Chapter 15

Principles of Fluency Instruction in Reading: Relationships with Established Empirical Outcomes

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The focus of this chapter is on methods to prevent or remediate reading fluency problems in children who are at risk for, or experiencing, reading difficulties. Our interest in this problem was stimulated by the recent experience of providing intensive remediation to a group of 8- to 10-year-old children with severe reading disabilities. In this study (Torgesen et al. 2001), we provided 67.5 hours of highly skilled, one-to-one instruction to 60 children who had been selected because of significant difficulties acquiring word-level reading skills. These children were taught using two different instructional methods that produced essentially the same effects on reading growth. Both methods provided systematic instruction in phonemic decoding and orthographic reading skills, although they differed in the extent and depth of instruction. The methods also differed in the amount of time spent reading and writing connected text.

The children began the study as very poor readers with general intellectual ability at the low end of the average range (average Verbal IQ = 92.6). Their average standard reading scores as
measured by the Woodcock Reading Mastery Test-Revised (Woodcock 1987) were very low: phonetic decoding was 69.3, word identification accuracy was 67.6, and passage comprehension was 82.6. The interventions provided to these children were very effective in improving the accuracy of their reading skills. Figure 1 shows growth over time on a combined measure of word reading accuracy and passage comprehension. Prior to our intervention, the children had received special education instruction in a resource room setting for an average of 16 months. During this time, they made negligible improvement in their standard scores on this measure of broad reading ability. However, they made dramatic improvement during our intervention, and these gains remained stable, with slight improvement, over the two-year period following the cessation of the intervention. It should be pointed out that figure 1 reports reading standard scores; improvement in these scores means that the children were becoming better readers relative to the average performance of children their age. In other words, the interventions significantly "closed the gap" in reading skills for these children. By any normal standard, the interventions employed in this study can be considered very effective in increasing the reading ability of a sample of children with severe reading dis-

Figure 1. Standard Scores on the Broad Reading Cluster before, during, and following the intensive intervention (from Torgesen et al. 2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. Journal of Learning Disabilities 34:33–58.
abilities. One caveat about these results, however, is that the reading fluency scores of the children showed virtually no improvement compared to their scores for reading accuracy. For example, on the Gray Oral Reading Test-Revised (Wiederholt and Bryant 1992), standard scores for reading accuracy went from 75.6 to 90.9 at the two year follow-up point, while scores for rate went from 71.4 to 71.7. Thus, while the children attained text reading accuracy scores in the low end of the average range, their scores for reading fluency were still almost two standard deviations below average for children their age. Although the interventions we provided enabled children to accurately read and understand more difficult text, they read this text at a rate substantially slower than other children their same age.

This large discrepancy between improvements in reading accuracy and reading rate raised obvious questions for us about the nature of the reading interventions in our study. The discrepancy may also suggest that it is fundamentally more difficult to "normalize" reading rate in older children than it is to bring their reading accuracy and comprehension into the normal range. We hope to present information in this chapter that will help to clarify the different instructional issues involved in remediating rate versus accuracy problems in older children with severe reading disabilities.

WHAT DO WE MEAN BY READING FLUENCY?

Before we address some of those instructional issues however, we will first clarify what we mean by the term "reading fluency." In a recent review of research in this area, Meyer and Felton (1999) define reading fluency as the ability to read connected text "rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding." Others suggest definitions of reading fluency that go substantially beyond reading rate, to include grouping words into meaningful phrases as one reads (Aulls 1978), prosodic reading (Allington 1983), or reading with the kind of intonation and stress that maximizes comprehension (Rasinski 1990). After reviewing a broad range of definitions of fluency, Hudson, Mercer, and Lane (2000) concluded that the richest interpretation of the concept would be to define it as "accurate reading at a minimal rate with appropriate prosodic features (expression) and deep understanding."

The latter definition suggests that the concept of fluency should be applied to the entire reading process from word identification to identification of word meanings, to construction of phrase and passage level meaning. We would not argue with this
as an ultimate definition of fluent reading. After all, the primary purpose of learning to read is to get meaning from text, and individual differences in speed of all the processes referred to in this more inclusive definition could theoretically influence overall reading fluency. However, for purposes of exposition and measurement in this paper, we will focus on a much narrower definition of fluency. We will borrow the definition of fluency proposed by proponents of curriculum based assessment, which defines fluency as rate and accuracy in oral reading (Hasbrouk and Tindal 1992; Shinn et al. 1992). This definition is appropriate for this chapter because it describes the behaviors on which our sample of severely reading disabled children were obviously different from their age-peers, because it can be reliably measured, and because it is consistent with the theoretical focus of definitions of dyslexia which stress the role of word-level reading difficulties as the primary bottleneck to good reading growth in these children (Lyon 1995).

