimize the confounding effects of decoding skills. All the tests were administered individually by graduate students working toward their master’s or PhD degree in reading education. The results of these tests are shown in Table 2.

Results

To assess the relative contribution made by word attack, listening comprehension, and letter naming speed to reading comprehension, the data were analyzed using a multiple regression procedure. The purpose of using multiple regression analysis was to learn about the relationship between the independent predictor variables and the dependent variable. In this study, only three predictor variables were used, although many other variables belonging to the psychological and ecological domains as well as the instructional method used in the classroom could have contributed to reading comprehension. The present study, however, was designed to test the validity of the cognitive components of the CMR and, therefore, only measures of decoding, linguistic comprehension, and letter naming speed were included.

The relative independence of comprehension and decoding skills is expected to minimize the problem of multicollinearity. Furthermore, visual inspection of the

Table 2
Means and Standard Deviations of Reading-Related Test Scores by Grade

Test	Grade							
	2		3		4		5	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
GMG Reading Comprehension	45.45	19.77	51.00	19.50	47.98	22.0	61.80	20.68
WLPB Listening Comprehension	100.51	11.39	107.61	18.59	110.23	16.38	113.48	16.22
WLPB Word Attack	104.61	17.13	104.91	17.18	109.36	16.53	107.70	18.16
Letter naming speed ^a	33.67	9.35	32.39	8.61	25.70	5.0	23.88	8.4

Note: GMG = *Gates-MacGinitie Test of Reading* (MacGinitie & MacGinitie, 1989) normal curve equivalent score, *M* = 50, *SD* = 10; WLPB = *Woodcock Language Proficiency Battery* (Woodcock, 1991) standard score, *M* = 100, *SD* = 15.

a. Time in seconds taken to name 40 letters.

Table 3
Multiple Regression Analysis: R^2 Values and Beta Weights of Reading Components by Grade

Component	Grade			
	2 ^a	3 ^b	4 ^c	5 ^d
R^2	0.475	0.462	0.470	0.631
Listening comprehension				
β	0.37	0.36	0.50	0.41
Decoding				
β	0.31	0.25	0.27	0.40
<i>p</i>	.004	.046	.040	.001
Letter naming speed				
β	-0.25	-0.31	-0.28	-0.16
<i>p</i>	.094	.009	.012	.002

a. *n* = 50.

b. *n* = 54.

c. *n* = 55.

d. *n* = 45.

Table 4
Multiple Regression Analysis: Contributions of Listening Comprehension, Decoding, and Letter Naming Speed to Reading Comprehension by Grade

Grade	Listening Comprehension × Decoding	Letter-Naming Speed
2 ^a	37	11
3 ^b	38	8
4 ^c	40	7
5 ^d	41	2.5

Note: All values expressed as percentages.

a. *n* = 50.

b. *n* = 54.

c. *n* = 55.

d. *n* = 45.

data indicated that there were no outliers, thereby reducing the risk of biased regression coefficients. The results of the regression analysis are shown in Tables 3 and 4. Multiple regression analysis showed that the variance accounted for by products of listening comprehension and decoding ranged from 37% to 41% and increased progressively from Grade 2 through 5. The variance accounted for by letter naming speed ranged from 11% to 2.5%, decreasing progressively from Grade 2 through 5.

Discussion

A review of studies that investigated the relationship between IQ and reading achievement scores shows that the correlation coefficient between these two variables ranged from .30 to .54 (Stanovich, Cunningham, & Feeman, 1984). This means that IQ can predict about 25% of the variability seen in reading achievement. The present study shows that the two components of the CMR (viz., listening comprehension and decoding) can predict from 38% to 41% of the variability seen in reading comprehension.

Apart from decoding and comprehension, speed of processing has been claimed to be yet another independent variable that affects reading performance (Wolf & Bowers, 1999). Speed of processing cannot be ignored because it is an important ingredient of information processing. Studies that have examined the role of processing speed with reference to the double-deficit hypothesis have concluded that speed of processing does contribute to the variability in reading comprehension, even though its contribution is relatively small. On the other hand, Adlof et al. (2005) noted that fluency need not be added as a separate component to the CMR. This suggestion

is based on a study in which a total of 522 children completed many tests of reading. Statistical analysis of the results indicated that in Grade 2, word recognition and fluency were undifferentiated as independent constructs. In Grade 4, the analysis showed that word recognition and listening comprehension accounted for 97% of the variance, whereas fluency did not explain any of the variance. In Grade 8, word recognition and listening comprehension accounted for all of the variance. In a study of German children, Hawelka and Wimmer (2005) found that rapid naming did not add to the variance already provided by multiletter word naming (i.e., instant word reading). Based on their studies of Chinese-, Korean-, and English-speaking children, Cho and McBride-Chang (2005) concluded that “speed of processing is a basic resource important across all tests of cognitive processing. However, it does not appear to be linked specifically to reading” (p. 13). Vukovic and Siegel (2006), who reviewed the studies on this topic, concluded that “although there are readers who meet the classification of the double-deficit subtype, the existence of a naming speed-only subtype of dyslexia has not been consistently documented” (p. 44). This conclusion appears to be convincing, because poor decoders invariably are also slow processors, indicating that phonological processing skills and speed of processing are intertwined with each other.

