Reading Fluency: Critical Issues for Struggling Readers

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Our interest in reading fluency as a topic for theoretical analysis and research has been stimulated by several findings from recent research. The first set of findings includes the powerfully converging data on the relationship between simple measures of oral reading rate and performance on measures of reading comprehension. (Chard, Vaughn, & Tyler, 2002; Fuchs, Fuchs, & Maxwell, 1988; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2000, 2003). Particularly for students at beginning stages of learning to read, but continuing into middle and high school, oral reading rate is strongly correlated with students' ability to comprehend both simple and complex text.

The relationship between individual differences in reading fluency and successful performance on measures of reading comprehension was dramatically illustrated in a recent study we conducted of the reading portion of Florida's Comprehensive Assessment Test (FCAT) which is use to monitor progress in reading in grades three through ten. In this study (Schatschneider, et al., 2004), we gave a two-hour battery of reading, language, and cognitive ability tests to approximately 200 students at 3rd, 7th, and 10th grades. The goal of the study was to determine which dimensions of reading, language, or cognitive ability were most important in accounting for individual differences in reading comprehension performance at each grade level. The FCAT is a criterion-based test that requires students to read lengthy passages (passages are approximately 325 words in 3rd, 820 in 7th, and 1000 in 10th grade) and then answer a variety of types of questions based on the content of the passages. The percentage of questions that assess "higher order" thinking skills increases from approximately 30% at third grade to 70% at 10th grade. Performance on the FCAT is categorized in five levels (1-5), with level 3 being considered grade level performance. Students must perform at level 2 or higher on the FCAT to be eligible for promotion from 3rd to 4th. grade, and they must also attain a given level of proficiency on the test in order to be eligible for a regular high school diploma.

At third grade, oral reading rate was the dominant factor in accounting for individual differences in performance on the FCAT, with the fluency factor accounting for 56% of the variance, the verbal knowledge/reasoning factor accounting for 44%, and the nonverbal reasoning and working memory factors accounting for 25 and 14% of the variance respectively. At seventh grade, fluency and verbal knowledge/reasoning were equally dominant in accounting for variance on the FCAT, and at 10th grade verbal knowledge/reasoning was the dominant factor (52% of the variance), with fluency (32% of the variance) being second, and the other variables being less important.

The sample used in this study was representative of the overall demographics of the student population in Florida at each of the three grade levels. Table 1 presents the average performance levels on a number of our tests for students who performed at each of the levels on

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the FCAT. The most striking finding from Table 1 is the extremely low performance of students at Level 1 on measures of reading fluency. When we asked the students to read FCAT-level passages orally, Level 1 students read them at half the rate of students who performed at the average level on the FCAT, and they achieved an average reading fluency score at the 6th percentile on a nationally standardized measure of reading fluency. In 2004, 22% of Florida's third grade students achieved level 1 performance on the FCAT. If the reading fluency scores of these students are well represented by the sample in our study, this means that about 45,000 students in the state may be struggling on FCAT primarily because they have not yet become fluent readers by the end of third grade.

Another reason for our interest in reading fluency, and one that interacts with the findings from our study of the FCAT, is that one of the more difficult aspects of reading skill to remediate in older struggling readers is reading fluency. For example, in one very successful intervention study with 3rd to 5th grade students (Torgesen, Alexander, et al., 2001), we showed that intensive remedial intervention could produce very large gains in reading ability in a group of students who began the study with very impaired reading skills. For example, during the 8 week intervention period, the students went from the 2nd to the 39th percentile in phonemic decoding accuracy, from the 4th to the 23rd percentile in text reading accuracy, and from the 13th to the 27th percentile in reading comprehension. However, their reading fluency scores only went from the 3rd to the 5th percentile. When these same students were followed up two years after the intervention, their percentile scores for phonemic decoding, text reading accuracy, reading comprehension, and reading fluency were the 29th, 27th, 36th, and 4th, respectively. While the students in this study were able to substantially "close the gap" with average readers in phonemic decoding, reading accuracy, and reading comprehension, the gap in reading fluency remained essentially unaffected by the intervention.