Although our definition of reading fluency is narrow when compared to the one offered by Hudson, et al. (2000), previous research has shown that direct measures of reading rate are highly correlated with measures of more complex reading outcomes. For example, Fuchs, Fuchs, and Maxwell (1988), reported that a measure of oral reading rate for text correlated .91 with reading comprehension scores from a widely used standardized measure in a sample of middle-school and junior high school students with reading disabilities. In fact, the measure of reading rate was more strongly related to the standardized measure of silent reading comprehension than were several different informal (and probably less reliable) measures of reading comprehension. Further, Jenkins et al. (2000) have recently reported that measures of oral reading rate were more highly correlated with reading comprehension scores than were measures of silent reading rate in a sample of children whose reading skills varied across a broad range. Again, this outcome may have been influenced by differences in reliability between measures of silent and oral reading rate, but this does not diminish the potential importance of oral reading rate as a significant dimension of reading performance.

A Model of Reading Fluency to Help Focus Intervention

As we think about the kind of interventions that may be most effective for reading fluency problems, we need to work within a model of reading fluency that identifies the major factors that are potentially responsible for a low score on a measure of reading rate. Logical analysis suggests the following primary components
that might underlie individual differences in reading fluency as we have defined it:

1. **Proportion of Words in Text That Are Recognized as Orthographic Units**  
   Reading rate will be limited if the text we are reading contains a high proportion of words that are not in our sight vocabulary.

2. **Variations in Speed with Which “Sight Words” Are Processed**  
   Individual differences on this dimension might be caused by variability in the number of times the word has actually been recognized in text (practice effects) or by fundamental differences in processing speed. Within this latter category of constitutionally based differences in speed of processing, we would include both more central word identification processes that would influence both oral and silent reading rate, and more peripheral processes such as articulation rate that might most heavily influence oral reading rate.

3. **Speed of Processes That Are Used to Identify “Novel” Words**  
   When words that are not recognized as orthographic units are encountered in text, they must be identified by a variety of means that often involve conscious analysis. The most common of these methods involve phonetic decoding, recognition by analogy to known words, and guessing from the context or meaning of the passage.

4. **Use of Context to Speed Word Identification**  
   Although passage context does not play a large role in increasing word reading fluency for skilled readers (Stanovich and Stanovich 1995), it does provide useful support for younger and poor readers (Ben-Dror, Pollatsek, and Scarpiti 1991; Pring and Snowling 1986). There may be important differences among young children and poor readers in ability to use context that are related to individual differences among them in reading fluency. One thing that might underlie differences in the ability of poor readers to use context as an aid to increasing their word reading fluency is the extent of their vocabulary and background knowledge. Children who are more adept at constructing meaning because of a larger knowledge base may experience a stronger beneficial effect of context on reading fluency than those who are less able to construct the meaning of a passage.

5. **Speed with Which Word Meanings Are Identified**  
   As long as children are under obligation to be actively thinking about the meaning of what they are reading, speed of identification of word meanings may play a role in limiting oral reading fluency. On a test like the Gray Oral Reading Test-Revised, children know they
will be expected to answer comprehension questions following their reading of the passage. Thus, differences in rate may be partially the result of individual variation in the rate that meanings for words can be accessed.

If we are working to develop effective fluency interventions, and our time to intervene is limited (as it always will be), then we should start with interventions that will have the biggest payoff. They should focus on the factors that actually account for the most variance in fluency among children with reading disabilities. Since it is widely accepted that the most fundamental reading bottleneck for children with reading disabilities lies at the word, rather than the text, level of processing (Lyon 1995), we might expect most of the limitation in rate disabled readers to be caused by problems identifying individual words fluently, rather than in using text level features or semantic access problems.

**FACTORS MOST RESPONSIBLE FOR FLUENCY PROBLEMS IN DISABLED READERS**

As an introduction to this section, we first revisit the data from the remediation study we described in the beginning of the chapter, and then present some more systematic regression results from five studies. As a context for our further analyses of the results from the remediation study, we first present some information about reading rates in normally achieving children.

There is actually a great deal of variability in the recommended oral reading rates for students both across and within grade levels. For fifth graders and above (children similar to those in our remediation study), Rasinski (1999) cites recommended rates ranging from 108 to 185 words per minute. Using a formula that provides rates for different reading accuracy levels (99% word accuracy = independent reading, 90-98% = instructional, and below 90% = frustration) Raskinski determined a rate of 136 words per minute (wpm) or higher for fifth grade independent reading. Mercer et al. (in press) recommended 100 to 180 wpm for third through eighth grade reading fluency with grade level text.

The standard scores for reading fluency we used in our remediation study were obtained from the Gray Oral Reading Test—Revised (Wiederholt and Bryant 1992), which provided a direct comparison between reading rates of the children in our study with those obtained by children in a national standardization sample. We examined the rate at which children would have to read on the passages of the GORT-R to achieve an average score on the test. For students aged 10.6 to 10.11 to achieve a standard
score of 100 for fluency, they would have to read at 137 to 150 wpm on each of the first seven stories.

We then examined the speed of reading for students in our remediation study on the GORT-3 story just prior to the last story on which they reached a ceiling because of too many word reading errors. Story levels ranged from Story 4 to Story 9. The average reading rate for the group was 78.3. Clearly, the students were reading at a rate well below expectations. However, the accuracy level was also more in line with an instructional level than an independent level. If we were to examine reading rate on passages where the children were reading at an independent level (two errors or fewer), would the rate still be slow and halting, or would it approach more normal fluency levels? Using the same subjects, but using the most difficult passage on which there were two or fewer errors (average story level was four), we found an overall reading rate of 122 wpm. This suggests that when the students were familiar with the words in a story, their fluency approached that of an average reader. However, when they encountered words they had to decode phonemically, or by some other conscious process, their overall fluency rate quickly declined. Because students are given 10 seconds to decode words on the GORT-3 before the examiner provides the word, it is easy to see how difficulty with just a few words could have a significant impact on reading rate.