In addition to the uncertainty about the independent status of reading speed, the present data show that there is a trend for the effect of speed on reading performance to decline as children move up in grade. The present study shows that the contribution of speed of processing to reading varies from 2.5% to 8% depending on grade, with a tendency to decline in higher grades. By the time they reach Grade 5, children become proficient in instantly identifying written words, which also makes it difficult to isolate the effect of fluency from that of word recognition. That is, individuals who have good word recognition skills (i.e., sight word readers) tend to be fluent readers and vice versa. Several studies have shown that the ability to identify words instantly (sight word reading) is not an isolated skill, but is built on grapheme–phoneme conversion skills (Aaron, Joshi, Ayotollah, et al., 1999; Ehri, 1992). These studies have shown that poor decoders are also dysfluent readers, and conversely, slow readers are often deficient in decoding skill.

The results of the validation study, together with the experimental, developmental, and neuropsychological studies previously mentioned, lend support to the validity of the component model of reading by showing that word

recognition and linguistic comprehension are two major but independent components of cognitive domains of reading. Fluency, on the other hand, makes inconsistent contributions to reading comprehension, accounting for a negligible 2.5% of the variance at the fifth-grade level.

Study 2: CMR-Based Instruction Versus Discrepancy-Based Instruction

In this study, the educational outcome of seven 1-year programs of diagnosis and instruction of reading disabilities based on the CMR is compared with the results of the traditional LD diagnosis and instruction carried out in resource rooms.

The simple view of reading continues to be influential in reading research even though its wholesomeness has been questioned by some (e.g., Duke et al., 2006). As noted in the introduction, the theoretical validity of the simple view of reading has been fairly well established by experimental, neuropsychological, and developmental studies. However, its instructional utility has not been fully explored. If its usefulness in remedial reading instruction can be demonstrated, the CMR can offer an alternative to the discrepancy model as well as to the recently proposed response to intervention (RTI) approach. Study 2 was designed to compare the effectiveness of CMR-based instruction with the outcome of the traditional LD program. With this goal in mind, Study 2 was carried out with the intention of answering the following four questions:

1. Is the word attack gain score of the children in the treatment group who received word recognition training under the CMR significantly greater than the word attack gain score of the children in the traditional LD comparison group?
2. Is the word attack gain score of the children in the treatment group who received comprehension training under the CMR greater than the word attack gain score of the children in the LD comparison group?
3. Is the comprehension gain score of children in the treatment group who received word recognition training under the CMR greater than the comprehension gain score of children in the LD comparison group?
4. Is the comprehension gain score of children in the treatment group who received comprehension training under the CMR greater than the comprehension gain score of the children in the LD comparison group?

Method

Participants

The reading achievement scores of a total of 330 children from Grades 2 through 5 were used for comparing the relative effectiveness of instruction based on the CMR with that of instruction based on the traditional LD model. Of these 330 children, 171 received remedial reading instruction based on the CMR (treatment group), and the remaining 159 children received instruction in LD resource rooms in their respective schools (comparison group).

Treatment Group

The 171 children in the treatment group were enrolled in a remedial program named READ (Reading for Excellence in Academic Development). The READ program is intended for children from Grades 2 through 5 and is conducted on the premises of the College of Education and supervised by one of the authors of the present article. During the month of July, starting from the year 1998, an announcement was placed in the local newspaper inviting parents who thought that their children were at risk for reading problems to enroll their children in a remedial reading program. Parents brought their children for an hour of instruction after school hours, 4 days a week, for one semester. The children were taught in small groups of four to five by seven or eight graduate students who were enrolled in the School Psychology program.

Children in the treatment group were from seven different cohorts taught during the course of 7 years. These children came from a midsize Midwest town and were mostly middle class. Most (90%) of these children were European American, 8% were African American, and 2% were of East European or Arab origin. Details of their distribution based on gender and grade level are shown in Table 5. The children in the treatment group were matched with children in the comparison group for grade level, gender, and socioeconomic status (SES).

Comparison Group

Children in the comparison group were from three different geographical regions of the United States: Oklahoma, Illinois, or the state of Washington. The reading scores of children with LD before and after resource room instruction were obtained from special education files kept in their respective districts. These files covered a period of 6 years, from 1998 through 2004. In the LD programs, posttests were administered 3 years after the administration of the pretests. The pretest and posttest word attack scores were available for 62 children, and

Table 5
Distribution of Children in Study 2 by Gender, Grade, and Type of Instruction Received

Grade	Treatment Group ^a		Comparison Group ^b	
	Boys	Girls	Boys	Girls
2	60	16	65	10
3	35	10	35	9
4	25	5	15	5
5	15	5	17	3

a. $n = 171$; 125 children received word recognition instruction; 46 children received comprehension instruction.

b. $n = 159$.