We would hasten to add that the students in this study did, in fact, become more fluent readers in an absolute sense. For example, before the study began, students read the most difficult passage they were exposed to on the Gray Oral Reading Test-III (Wiederholt & Bryant, 1992) at a rate of 38 words per minute with 10 errors. At the two-year follow-up, the students read passages of similar difficulty at 101 words per minute with 2 errors. Similarly, rate for the next most difficult passage they read increased from 42 to 104 words per minute. Thus, for passages that had a constant level of difficulty, the children's reading rate more than doubled from pretest to the end of the follow-up period. Although the students clearly became more fluent readers, they were not able to "close the gap" with their average reading peers, because their peers themselves were growing rapidly in reading fluency during this period in their lives. This relative difficulty with "closing the gap" in reading fluency in older struggling readers has been replicated in other studies using a variety of instructional methods (Torgesen, in press), and we will offer an explanation for it later in this chapter.

The final piece of evidence from recent research that has helped to focus our interest on reading fluency comes from studies of reading disabled students who are learning to read in languages in which grapheme-phoneme relationships are more consistent than they are in English. Most of this research has been conducted in Germany and reported by Heinz Wimmer (Wimmer & Mayringer, 2001). The basic finding is that children with severe reading difficulties in Germany tend to have far less severe problems with phonemic decoding and reading accuracy than dyslexic students in the United States, but they do have substantial difficulties with reading fluency. A longitudinal study with Dutch children (de Jong & van der Leij, 2003) similarly found that whereas 6th grade dyslexic and normally reading groups were very different on their reading speed or reading level there was considerable overlap on decoding accuracy. This relative dissociation between reading accuracy and reading fluency among dyslexic students learning to read languages with more transparent orthographies is interesting in light of the difficulties we have just described in "closing the gap" in reading fluency with older children with reading disabilities. In both cases, after effective instruction, students with reading disabilities are more similar to average readers in their phonemic decoding and reading accuracy scores than they are in reading fluency. Why is it so difficult for them to become fluent readers?

What is reading fluency: A definition

Fluent reading comprises three key elements: *accurate* reading of connected text at a conversational *rate* with appropriate *prosody* (Hudson, Mercer, & Lane, 2000). A fluent reader can maintain this performance for long periods of time, retains the skill after long periods of no practice, and can generalize across texts. A fluent reader is also not easily distracted and reads in an effortless, flowing manner.

Word reading *accuracy* refers to the ability to recognize or decode words correctly. Strong understanding of the alphabetic principle, the ability to blend sounds together (Ehri & McCormick, 1998), the ability to use other cues to the identity of words in text (Tunmer & Chapman, 1995) and knowledge of a large bank of high frequency words is required for word reading accuracy.

Reading *rate* comprises both fluent identification of individual words and the speed and fluidity with which a reader moves through connected text. As children practice in learning to read, they come to recognize larger and larger numbers of words "by sight" without having to sound them out or guess at their identity from contextual cues (Ehri, 2002; Share & Stanovich, 1995). Well-practiced words are recognized *automatically* (Kuhn & Stahl, 2000, LaBerge & Samuels, 1974), which implies that recognition occurs very quickly, and with little cognitive effort. The automaticity with which a reader can recognize words is almost as important as word reading accuracy. It is not enough to get the word right if a great deal of cognitive effort is required to do so, because the effort and attention involved in phonemically decoding words or in guessing at words from context, distract the reader's attention from building a coherent representation of the meaning of the text (Schwanenflugel, Hamilton, Kuhn, Wisenbaker, & Stahl, 2004). Most educators quantify rate in terms of reading speed—either the number of words read correctly per minute or the length of time it takes for a reader to complete a passage.