The informal data from our remediation study suggests that the proportion of words in a passage that can be recognized easily by sight has a substantial effect on oral reading rate. This informal observation is consistent with the data in Table 1 that more formally describes relationships between the reading fluency score on the GORT-3 and a variety of other potentially related skills and knowledge. The first column reports data from fifth grade children taken from a longitudinal study of 201 randomly selected children whose reading growth was followed from kindergarten through fifth grade (Wagner et al. 1997). The second column reports data from the 2-year follow-up assessment of children in the remediation study that has already been described in this chapter. Remediation study II (Rashotte, MacPhree, and Torgesen in press) provided 35 hours of small group instruction to children in grades 3 to 5 who were struggling to learn to read in the regular classroom. Prevention Study I (Torgesen et al. 1999), provided 88 hours of teacher- and aide-led instruction to children identified as the 12% most at risk for reading failure in kindergarten. The intervention lasted from kindergarten through second grade, and the data presented are from the follow-up scores at the end of fourth grade. Prevention Study II (Torgesen et al. 2000) provided 92 hours of
Table 1. Correlations between text reading rate and component reading skills, phonological variables, and estimated verbal intelligence

<table>
<thead>
<tr>
<th></th>
<th>Longitudinal (5th grade)</th>
<th>Remediation I (5th-7th)</th>
<th>Remediation II (3rd-6th)</th>
<th>Prevention I (4th)</th>
<th>Prevention II (2nd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Attack</td>
<td>.66**</td>
<td>.50**</td>
<td>.63**</td>
<td>.74**</td>
<td>.69**</td>
</tr>
<tr>
<td>Word Identification</td>
<td>.71**</td>
<td>.68**</td>
<td>.81**</td>
<td>.82**</td>
<td>.75**</td>
</tr>
<tr>
<td>Nonword Eff.</td>
<td>.75**</td>
<td>.55**</td>
<td>.73**</td>
<td>.87**</td>
<td>.81**</td>
</tr>
<tr>
<td>Sight Word Eff.</td>
<td>.82**</td>
<td>.71**</td>
<td>.81**</td>
<td>.88**</td>
<td>.89**</td>
</tr>
<tr>
<td>Phon. Aware.</td>
<td>.53**</td>
<td>.54**</td>
<td>.53**</td>
<td>.56**</td>
<td>.44**</td>
</tr>
<tr>
<td>Rapid Naming (lets)</td>
<td>.43**</td>
<td>.29*</td>
<td>---</td>
<td>.64**</td>
<td>.60**</td>
</tr>
<tr>
<td>Rapid Naming (digs)</td>
<td>.44**</td>
<td>.28</td>
<td>.53**</td>
<td>.66**</td>
<td>.63**</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>.62**</td>
<td>.13</td>
<td>.33*</td>
<td>.44**</td>
<td>.07</td>
</tr>
<tr>
<td>Text Fluency Range</td>
<td>55-145</td>
<td>55-95</td>
<td>55-115</td>
<td>55-140</td>
<td>0-130</td>
</tr>
</tbody>
</table>

1The Word Attack and Word Identification sub-tests were both taken from the Woodcock Reading Mastery Test-Revised (Woodcock 1987).
2Non-word Efficiency Test from the Test of Word Reading Efficiency (Torgesen, Wagner, and Rashotte 1999).
3Sight Word Efficiency Test from the Test of Word Reading Efficiency.
4Phonological awareness was measured by the Elision sub-test of the Comprehensive Test of Phonological Processes (CTOPP) (Wagner, Torgesen, and Rashotte 1999).
5Rapid Naming of Letters sub-test from the CTOPP
6Rapid Digit Naming sub-test from the CTOPP
7Estimated verbal IQ was calculated somewhat differently across studies. For the longitudinal study it was estimated from the Vocabulary sub-test of the Stanford Binet (Thorndike, Hagen, and Sattler 1986). For remediation study I, it was the Verbal IQ score from the Wechsler Intelligence Scale for Children-Revised (Wechsler 1974) and for remediation study II, it was estimated from the Vocabulary sub-test of the Stanford Binet. For prevention study I it was estimated from the Vocabulary and Similarities sub-tests of the WISC-R, and for prevention study II, it was estimated from the Vocabulary sub-test of the Stanford Binet.
8This is the range of standard scores on the reading rate measure from the Gray Oral Reading Test-Revised. Standard scores were transformed to a mean of 100 and standard deviation of 15.

*p < .05, **p < .01

Small group and computer based instruction to children identified as the 20% most at risk for reading failure at the beginning of first grade. The data are from the one year follow-up test at the end of second grade.