reading comprehension scores for 97 children, making up a total of 159 LD comparison children. The word attack and reading comprehension scores of the LD group children had been obtained by the school psychologists in their schools by administering the *Woodcock-Johnson Tests of Achievement* (Woodcock, 1989; Woodcock, McGrew, & Mather, 2001). One might expect that the school records would contain both word attack and comprehension scores of all the 159 children in the comparison group. This, however, was not the case. The psychologists who administered the tests in the schools were looking only for a discrepancy between the reading comprehension and the IQ scores, and once they saw a significant discrepancy between IQ and reading comprehension, they terminated their assessment procedure and did not administer any other reading-related tests. The main objective of the school psychologist was to categorize the at-risk reader as having LD or not having LD, not to look for the source of the reading difficulty of the child.

The LD programs reported here did not classify children on the basis of their weakness and did not target instruction at the weakness. In this respect, the LD programs differed from the CMR-based instruction. It was difficult to gather detailed information about the nature and type of remedial instruction that was provided to children in the comparison group. The teachers could give only rough descriptions of their instructional procedures. However, the available information shows that all these children received instruction for at least 1 hour per day during the school days. The method of instruction varied from school to school. Some teachers worked on improving word recognition skills by asking the children to read the assigned material. When the children failed to recognize a word or could not read the word correctly, the teacher supplied the word. Other teachers used the time for helping the children with their classroom writing assignment. The number of children with reading disabilities in the resource room varied from three to seven.

The children in the comparison group were matched, grade by grade, with those in the treatment group on the basis of their pretest scores on reading-related tests. Outliers in both groups were eliminated by visual inspection. The ethnic composition and SES of this group of children was comparable to those in the treatment group, except that nearly 2% of the children in the comparison group were Native American and Asian children. The distribution of comparison children according to gender, grade, and type of reading instruction received is shown in Table 5.

Design and Procedure

Based on the nature of the reading component they showed a deficit in (word recognition or comprehension), 125 children in the treatment group received word recognition training, and 46 children received reading comprehension strategy training. As for the comparison group, pretest and posttest word attack scores were available for 62 children and reading comprehension scores for 97 children, making up a total of 159 LD comparison children.

The results reported for the treatment group come from remedial instruction based on the CMR carried out over a period of 7 years, from 1998 through 2005, with seven different groups of children. The CMR-based diagnosis and instruction were carried out every year by a set of new graduate students who were in the School Psychology program of the university. These graduate students had taken courses in reading disability and received training in remedial instruction before the beginning of the READ program. The remedial instruction program started in the month of August and ended by mid-December. Parents brought their children to the College of Education building for 1 hour per day after school hours, 4 days per week. The total number of children served during any 1 year ranged from 20 to 28. As the number of graduate students in the School Psychology program ranged from 7 to 10, it was possible to carry out reading instruction in small groups of 3 to 5 children per group.

On the 1st day, when the parents brought their children, the READ program was explained to them. They were told that the program would not categorize their children as poor readers with LD and poor readers without LD, but that by administering reading-related tests, the weak area of the child (word recognition, vocabulary, or comprehension) would be identified and remedial instruction would target the weak area. The parents were also told that at the end of the semester, children would be given posttests, and information about the progress (or lack thereof) of the children would be made available to them.

After the pretests were given, the graduate students and the supervisor (one of the authors) met and discussed each case and determined a plan of action. On the basis of the pretest scores, children were placed in one of two groups—the word recognition training group or the comprehension training group (see the next section for more details). After this, the supervisor and one or two graduate students met with the parents or guardian of each child and explained the pretest profile of their child and the plan of instruction. During this interview with the parents, noncognitive reasons for the reading problem, such as home environment and parental involvement in the child's reading, were also explored, and, when necessary, appropriate recommendations were made. All information, including test scores, was kept confidential. During the course of the instructional period, the supervisor moved from group to group and observed how the instruction was proceeding. Once every 3 weeks, a staffing meeting of the supervisor and graduate instructors was held, at which time the progress of each child and the problems encountered were discussed.

In the past, behavioral problems were minimal because instruction took place in groups of three, four, or five children. When behavior problems cropped up, the instructors, being school psychologists, used behavior modification techniques to minimize the problems. On occasions such as Halloween, Thanksgiving, and Christmas season, pizza parties were given and children had games to play.

Tests Administered

The following tests were administered as pretests, but only selected tests from this list were given as posttests:

1. From the *Woodcock Language Proficiency Battery* (WLPB; Woodcock, 1991)
 - Listening Comprehension
 - Passage (reading) Comprehension
 - Word Attack
 - Oral Vocabulary (synonyms and antonyms)
 - Reading Vocabulary (synonyms and antonyms)
2. From the *Stanford Diagnostic Reading Test* (SDRT; Karlson & Gardner, 1996)
 - Reading Comprehension
3. *Test of Word Reading Efficiency* (TOWRE; Torgesen, Wagner, & Rashotte, 1999)
4. From the *Comprehensive Test of Phonological Proficiency* (CTOPP; Wagner, Torgesen, & Rashotte, 1999)
 - Elision
 - Rapid color naming
 - Rapid letter naming

Before standardized tests of word reading and phonological proficiency (TOWRE and CTOPP) became available, a set of informal tests of letter naming, nonword reading, word reading, and spelling, which were developed at the Educational Psychology laboratory, were administered to the children.