Prosody is a linguistic term to describe the rhythmic and tonal aspects of speech: the "music" of oral language. Prosodic features are variations in pitch (intonation), stress patterns (syllable prominence), and duration (length of time) that contribute to expressive reading of a text (Allington, 1983; Dowhower, 1991; Schreiber, 1980, 1991). These elements signal question, surprise, exclamation, and other meanings beyond the semantics of the words being spoken. When these features are present and appropriate in oral reading, the reader is reading prosodically or "with expression". Struggling readers are often characterized as reading in a monotone without expression or with inappropriate phrasing.

One of the most interesting current questions in research on fluent reading concerns the role of prosody in the definition. The role of accuracy and rate seem very central to the notion of fluent reading, but what role does prosody play? Perhaps the most straightforward reason to include prosody as part of the definition of fluency is that it may reflect the reader's understanding of the meaning of the passage being read. Central to the meaning of reading fluency is the idea that it goes beyond just the ability read text fast to include an understanding of the message being conveyed by the text. In this sense, prosody is a sign or an index that the reader is actively constructing the meaning of the passage as the words are being identified and pronounced.

Another, and less obvious reason to include prosody as part of the definition of fluent reading is that prosodic reading may serve as an aid to comprehension itself. This view of prosody in relation to comprehension is expressed in the following statements from a recent widely disseminated introduction to the assessment of reading fluency written for teachers and other school professionals (Rasinski, 2004):

> Just as fluent musicians interpret or construct meaning from a musical score through phrasing, emphasis, and variations in tone and volume, fluent readers use cognitive resources to *construct meaning through expressive interpretation of the text* [italics added]. (p. 4)
>
> Expressive reading happens once a degree of automaticity is established, and *expression is one way in which a reader constructs meaning while reading* [italics added]..(p. 14)

The idea that prosody may be reciprocally related to comprehension is expressed within the same text in the following passages:

> When readers embed appropriate volume, tone, emphasis, phrasing, and other elements in oral expression, they are *giving evidence of actively interpreting or constructing meaning* from the passage…[italics added] (p. 4)This embedding of prosody shows that the reader is *trying to make sense of or comprehend the text*…[italics added] (p. 14)The

question of whether children need to read prosodically in order to improve their comprehension or whether prosody in reading is an index that comprehension has occurred has obvious instructional implications. While it is clear that prosody in reading may be an important aid in understanding to the individual who is *listening* to someone read, it is less clear that prosody is used by the *reader* to help construct meaning. Schwanenflugel, et al. (2004) reported a recent investigation in which this question was directly addressed.

These investigators administered measures of individual word reading efficiency, prosody in reading, and reading comprehension to a sample of 120 second grade students. The standard for prosodic reading on selected passages was first established by recording the tonal inflections, pauses, etc. of a sample of adult readers. Then, the acoustic profile of child and adult readers was compared using digital recording and comparison techniques. Children's prosody scores depended on the extent to which their acoustic profiles matched those of the adult profile. This study found that, although prosody was strongly related to individual word reading efficiency, individual differences in prosody did not have a strong or consistent relationship with reading comprehension. In other words, students who were able to read individual words rapidly and accurately showed more adult-like prosodic features in their reading, and these students also showed stronger reading comprehension. However, once the effect of single word reading efficiency was controlled, individual variations in prosody did not make a meaningful contribution to comprehension of the text. The investigators also found little evidence that prosody in oral reading explained additional variance in reading comprehension above and beyond that accounted for by simple measures of word reading efficiency.

In addition to ambiguities in the role of prosody as a central feature of fluent reading that contributes to comprehension or that can provide an independent assessment of comprehension, the prosodic features of oral reading are also more difficult to reliably assess than are the features of accuracy and rate. Only when prosody rating measures include an assessment of rate do they approach reasonable levels of reliability for purposes of individual assessment (Rasinski, 2004). For all of these reasons, it seems appropriate that the most widely used current assessments for reading fluency focus on accuracy and rate to assess growth on this dimension of reading skill, and do not typically include an assessment of prosody. The assessment of rate and accuracy is done using samples of oral reading, since measures of silent reading rate are much less reliable

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than those in which the examiner actually listens to the child read each word in the passage (Jenkins et al., 2000).

What factors most strongly influence oral reading rate in struggling readers?