Table 1 indicates that most of the variables were consistently correlated with text reading rate when considered by themselves. The Sight Word Efficiency (SWE) measure, which assesses how many words from a list of increasingly difficult words a child can read in 45 seconds, was either most strongly related, or tied for most strongly related to text reading rate, across all the studies,
and verbal ability showed the most variable relationship with reading rate across the studies. In order to determine which combinations of variables uniquely contributed to explaining the most variance in text reading rate, a series of multiple regressions were performed. In all cases except Remediation Study II, for which raw scores were not available, the variables entered first into the regressions were age and Sight Word Efficiency. We then examined whether any of the other variables explained significant additional variance in text reading rate. Finally, we identified the set of variables whose combined unique contributions explained the most variance in reading rate. The results of these regression analyses are reported below.

LONGITUDINAL STUDY

The Sight Word Efficiency (SWE) test accounted for 67% of the variance in Text Reading Rate. The only variables that were significantly related to Text Reading Rate with SWE in the equation were Non-word Efficiency (additional 1%), and the Verbal IQ measure (additional 6%). The combination of variables that uniquely explained the most variance were SWE and Vocabulary (73%). In order to determine whether Verbal IQ accounted for unique variance in text reading fluency for children whose fluency scores were below average, we selected children from the longitudinal sample whose range in rate scores was similar to the sample in the Remediation I study. This meant that children with rate scores of 100 or greater were eliminated from the sample. With this change, the relationships of most of the variables to Text Reading Rate dropped slightly. However, the relationships with Rapid Naming of Letters ($r = .50$) and Digits ($r = .48$) showed a slight increase, and the relationship with Verbal IQ was reduced by half ($r = .31$). In this case, Verbal IQ no longer explained additional variance in reading rate beyond that explained by the SWE measure (54%), and the combination of variables that uniquely explained the most variance were SWE and rapid naming rate for letters (56%).

REMEDIATION STUDY I.

The combination of age and Sight Word Efficiency explained 58% of the variance in Text Reading Rate. When entered after SWE, both the Word Identification measure (additional 6%) and the Word Attack measure (additional 4%) explained additional unique variance in reading rate. None of the other variables explained variance beyond that accounted for by the SWE measure.
combination of variables that uniquely explained the most variance was SWE and Word Identification (64%).

**REMEDIATION STUDY II**

Sight Word Efficiency explained 66% of the variance in text reading rate, and Word Identification (additional 10%), Word Attack (additional 2%), and Non-word Efficiency (additional 2%) all explained additional unique variance in the dependent variable. The combination of variables that uniquely explained the most variance was SWE and Word Identification (76%).

**PREVENTION STUDY I**

The combination of age and Sight Word Efficiency explained 78% of the variance in Text Reading Rate. The only variables that explained additional unique variance in reading rate were Non-word Efficiency (additional 2%), Rapid Naming of Letters (additional 1%), and digits (additional 1%). The combination of variables that uniquely explained the most variance in Text Reading Rate was SWE and Non-word Efficiency (80%).

**PREVENTION STUDY II**

The combination of age and Sight Word Efficiency explained 82% of the variance in Text Reading Rate. The only other variables that explained additional unique variance in reading rate were Non-word Efficiency (additional 1%), Rapid Naming of Letters (1%), and digits (1%). The combination of variables that uniquely explained the most variance in Text Reading Rate was SWE and Non-word Efficiency (83%). In discussing the results of these analyses, we will address the contributions of each of the variables to reading fluency one at a time.

**Proportion of Words in Text that are Recognized as Orthographic Units**

The most direct measure of the extent to which children could recognize words as orthographic units was the Sight Word Efficiency Measure. In order to obtain a high score on this measure, one must be able to recognize individual words very rapidly. The Word Identification measure also assessed this construct, and may have been particularly sensitive to the child's ability to identify more complex words accurately. What is clear from both the correlational and regression analyses is that the size of one's "sight
vocabulary" is the variable most strongly related to text reading rate in both large random samples and in samples of children with reading disabilities. In the two remedial studies, it was the combination of the Sight Word Efficiency and Word Identification tests that uniquely explained the most variance in text reading rate.

**Speed of Processes that are Used to Identify "Novel" Words**

We did not have measures available for all of the potentially important processes in this area, but we did have good measures for phonemic decoding and letter identification processes. The Word Attack, Non-word Efficiency, and Rapid Naming speed for letters all assessed speed and accuracy of processes within this domain. In every study, one of these measures accounted for additional unique variance in text reading rate beyond that explained by the SWE measure. For the two prevention studies, it was the combination of Sight Word Efficiency and Non-word Efficiency that together explained the most variance in text reading rate.