Differential Diagnosis

The logic behind the differential identification of the weak component and the assignment of the children to different instructional groups is based on the close relationship between listening comprehension and reading comprehension. Reading comprehension and listening comprehension are highly correlated with each other, the coefficient sometimes being as high as .78 (Palmer et al., 1985), which led Palmer et al. (1985) to propose that reading comprehension can be predicted almost perfectly by a listening measure. If a child's listening comprehension is in the average range and higher, but his or her reading comprehension is lower, then the reading difficulty is most likely due to a weakness in the word recognition component. Invariably, the child will have below-average word attack and spelling scores. Children with a weak word recognition component receive instruction in word recognition skills. In contrast, if the child has below-average scores on tests of both reading and listening comprehension, but has word attack scores in the average range, then his or her impediment to reading is the weak comprehension component. Such a child will receive instruction in comprehension strategies. Children who have deficits in both word recognition and comprehension skills are started off with word recognition skills training. If and when they have attained sufficient word recognition skills, they are moved to the comprehension group.

Assignment to different instructional groups was based on the children's performance on tests of reading comprehension, listening comprehension, and word attack. Furthermore, scores from the TOWRE, CTOPP, and informal nonword reading, spelling, and letter naming tests were also used. Information obtained from these tests is helpful when a child cannot be assigned unambiguously to either of the instructional groups.

In the READ program, the following criteria are used for diagnosis of a word recognition deficit: the child's listening comprehension score is in the average range (standard score 90–110), but his or her reading comprehension score is two standard errors below this range (80 and below) on one of the tests of reading comprehension (WLPB or SDRT). The word attack scores of these children tend to be very similar to their reading comprehension scores. That is, a child with

a word attack standard score of 80 is unlikely to have a reading comprehension score much above 80. This diagnosis of a weak word recognition component should be further confirmed by poor spelling and slow word reading, as assessed by the TOWRE. The child is then assigned to the word recognition instruction group.

Conversely, if a child's word recognition score (from the WLPB Word Attack test) is in the average range (standard score 90–110), but his or her listening and reading comprehension scores are noticeably below the word attack score (80 or below), then the deficit is in the comprehension component. A child with such a profile is assigned to the comprehension instruction group.

There are also children who are weak in both word recognition and comprehension skills. Theoretically speaking, such children need instruction in both word recognition and comprehension. However, experience with children who have this profile has led to the conclusion that word recognition skills should be brought up to the functional level before the child can be expected to comprehend what he or she reads. If words cannot be recognized and understood, the passage in which these words appear also cannot be understood.

Often, children with below-average comprehension skills also have limited vocabulary. In the READ program, vocabulary training is provided as part of comprehension training, because words encountered in context are more readily learned and retained than words learned in isolation (Carlisle & Katz, 2005)

Occasionally, some children have reading comprehension scores that are higher than their listening comprehension scores. This is a profile that is opposite to the one seen in children with reading disabilities. Research has shown that children with this type of profile invariably have difficulty with sustained attention (Aaron, Joshi, Palmer, Smith, & Kirby, 2002). This is because listening is more attention demanding than reading. The READ program does not have a provision to deal directly with attention-related difficulties. Inconsistent attention is dealt with by requiring children to summarize, in one or two sentences, what they have read as material for strategy instruction. This strategy seems to minimize the attention problem of some children and has produced satisfactory results. In general, inconsistent attention has not been a major impediment to instruction, probably because of the small size of the reading groups. Some children in the READ group have also been taking medication for attention-deficit/hyperactivity disorder (ADHD).

Children whose reading shows a weak word recognition component are also invariably slow in reading. These children are described as lacking in fluency, and some researchers have advocated that direct instruction is

necessary for improving the reading fluency of such children. As discussed earlier, the existence of poor decoders who are nevertheless fast readers has not been demonstrated unequivocally (Vukovic & Siegel, 2006). Furthermore, studies of fluency training have provided mixed results, indicating that rereading improves the speed of processing practiced passages but may not transfer to new passages. The READ program, though not denying the importance of fluency for reading, considers fluency as a *product* and not a *process* and does not provide special training that is aimed at improving reading speed per se. Children are simply provided with more opportunity to read. Furthermore, during word recognition and comprehension strategy training, children scan the passages and reread words and sentences with which they have difficulty. It is expected that when word recognition skill improves, a concomitant increase in speed would be the outcome.

It is not uncommon that some children cannot be assigned to any one of the two instructional groups with certainty. Under these circumstances, the child is first assigned to one of the two instructional groups and his or her progress monitored. Based on the outcome of such trial teaching, the child either continues in the same group or is transferred to the other group.