One of the goals of this chapter is to contribute to understanding of the factors that may be most critical to the reading fluency problems of students with reading difficulties. Logical analysis suggests the following primary components that might underlie individual differences in text reading fluency as we have defined it:

1. *Proportion of words in a passage that can be recognized "by sight."* As Ehri (2002) and others have pointed out, words in text can be recognized in several ways. The reader can use letter-sound relationships to "sound out" the word, or the word can be guessed from one's sense of the context, or words can be recognized from memory. Adult readers rely mostly on the third strategy, and this is what allows them to achieve high levels of reading fluency. If a student is asked to read a passage in which a relatively high proportion of the words must be decoded analytically or identified by contextual inference, this will have an obvious impact on reading fluency. This is why a child, such as those in our intervention studies with older students, might appear to be relatively fluent on a "second grade" level passage, but relatively dysfluent on a "fifth grade" level passage. When reading passages at the higher level, there are simply too many words that are not part of the child's "sight word vocabulary" and which cannot be decoded without some kind of analytic or inferential process that takes more time than simple recognition.

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, since speed of word recognition increases directly with practice (Levy, Abello, & Lysynchuk, 1997), or by fundamental differences in processing speed. We know, for example, that processing rate on cognitive tasks is a relatively stable and general characteristic on which individuals differ from one another (Kail, 1988). It seem likely that differences in processing speed that might have a biological or constitutional basis would extend to reading fluency, which is itself a very complex cognitive task. 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. An interesting question for research, of course, would be to determine whether the reading fluency problems of disabled readers are primarily the result of limitations to the range of words they can recognize "by sight" or whether they result primarily from limitations in the rate at which words within their sight word vocabularies are identified in text. The answer to this question is not likely to have an either/or answer, but answers to questions about the relative impact of these two factors would have important implications for intervention methods for students struggling with reading fluency.

3. *Speed of decoding processes used to identify unknown words (decoding fluency)*. When words are not read by sight, they must be identified analytically. This may be through phonemic decoding, use of analogy, or guessing from context. Decoding is a sequentially executed process where the reader blends sounds to form words from their parts. This can take place by blending individual phonemes (beginning decoding) or phonograms (a more

advanced form of decoding; Ehri, 2002). In order to decode unknown words fluently, readers need to develop at least the following knowledge and skills to a fluent level: knowledge of sound-symbol relationships, blending of sounds into words, recognition of reoccurring patterns across words (phonograms), and coordination of phonemic/orthographic and meaning information to determine exactly the right word. If any of the analytic or knowledge retrieval processes that are required for decoding unknown words in text operate slowly or inaccurately, this should have a noticeable impact on both the speed and accuracy of text processing.

4. *Use of context to speed word identification.* Words are consistently read faster when they occur in a meaningful context than when they are read in isolated word lists (Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; Stanovich, 1980). Although some studies suggest that passage context plays a much larger role in supporting word reading fluency and accuracy for students with poor word reading skills than for skilled readers (Stanovich & Stanovich, 1995), other research has reported relatively consistent effects of context for both good and poor readers (Bowey, 1985). A consistent finding, however, is that context does provide useful support for younger and poor readers (Ben-Dror, Pollatsek, & Scarpati, 1991; Pring & Snowling, 1986). There may be important differences among young children and poor readers in ability to use context that are related to individual differences 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 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. The child's sense of the context can improve word reading accuracy and fluency in at least two ways. First, it can provide slight improvements in the speed with which "sight words" are identified (Share & Stanovich, 1995). Second, it can be combined with phonemic information about words to help children identify previously unknown words in text (Ehri, 2002).

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-III (Wiederholt & Bryant, 1992), 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 speed with which students can access the meaning of words in text (Wolf, 2001b).