**Speed with Which Word Meanings are Identified**

We obviously do not have fully adequate measures in this domain. However, the level of a child's verbal intelligence or extent of vocabulary as assessed by standardized measures does capture some of what is meant by this concept, if we can assume that children with more extensive vocabularies have had more exposures to a broader variety of words than other children (Cunningham and Stanovich 1998). Further, there is evidence that speed of verbal processing is substantially correlated with measures of verbal knowledge (Hunt, Lunneborg, and Lewis 1975). In the correlational analyses, this variable was significantly related to text reading rate in three of the five studies examined. However, it explained unique variance (beyond that explained by the SWE test) in text reading rate only in the longitudinal sample in which fluency scores covered the full range from extremely dysfluent to extremely fluent. Since it is likely that the causal relationship between text reading rate and richness of verbal knowledge is reciprocal, we also examined the influence of verbal ability on text reading rate in the longitudinal sample with verbal ability measured in the first grade, rather than concurrently with rate. For this longitudinal sample, the correlation between verbal ability measured in first grade and text reading fluency measured in fifth grade is .48, and first grade verbal ability explained additional variance in reading rate beyond that explained by concurrent Sight Word Efficiency scores (additional
2%). However, there is also evidence in this sample that the richness of a child’s semantic network may be uniquely important to text reading efficiency only in older children at higher ranges of fluency. When children with above average fluency scores were eliminated from the sample, the correlation between verbal ability and fluency was cut in half (from .62 to .31), and verbal ability no longer explained unique variance in text reading rate. At lower levels of fluency, speed of recognition for individual words assumes primary importance in explaining individual differences in text reading rate. At these lower rates, size of vocabulary may influence reading rate through its relationship with the size of a child’s sight word vocabulary. There is, for example, some evidence that children with large oral language vocabularies acquire “sight words” more readily than do children with more restricted vocabularies (Cunningham and Stanovich 1998; Torgesen et al. 2001).

**General Naming Speed, or Speed of Processing**

Our purest measure of the naming speed variable was rapid naming rate for digits. This variable is obviously similar to rapid naming rate for letters, and the relationships of these two variables to the dependent variable (text reading rate) were also very similar. However, since RAN for digits does not involve stimuli that are processed during reading, it serves as a better indicator than RAN for letters of speed-based processes that may be independent of reading related orthographic knowledge. That naming rate for digits was strongly correlated with text reading rate in all the studies but one indicates a potentially important contribution of general cognitive speed to text reading rate. That general cognitive speed did not contribute substantially to explaining variance in text reading rate beyond the variance accounted for by the Sight Word Efficiency measure should not be surprising, as the latter measure is also very likely sensitive to rate of processing differences among children. In the study in which rapid naming for digits was not significantly related to text reading rate (Torgesen et al. 2001), the most likely explanation is that students were more concerned about accuracy of word reading and comprehension than they were about reading rapidly, so that processing rate differences were less influential than they might otherwise have been.

**OUTCOMES FROM FLUENCY ORIENTED INTERVENTIONS**

The previous analyses suggest that the extent of one’s “sight vocabulary” is certainly the most important factor explaining indi-
vidual differences in reading fluency among children with reading disabilities. In all the intervention studies, speed or accuracy of phonetic decoding processes also helped to explain additional unique variance in fluency scores beyond that explained by sight word efficiency. It is interesting to consider these findings in light of outcomes from instructional or practice interventions that have focused on building reading fluency.

The oldest and most widely used method to increase reading fluency is the repeated reading technique (Meyer and Felton 1999). This is a straightforward practice/instructional technique in which the student repeatedly reads letters, words, phrases, or passages a specific number of times, or until fluency has reached a specified level. In the recent report of the National Reading Panel (National Reading Panel 2000), the repeated reading technique was found to be the only method for which there is consistent, positive support of effectiveness in increasing reading fluency.

Although repeated reading of connected text is the most commonly used application of the repeated reading technique, several kinds of focused, fluency-oriented practices have been found to produce gains in reading fluency. For example, both Tan and Nicholson (1997) and Levy, Abello, and Lysynchuk (1997) showed that practice reading single words generalized to increases in fluency for text containing those words. Further, when equivalent amounts of practice time were devoted to single word practice verses practice of the same words in context, both methods produced equivalent fluency increases on new passages containing the target words (Levy 1999). Methods that emphasize modeling and training of prosodic reading skills have not been found to be more effective in increasing fluency than those that simply have children reread passages an equivalent number of times (Young, Bowers, and McKinnon 1996).

The characteristics shared by most effective applications of the repeated reading technique include: (1) reading and rereading text a specified number of times or to a specified fluency criteria; (2) an actual increase in oral reading practice in a supported context using tutors or peers; (3) various types of feedback concerning accuracy and fluency of reading. In a recent demonstration of the effectiveness of the repeated reading technique over an extended period of time, Mercer et al., (in press) provided six minutes a day of repeated reading practice involving individual letters, phonograms, words, phrases, and passages to children with reading disabilities in a special education setting. The training, which was administered by an instructional aide, lasted for periods varying from 6 to 9 months to 19 to 25 months. Substantial gains in reading fluency and accuracy
were demonstrated by almost all children in the study. Both Meyer and Felton (1999) and the report of the National Reading Panel (National Reading Panel 2000) contain much more extensive discussions of the repeated reading technique than can be provided in this chapter. Rasinski (2000) has recently described a variety of techniques for embedding opportunities for repeated reading practice within motivating and "authentic" reading contexts.