Instructional Procedures

Word Recognition Training

As a starting point, children in the READ program who were placed in the word recognition instruction group received phonemic awareness training. During the initial stages, the instructional procedure followed the steps recommended in the Phoneme Sequencing Program for Reading, Spelling, and Speech (Lindamood & Lindamood, 1998). Following the procedures recommended in this program, the consonant sounds and vowel sounds were introduced using the multisensory approach, followed by the introduction of graphemes and simple words.

After the phonemic awareness training, *The Writing Road to Reading* (Spalding & Spalding, 1990) was used for further training in word recognition. Following the instructions provided in this program, phonograms (graphemes) such as /b/, /c/, and /ough/ were introduced gradually, with the children copying the phonograms and pronouncing them. There are 70 phonograms in this program; about 4 phonograms were introduced in every session. The instructor sounded out a phonogram first and then introduced the word in which the phonogram appeared. The children were asked to say the phonogram

and to copy the word down and then pronounce it. The instructor drew the attention of the children to the word and its meaning. The following day, the words that had been learned the previous day were pronounced again by the instructor, and the children were asked to spell the words by writing them down. The rate of introducing new phonograms depended on how fast the group had learned the previous phonograms. When the phonograms segment was completed, simple sentences using the previously learned words were constructed, and children were asked to read them and copy them. Depending on the progress each child had made, he or she was introduced to simple decodable storybooks.

The READ program is based on the belief that all children, regardless of their IQ, can make progress, albeit to a small degree, and that all poor readers can become better readers. As a result of this policy, we have had a few children who had borderline cognitive abilities. In this category, there were two children with Down syndrome and three others the etiology of whose low cognitive ability was not known. These children experienced difficulty even in learning the letters of the alphabet. The instructional program was, therefore, modified to suit their abilities. First, these children were taught to associate a few pictures with their names. Subsequently, they were taught to associate written words with these pictures "by sight." Once the children had learned the names of about 10 words by sight, they were taught the names of the constituent letters in these words. The method followed could be described as *analytic phonics*. This is in contrast to the *synthetic phonics* approach used to teach the rest of the children in the word recognition group. In the present article, the data of the children who were taught through the analytic phonics method were not used in data analysis.

Comprehension Training

Children in the comprehension training group were taught to use seven strategies that many researchers have found to be useful in promoting reading comprehension skills. The instructional method drew heavily from procedures recommended by researchers such as Brown, Pressley, Van Meter, and Schuder (1996) and Palincsar and Brown (1984). Passages within the reading level of the children were used for comprehension training exercises. Stories that were fewer than two pages long and could be completed within the 45-min session were preferred. Such short stories were helpful in keeping the children motivated, which served as a factor in maintaining attention.

The steps followed in comprehension strategy instruction were as follows:

1. Schema activation (“What do I already know about this?”)
2. Purpose of reading (“What am I reading this for?”)
3. Stop and think (“Am I understanding what I have read?”)
4. Visualize (“Are there maps and pictures that I should look at?”)
5. Seek help (“If I do not know a word, I should raise my hand”)
6. Ask a question (“I should ask the teacher or the author a question”)
7. Summarize (“Can I tell the story in one or two sentences?”)

These seven comprehension strategies were written on blank sheets of paper, and the children were told that they should memorize them and use them as they read.

First, the instructor modeled the process of reading using all the seven strategies.

Strategy 1: Schema activation. Each child in the group was provided with a copy of the story to be read that day. Children were then asked to scan the story, look at the pictures, and highlight the words they did not know. Each child then highlighted or pointed to the words he or she did not know, and the instructor pronounced the words and explained the meaning of these words by embedding them in simple sentences. This initial activity was used as a means of vocabulary development. Following this, the instructor asked the children a few questions and made some remarks that enabled activation of the appropriate schema.

Strategy 2: Purpose of reading. The reader, who was one of the children in the group, was instructed to be aware of the reason for reading the story. Was it about knowing something, for answering questions, or was it for enjoying the story?

Strategy 3: Stop and think. As the reader progressed along, he or she was asked to occasionally stop and think if he or she was understanding what he or she had been reading.

Strategy 4: Visualization. The reader was encouraged to look at the pictures or the maps in the passage and try to relate them to the text at several points as he or she read.

Strategy 5: Seek help. If the child did not know how to pronounce a word or did not know what the word meant,

he or she was asked to raise a hand and ask the instructor for help.

Strategy 6: Ask a question. If the reader had a question, what would he or she ask the author of the story, or the instructor?

Strategy 7: Summarize. The reader was reminded at the beginning, and again periodically, that he or she should be able to tell what he or she had read in one or two sentences. The child had to recall the main idea from memory without looking at the passage or the story. Stressing the summarization requirement is important because it helps to keep the reader’s attention from wandering.

During strategy instruction, one child in the group was the focus of instruction, and other children were encouraged to be actively involved in making comments and seeking help. For instance, any child in the group could remind the target child to look at the map or pictures in addition to asking the meaning of a word in the text. A fact that was learned over the years is that children can learn to recite the seven comprehension strategies but fail to incorporate them when they read a story or a passage. In the READ program, modeling by the instructor has been found to be the most effective way of overcoming this difficulty. This requires the instructor to model the use of the seven strategies before every new lesson is introduced.

In the READ program, there was no special vocabulary instruction group. Vocabulary instruction was introduced through morphemic patterns, prefixes, suffixes, and root words that were used in the comprehension group by asking the children to look at the story and highlight the words they did not know. The instructor pronounced these words and gave their meaning with ample illustrations. Thus, vocabulary instruction was provided in context, with an emphasis on the meaning of the words.

Throughout the 7-year period, the basic format of training remained unchanged. However, in the light of experience gained every year, small changes in instruction were made. For instance, we started the 1st year with the instruction of 10 comprehension strategies. Soon we found that was too many and reduced it to the present 7 strategies. Similarly, during the first 2 years, we spent almost 8 weeks with the Phoneme Sequencing program, but we found that this did not leave much time for reading sentences. As a result, we reduced it to 4 weeks and moved on to *The Writing Road to Reading* immediately after that. We also allotted more time to reading decodable texts after the first 2 years.

Table 6
Pre- and Posttest Word Attack and Comprehension Scores by Instructional Group

Measure	Treatment Group					Comparison Group				
	n	Pretest		Posttest		n	Pretest		Posttest	
		M	SD	M	SD		M	SD	M	SD
WLPB Word Attack						62	86.19	12.55	87.08	11.08
Word recognition training	125	84.66	9.96	90.05	11.41					
Comprehension training	46	98.55	12.08	98.74	12.81					
WLPB Comprehension						97	86.67	14.12	84.90	12.97
Word recognition training ^a	125	88.14	12.40	91.79	12.48					
Comprehension training ^b	46	88.50	9.47	93.54	10.61					

Note: WLPB = *Woodcock Language Proficiency Battery* (Woodcock, 1991).

a. The mean listening comprehension score of this group of children was 102.3. Their reading comprehension score was much lower because of their poor word recognition skills.

b. The mean pretest comprehension score of these children on the *Stanford Diagnostic Reading Test* (SDRT; Karlsen & Gardner, 1996) was 88.21 ($SD = 10.11$). They did not complete SDRT posttests.

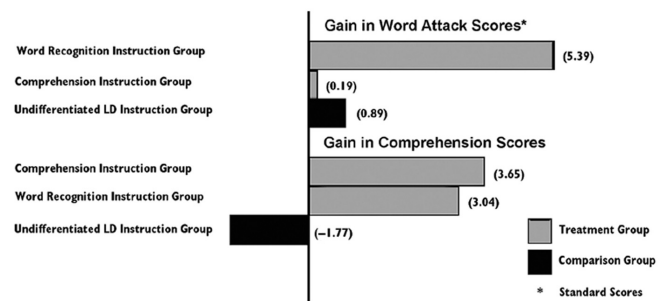
Comparison Group Instruction

Whereas children in the treatment group received differential training according to the nature of their deficit, such instruction had not been provided in the resource rooms. The 15 teachers of the children in the LD comparison group used a variety of procedures to teach the children. Information obtained through informal interviews of the teachers indicates that most of the instructional time in the resource room was used for completing homework assignments. This was so because many of the children with LD were lagging behind in their assignments. There is no evidence that instruction was individualized or that specific instruction focusing on phonology or comprehension was used by most of the teachers. Three teachers reported that they provided phonics training, but it was not clear if the children they taught had weak decoding skills or what specific procedure was followed. In general, teachers were reluctant to discuss their instructional strategy but reported that they provided individual help as needed.

Results

Depending on their weak reading component, children in the treatment group received either word recognition training or comprehension training. Children in the comparison group did not receive such differential instruction in their LD resource rooms. It may be recalled that 125 children from the treatment group received word recognition training, and 46 children from the same group received comprehension strategy training. Of the 159 children in the comparison group, word recognition scores were available

Figure 2
Gains in Word Attack and Comprehension Scores by Treatment and Comparison Groups



Note: LD = learning disabilities.

for 62 children and comprehension scores for 97 children. Pre- and posttest scores of the children in the treatment group and the comparison group are shown in Table 6. Reading scores gained or lost by the two groups are shown in Figure 2.

Four questions were raised to evaluate the relative outcomes of reading instruction based on the CMR and instruction based on the LD discrepancy model. Repeated measures analysis of variance was used to answer these questions.

1. Is the word attack gain score of the children in the treatment group who received word recognition training under the CMR significantly greater than the word attack gain score of the children in the traditional LD comparison group who did not receive differentiated instruction? Of a total of 171 children in the treatment group,

125 received training in word recognition skills. Of the total of 159 children in the comparison group, word attack scores were available for 62 children. The repeated measures statistical analysis showed that the word attack gain scores of the treatment group who received word recognition training were significantly higher than the word recognition gain scores of the comparison group, $F(1, 185) = 7.793, p < .006, \eta^2 = 0.4$. This finding is interpreted to mean that word recognition training provided to children with a deficit in the word recognition component is more effective than the undifferentiated instruction provided to children in resource rooms.