One interesting, but only partially answered question, concerns the mechanisms through which repeated reading practice has an impact on reading fluency. For example, repeated reading of text might have an impact on children's ability to use text level syntactic or symantic cues, it might help children develop more sensitivity to appropriate phrasing (prosody) as they read, or it might simply provide practice recognizing the individual words in the passage. The preponderance of evidence at this point suggests that the primary impact of repeated reading practice is to increase the speed with which individual words are recognized in text. For example, Rashotte and Torgesen (1985) demonstrated generalized gains in reading fluency after three weeks of repeated reading practice in a sample of children with reading disabilities, but only for passages that shared a substantial number of words with the practiced passages. In a similar vein, Faulkner and Levy (1999) produced evidence suggesting that for poor readers, the primary impact of the repeated reading technique is to improve the efficiency with which they process individual words in text. When this positive evidence is considered along with the failure to find differences between single word and text reading practice (Levy 1999), and the failure of practice in prosodic reading to produce stronger fluency gains than simple rereading of passages (Young, Bowers, and McKinnon 1996), it is apparent that the primary locus of the repeated reading effect is on individual word reading efficiency. Whether the technique is primarily useful in helping children acquire orthographic representations for previously unknown words, or whether it produces increases in the speed with which previously known words are identified is not clear from the research, but it seems likely that both types of effects would be present.

A relatively new approach to fluency training for children with reading disabilities, called RAVE-O (Wolf, Miller, and Donnelly 2000), provides training and practice to increase the richness of children's semantic networks in addition to practice to improve the speed of their text-based word identification processes. The idea of the semantic training is to improve children's ability to access rapidly the meaning of words in a variety of contexts. This approach is currently being evaluated in an ongoing series of stud-
ies, and preliminary reports (Wolf et al. 2000) that have shown 
that children receiving the RAVE-O intervention made significant 
gains in oral reading accuracy and fluency, as well as comprehen-
sion, when compared to children who received a math and study 
skills intervention. When compared to an instructional condition 
that emphasized phonetic decoding accuracy and word reading 
strategies, the RAVE-O students still showed greater gains in flu-
ency, although the differences were smaller than in comparison to 
the math and study skills group. From the design of current stud-
ies, it is not possible to determine whether the semantic training 
component of RAVE-O contributes directly to these effects on flu-
ency, or whether they are produced primarily by the lexical and 
sublexical repeated reading practice that is part of the program.

Our earlier analyses of the component reading and cognitive 
skills related to text reading fluency indicated that extent of vo-
cabulary was uniquely related to fluency only at higher levels of 
fluency. Individual differences at lower ranges of fluency appeared 
to be primarily the result of differences among children in the effi-
ciency with which they could identify the words in the passage. If 
this conclusion is supported in other analyses, it would not be sur-
prising if the component of the RAVE-O intervention that is most 
effective in producing fluency gains for children with reading dis-
abilities is the part that focuses on improving speed and accuracy 
of individual word identification. It also leaves open the clear pos-
sibility that, as children’s word reading difficulties are more fully 
remediated, the semantic components of the intervention may be 
more important in producing additional gains in reading fluency.

INDIVIDUAL DIFFERENCES IN READING PRACTICE AS A LOCUS FOR 
FLUENCY PROBLEMS IN CHILDREN WITH READING DISABILITIES

Two obvious and related consequences of failure to acquire early 
reading skills at a normal rate are relative limitations in overall 
time spent reading, and more specifically, in the amount of prac-
tice reading individual words. For example, Allington (1977) 
found that children who needed reading practice the most (those 
with the poorest initial reading skills) actually received the least 
amount of time in actual reading during the school day. In a later 
study, Allington (1984) showed that children in low reading 
groups read as few as 16 words in a week of instruction, while chil-
dren in high reading groups read as many as 1,933 words per 
week. Beimiller (1977-1978) has reported similar ability group 
differences in amount of actual practice in reading that is available to 
children in early elementary school.
These differences in reading practice opportunities are not restricted to the period of beginning reading instruction, but may actually become more pronounced as children get older. For example, Nagy and Anderson (1984) estimated that good readers may read as many as one million words a year both in and out of school, while less skilled readers may read as few as 100,000—a tenfold difference in the amount of word reading practice. More recently, Cunningham and Stanovich (1998) reported evidence suggesting enormous differences in the amount of reading done by 5th grade good and poor readers outside of school. For example, a child at the 90th percentile of reading ability may read as many words in two days as a child at the 10th percentile reads in an entire year outside the school setting. Differences in reading practice vary directly with the severity of a child’s reading disability, so that children with severe reading disabilities receive only a very small fraction of the total reading practice obtained by children with normal reading skills.

Extensive exposure to text through wide and deep reading practice is essential to growth in the number of words that children can recognize orthographically. The best current theory of the way that children acquire the fully specified orthographic representations that enable fluent reading (Ehri 1998; Share and Stanovich 1995) requires that individual words be identified accurately on a number of different occasions during text reading. If words are not identified accurately in sufficient numbers of repetitions, then accurate orthographic representations are not formed, and words must be recognized through analytic means (phonemic analysis, analogy, context) that take more time than recognition on the basis of a unitized orthographic representation. Thus, one of the principle characteristics of most children with reading disabilities after the initial phase in learning to read is a severe limitation in the number of words that can be recognized instantly, without use of analytic processes (Rashotte et al. in press; Torgesen et al. 2001; Wise, Ring, and Olson 1999).