2. *Is the word attack gain score of the children in the treatment group who received comprehension training under the CMR greater than the word attack gain score of the children in the traditional LD comparison group who did not receive differentiated instruction?* Of a total of 171 children in the treatment group, 46 received comprehension strategy instruction. Of the 159 children in the comparison group, word attack scores were available for 62 children. Statistical analysis of data showed no significant differences between the comprehension gain scores of the two groups. That is, both groups did not show any significant improvement in decoding skills, and, therefore, there was no significant difference between the gain scores of the two groups, $F(1, 106) = 0.147, p < .7, \eta^2 = 0.01$. This means that the comprehension training provided to children who were not identified as having a word attack deficit in the READ program did not improve their word attack scores. Children in LD resource rooms likewise did not significantly improve their word attack scores.

3. *Is the comprehension gain score of children in the treatment group who received word recognition training under the CMR greater than the comprehension gain score of children in the traditional LD comparison group who did not receive differentiated instruction?* There were 125 children in the treatment group who received word recognition training. Their reading comprehension scores were compared with the reading comprehension scores of the 97 LD comparison children for whom these scores were available. Statistical analysis showed that the treatment group who received the word recognition training made significant gains in their comprehension scores, which were greater than the gains in comprehension attained by the comparison group, $F(1, 220) = 13.05, p < .001, \eta^2 = 0.56$. Assignment to the comprehension training group was based on their performance on two tests of comprehension, the WLPB and the SDRT. The fact that the children in the READ group who received training in word recognition skills showed significant gains in comprehension could be

seen as an unexpected outcome. However, the comprehension gains of children who received word recognition training are not surprising because the reading comprehension of these children was held down by poor word recognition skills. In other words, poor word recognition skills might have functioned as a factor that limited the reading comprehension of these children. It has to be remembered that these children were placed in the word recognition training group because their listening comprehension was in the typical range but their word attack skill was well below average. Once the constraints of poor word recognition skill were removed, a concomitant improvement in reading comprehension occurred.

4. *Is the comprehension gain score of children in the treatment group who received comprehension training under the CMR greater than the comprehension gain score of the children in the traditional LD comparison group who did not receive differentiated instruction?* There were 46 children in the treatment group who received comprehension strategy instruction. Reading comprehension scores were available for 97 children in the LD comparison group. Statistical analysis showed that the treatment group who received the comprehension strategy training made gains in their comprehension scores that were significantly higher than the comprehension "gain" scores of the comparison group, $F(1, 141) = 3.855, p < .05, \eta^2 = 0.26$. Actually, the children in the LD resource rooms lost 1.77 comprehension standard scores, the difference between their pretest and posttest scores being marginally significant, $t(96) = 1.43, p = .07$, an instance of the Matthew effect. The data suggest that the reading instruction provided in the READ program, which focused on the weak comprehension component, improved comprehension skills, whereas the LD resource room instruction did not.

Discussion

The outcomes of the present study can be summarized as follows:

1. Word recognition training provided to children with a deficit in that component is more effective than the undifferentiated resource room instruction provided to children with LD.
2. Children in the READ group who received training in word recognition skills showed significant gains in comprehension. This is so because poor word recognition skill usually functions as a factor that limits reading comprehension. However, children in the READ group who received comprehension training did not improve in their word recognition skills.

3. The data also suggest that reading instruction provided in the READ program that focused on the weak comprehension component improved comprehension skills.

On the whole, the results indicate that instruction provided under the framework of the CMR is more effective than undifferentiated resource room instruction. As noted earlier, there could be several reasons for the failure of the LD comparison children to improve, but the data show that the CMR-based diagnosis and treatment of children increased the word recognition and comprehension skills of children in the treatment group. Several studies have shown that phonological awareness instruction improves children's reading skills. Similarly, many studies also have reported success in improving children's comprehension when these children are provided with comprehension strategy instruction. As far as the present authors know, differential diagnosis and instruction in the format described in this article has not been previously reported.

General Discussion

Study 1 was designed to assess the relative contribution made by word recognition and comprehension skills to the reading performance of children in Grades 2 through 5. Because fluency has been receiving much attention recently, its contribution to reading was also examined. Multiple regression analysis of the reading-related scores of 204 children showed that listening comprehension and decoding can account for between 38% and 41% of reading comprehension. Speed of processing accounted for 11% of the variance at the second grade and 2.5% at the fifth grade. This steady decline of the contribution made by speed of processing may be due to the fact that by the time children reach Grade 5, particularly in the case of typical readers, as in the present case, they have mastered word recognition skills. This indicates that fluency—or the lack of it—may be a by-product of word recognition skill. Repeated reading has been shown to improve reading performance, maybe because repeated reading improves word recognition skills and thereby increases fluency. As noted earlier, according to Vukovic and Siegel (2006), speed deficits are unlikely to occur in isolation in individuals with reading impairments and, therefore, slow naming is unlikely to be a core deficit in reading disabilities. This is not to say that striving for fluency is not productive, but that fluency should be treated as a symptom and not as a cause. This can be accomplished through guided repeated reading (National Reading

Panel, 2006) using a variety of reading materials, which affords an opportunity for repeated exposure to different words and also teaches students to read with expression.