We have seen from our earlier analyses (table 1) that inefficiency in identifying single words is the most important factor in accounting for individual differences in text reading fluency in samples of children with reading disabilities. We also saw in our analyses of data from Remediation Study 1 that the reading fluency problems of these children were particularly pronounced for passages closer to their grade level expectancy that contained many words they could not easily identify.

When these findings are combined with the fact that the number of less frequent words (words children are less likely to
have encountered before in text) increases rapidly after about third grade level (Adams 1990), it is easy to see why it is so difficult for children who have failed in reading for the first three or four years of school to close the gap in reading fluency with their normally achieving peers. If successively higher grade level passages include increasing numbers of less frequent words, and normal readers are continually expanding their sight vocabularies through their own reading behavior, it should be very difficult for children, once significantly behind in the growth of their sight word vocabulary, to close the gap in reading fluency. Such “catching up” would seem to require an extensive period of time in which the reading practice of the previously disabled children was actually greater than that of their peers. Even if word reading accuracy is dramatically increased through the more efficient use of analytic word reading processes (Torgesen et al. 2001), reliance on analytic processes will not produce the kind of fluent reading that is supported by orthographic word recognition processes.

The difficulties involved in “closing the gap” in reading fluency once children have experienced severe reading difficulties for several years is illustrated graphically in figure 2. Prior to intervention at grade four, children with dyslexia are very inaccurate readers and receive only a small fraction of the amount of practice in reading words obtained by children with normally developing reading skills. Both the inaccuracy in decoding new words in text and limitations in the number of word reading trials that children with dyslexia actually experience lead to a significantly slowed

![Figure 2](image-url). Projected growth in “sight vocabulary” of normal readers and disabled children before and after remediation.
rate of acquisition for new sight words. Thus, by grade four, when interventions that help them become more accurate, independent readers occur, they have a large relative deficit in the size and range of their sight word vocabulary when compared to average readers. If we make the generous assumption that, following intervention, they begin to read as much as average readers, we could speculate that they will form new orthographic representations (acquire sight words) at about the same rate as children with average reading skills. However, average readers can be expected to continue to form orthographic representations at a high rate during the late elementary school and middle school years. Thus, unless our remediated children with dyslexia receive more intensive, or more focused reading practice during these years, they will not “close the gap” in the number and range of words that can be recognized easily and fluently by sight. At each successively higher grade level, average readers will be able to identify a higher proportion of words in text at a single glance, and they will continue to be more fluent readers than the children with dyslexia who may now be accurate readers (because of more effective analytic word reading strategies), but whose sight word vocabulary will remain relatively deficient compared to average readers.

The foregoing analyses suggests that approaches emphasizing the prevention of reading disabilities, in which good reading ability is supported from the very beginning of reading instruction, may be the most effective way of eliminating reading fluency problems. In table 2, we present data from four intervention studies that are consistent with this idea.

Two of these studies in table 2 provided remedial interventions for children who were experiencing reading difficulties in 3rd through 6th grades, and two involved preventive interventions that were provided to children identified as at-risk for reading difficulties on the basis of poor performance on pre-reading and phonemic processing measures. Remediation study I (Torgesen et al. in press) has already been extensively discussed in this chapter, and Remediation study II (Rashotte et al. in press) was described briefly when table 1 was presented. The pretest standard scores are provided for both remediation studies to indicate differences in the level of severity of reading impairment before intervention in the two samples of children. Both Prevention studies were also briefly described earlier. The outcomes for Prevention Study I (Torgesen et al. 1999) are provided for immediate post-test at the end of second grade and for the two year follow-up at the end of fourth grade. The data from Prevention Study II (Torgesen et al. 2000) are from the one year follow-up test at the end of second grade.
Table 2. Differences in outcome for reading rate in prevention vs. remediation studies

<table>
<thead>
<tr>
<th>Reading Measure</th>
<th>Remediation I (67.5 hours)</th>
<th>Remediation II (35 hours)</th>
<th>Pre</th>
<th>Post</th>
<th>Prevention I (88 hours)</th>
<th>Prevention II (92 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre 2yr foll.</td>
<td>Pre 2nd</td>
<td>4th</td>
<td>2nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text Rate(^1)</td>
<td>71.3</td>
<td>77.3</td>
<td>85.3</td>
<td>93.3</td>
<td>96.8</td>
<td>94.3</td>
</tr>
<tr>
<td>Text Accuracy(^1)</td>
<td>75.8</td>
<td>89.5</td>
<td>98.3</td>
<td>96.7</td>
<td>.98.5</td>
<td>96.2</td>
</tr>
<tr>
<td>Word Attack(^2)</td>
<td>69.3</td>
<td>82.3</td>
<td>99.5</td>
<td>101.1</td>
<td>99.8</td>
<td>104.7</td>
</tr>
<tr>
<td>Word Ident.(^2)</td>
<td>67.6</td>
<td>87.9</td>
<td>94.7</td>
<td>100.7</td>
<td>95.6</td>
<td>102.7</td>
</tr>
<tr>
<td>Passage Comp.(^2)</td>
<td>82.6</td>
<td>93.1</td>
<td>104.7</td>
<td>94.2</td>
<td>87.5</td>
<td>95.9</td>
</tr>
<tr>
<td>Est. Verbal IQ(^3)</td>
<td>93.1</td>
<td>101.5</td>
<td>89.4</td>
<td>95.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Text rate and accuracy measures were from the Gray Oral Reading Test-Revised (Wiederholt and Bryant 1992). Standard Scores were transformed to have a mean of 100 and a standard deviation of 15 for purposes of comparison with other measures.

\(^2\)The Word Attack, Word Identification, and Passage Comprehension tests were all taken from the Woodcock Reading Mastery Test-Revised (Woodcock 1987).

\(^3\)Estimated verbal IQ was calculated somewhat differently across studies. For remediation study I, it was the Verbal IQ score from the Wechsler Intelligence Scale for Children-Revised (Wechsler 1974) and for remediation study II, it was estimated from the Vocabulary sub-test of the Stanford Binet (Thorndike, Hagen, and Sattler 1986). For prevention study I it was estimated from the Vocabulary and Similarities sub-tests of the WISC-R, and for prevention study II, it was estimated from the Vocabulary sub-test of the Stanford Binet.

The major observation from Table 2 is that preventive studies do not show the large differences in outcomes for accuracy and fluency that are manifest in the remediation studies. One possibility might be that noticeable impairments in fluency do not begin to emerge in children with reading disabilities until late elementary school. However, the data from Prevention Study I show that this group of highly at-risk children actually improved their standard scores in rate from second to fourth grade. It is also possible that the children in the prevention studies, because they were identified by risk status rather than actual reading failure, may not have been as severely impaired as those in the remediation studies. This may clearly be true for Remediation Study I which intervened with children in the bottom 2% of reading skill, but it is less likely for the comparison with Remediation Study II, which served children in roughly the bottom 16% of reading skill. Additionally, a control group in Prevention Study I that received a variety of school-based interventions, but no research-based interventions, obtained a standard score of 81.7 on the fluency measure. Furthermore, a group of children from the large longitudinal study described earlier (Wagner, Torgesen, and Rashotte 1994; Wagner et
al. 1997) who were selected by the same criteria in kindergarten as those in Prevention Study I, but who received no research-based interventions, obtained a standard score of 76 on the rate measure at the end of 5th grade. Thus, these comparisons suggest that early interventions that help to equalize the early reading practice between children at-risk for failure and normal learners by helping the at risk children keep pace in the development of early word reading skill, may eliminate many of the reading fluency problems of older children with reading disabilities. The comparisons also suggest that one of the major reasons for the seriously impaired fluency of older children in remediation studies is that they are simply not able to make up for the huge differences in reading practice that occur during the time they are poor readers.

CONCLUDING COMMENTS

The goal of this chapter was to consider information and ideas that may help to focus our efforts in studying ways to prevent or remediate reading fluency problems in children with reading disabilities. One conclusion from a comparison of outcomes between preventive and remedial studies is that it may be much easier to prevent reading fluency problems from arising than to remediate them once they are established in older children. The differences between outcomes of prevention and remediation studies are understandable in terms of current theories about the growth of orthographic reading skills. These theories suggest that the enormous reading practice differences that occur between disabled and normal readers produce large differences in the number of words that can be recognized as orthographic units in a single glance. Because one of the primary factors that limits reading fluency is inefficiency in recognition of individual words, this huge difference in “sight word” vocabulary can account for most of the fluency differences between disabled and normal readers. If prevention studies are successful in providing accurate word reading strategies for at-risk children from the beginning of reading instruction, they may help to eliminate many of the differences in cumulative reading practice that are a likely source of older disabled children’s continuing fluency problems.

For children with reading disabilities who have limited sight word vocabularies and limited proficiency in decoding novel words, it seems that the first target of intervention should be to increase the accuracy of their individual word reading skills. As children read more accurately, they will receive more practice trials in which individual words are pronounced correctly, and should thus
add to the vocabulary of words they can recognize by sight. This is clearly what happened to the children in our first remediation study (Torgesen et al. 2001). Although they were not able to add words to their sight vocabulary fast enough to “close the gap” in fluency relative to average children their same age, they did become able to read increasingly difficult passages containing familiar words at relatively fluent rates. The most successful fluency intervention described to date, repeated reading, is effective because it provides the kind of repeated exposure to words that leads either to the formation of new orthographic images or increases efficiency of access to images already formed. If, as some have suggested (Wolf and Bowers 1999), many reading disabled children have special difficulties in forming orthographic images of words in addition to problems acquiring phonetic decoding skills, repeated reading practice may be particularly effective because it concentrates exposure to specific words over a relatively short span of time. Simply providing more reading opportunities for these children may not be sufficient to increase their sight vocabulary at an acceptable rate, because, at higher grade levels, the less frequent words they are trying to learn occur at such infrequent intervals in text (Adams 1990). An important question for future research is how to increase the efficiency of reading practice for children whose reading accuracy problems have been remediated through successful interventions. In other words, how should practice be engineered and focused so that it produces accelerated growth in the fluent word reading processes that are the most critical factor in oral reading fluency?

REFERENCES