Study 2 showed that when the weak reading component that is responsible for poor reading performance is identified, and instruction is targeted at that weak component, the word recognition and reading comprehension scores of poor readers improve significantly more than those of children with LD who are provided with instruction in resource rooms. Thus, the present report not only validates the component nature of the reading process but also shows that instruction based on the component model of reading could be used with greater success for teaching poor readers. That is, to be successful, remedial instruction should focus on the source of the reading problem and address it. In addition to being direct and effective, this CMR-based procedure also eliminates the need for the administration of numerous tests and ties assessment to intervention. It also obviates the need for labeling poor readers into categories. The results of the present study further confirm the limited utilitarian value of the discrepancy model in dealing with the reading problems of children.

The observed limitations of the LD practice have led researchers and educators to look for better methods of teaching students who experience difficulty in learning to read and write. One such approach that has received much attention in recent years is RTI (Bradley et al., 2005; D. Fuchs et al., 2003; L. S. Fuchs, Fuchs, & Speece, 2002). RTI is primarily an alternate process for the identification of and intervention in LD. It is embedded in a multitiered model of assessment, intervention, and progress monitoring (Kovaleski, 2004). RTI comes in more than one model, but they all have more than one tier or phase. During the initial phase, a determination is made whether effective instruction is in place in the classroom. During the next phase, intense instruction is provided to at-risk students, and its effect is measured. During the next phase, individualized instruction is provided for those students whose progress is below average. During the final phase, the students who still failed to make progress are further tested, or their previous history is reviewed. Based on the outcome of this evaluation, the students may be referred to special education services.

Although the concept of RTI was introduced in the opening section of this article, the present study did not make a direct comparison between the CMR and RTI. As an alternative to the discrepancy model, RTI is believed to be promising and is being tried out in several school systems. Some unanswered questions, however, remain.

One of them is, How is RTI different from what teachers usually do with their poor readers in the general education classroom? According to Gerber (2005), RTI is simply urging the educational system to try harder and to invest more effort in students who are difficult to teach and manage. According to Kavale (2005), RTI simply reoperationalizes LD instead of redefining it. Furthermore, there are several variants or approaches to RTI (D. Fuchs & Fuchs, 2006), indicating that a consensus about the method of implementation of RTI has not yet emerged. A review of the titles of published reports also indicates that the focus of RTI is still on the identification of LD and not on the specific method of instruction. If RTI is implemented as presented in the literature, it still relegates the unresponsive children to special education without recommending what should be done with them. In this respect, RTI differs from the CMR-based remedial instruction.

Limitations of the Present Study

One of the obvious limitations of the present study is that children in the LD programs were tested after 3 years of instruction in the resource rooms, whereas the children instructed using the CMR were tested after one semester. The interval between pre- and posttests may be a confounding factor. Nevertheless, if long-term instruction bestows any advantage, it should favor the children in the LD program.

Another limitation is that the resource room instruction was not uniform in the three regions from where data were collected. Generally speaking, the lack of uniformity of assessment and instruction is also a weakness of LD programs. On the other hand, the instruction given to the children taught under the CMR was fairly uniform, though short. Attempts to replicate the present study should, therefore, provide CMR-based instruction for a longer period.

Conclusions

The educational strategy described under the CMR has several advantages over the discrepancy model. The assessment procedures used by the CMR are simple and straightforward, and the instructional strategies that emanate from them are uniform, logical, and effective. Implementation of a CMR-based educational policy does not require IQ testing—a procedure that typically consumes a good part of the psychologist's time. Most of the tests used by the CMR can be administered by classroom teachers or trained teacher's aides. Most important, a diagnosis based on the CMR tells the teacher what component of reading should be the focus of instruction and how that

instruction is to be delivered. Furthermore, the present study indicates that children who experience reading difficulties can be made to become better readers regardless of their current level of reading skills. Finally, the component model of reading leaves no child behind uninstructed.

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P. G. Aaron, PhD, is the Coffman Distinguished Professor in the Department of Educational Psychology at Indiana State University. His areas of research interest are reading disability and inconsistent attention in children. His publications focus on differential diagnosis and treatment of these learning-related problems.

R. Malatesha Joshi, PhD, is a professor of literacy education at Texas A&M University, where he teaches courses and conducts research in the areas of assessment and intervention of reading problems.

Regina Gooden, PhD, is director of reading at St. Thomas University in Houston, Texas. Her current interests are identifying early reading failure, oral language comprehension, and teaching reading to English language-learning children.

Kwesi E. Bentum, PhD, is a school psychologist in the Bi-County Special Education Cooperative in Sterling, Illinois. His area of professional and research interests are intervention and intervention-related diagnosis of reading and behavioral problems in children.