6. *Speed with which overall meaning is constructed.* Again, if students know they must answer questions about meaning after a passage is read, they may devote varying amounts of attention and spend varying amounts of time in identifying and rehearsing the major meaning elements of a passage as they are reading. For example, it is plausible that students might pause for varying amounts of time while reading a passage in order to consolidate or integrate the meaning of a sentence that has just been read. Other processes involved in reading comprehension that require attentional resources that might vary in their fluency across children and require attentional resources include making connections between words and sentences, relating textual meaning to prior knowledge, and making inferences. These processes could potentially limit the reading fluency of readers depending on how much attentional resources they use and how quickly the processing takes place.

7. *Differences in the relative value a child places on speed vs. accuracy in reading*. On almost any task in which both speed and accuracy of performance are measured, rate of responding can be influenced by the value one sets on speed vs. accuracy. For example, some students may be so concerned about making errors when reading orally, that they unnecessarily slow their rate to provide an extra measure of insurance against mistakes. In contrast, other students may place a premium on getting through the text quickly, and as a result they make more errors than they would have if they allowed themselves to read at a little slower rate. On measures of oral reading rate, the best performance will be achieved by students who pick the right balance between speed and accuracy: one that allows them to read as fast as possible while keeping errors to a minimum. It might also be the case for some struggling readers that they rely on a "reliable and safe" strategy for reading words, such as phonemic decoding, when they could actually read most of the words through simple recognition processes. Teachers sometimes report that students are dysfluent readers because they continue too long to rely on phonemic decoding strategies, but there is no reliable evidence that this is a widespread problem with dysfluent readers. A more likely explanation of why older struggling readers use analytic procedures to identify words in text is that they have not had enough correct learning trials to be able to identify the words by sight.

Given this logical analysis of the factors that might contribute to individual differences in reading fluency, it is clear that differences among students in reading fluency are likely to be multiply determined. However, if one of our goals is to develop effective interventions for struggling readers, 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, as long as those factors are amenable to instructional interventions. In an earlier analysis (Torgesen, Rashotte, & Alexander, 2001) we provided substantial evidence that the single most important factor in accounting for individual differences in reading fluency among students with reading disabilities was the speed with which individual words are recognized. In other words, when students with reading disabilities are compared to one another on a measure of text reading fluency, the most important predictor of variability in reading fluency was a measure that assessed both speed of recognition for individual words and the range of words that could be recognized by sight. In this analysis, we examined the relationships between a standardized measure of oral reading fluency and student's knowledge and skill in a number of areas, including these four:

1. *Sight word reading efficiency* – this was a direct measure of both the size of a child's sight word vocabulary and the speed with which individual words can be recognized. This measure (Torgesen, Wagner, & Rashotte, 1999) requires students to rapidly identify words that that increase rapidly in difficulty from simple high frequency words like *it, look, and hot*, to less frequent, more complex words like *question, horizon, and inquire*. Thus, a child's score on the test is a function of both the speed with which "sight words" can be identified (words like *it, look, and hot*, are likely to be in the sight word vocabulary of most of the students in these samples) and the extent and range of the child's sight word vocabulary itself (students with larger sight word vocabularies will be able to go further in the list, because they can recognize more of the difficult words by

sight). A child's total score is the number of words that can be correctly recognized within 45 seconds.

2. *Phonemic decoding efficiency* – this was a measure of how fluently and accurately the children could pronounce regularly spelled nonwords that increased gradually in difficulty from words containing two phonemes to words containing 7 phonemes.
3. Siz*e of vocabulary* – although this is not a direct measure of speed of access to word meanings, it is a reasonable proxy, since there is good evidence that speed of verbal processing is substantially correlated with measures of verbal knowledge (Hunt, Lunneborg, & Lewis, 1975). It also seems reasonable to assume that children with more extensive vocabularies have had more exposures to a broader variety of words than other children (Cunningham & Stanovich, 1998), and thus may be relatively more fluent in identifying word meanings within text.
4. *General naming speed, or speed of processing*. This was measured by assessing how rapidly students could name series of randomly repeated digits.

Although these measures do not encompass all of the variables identified as potentially important in explaining individual differences in reading fluency, they do assess several of the most important ones. We examined relationships between these variables and reading fluency in five samples of students. For purposes of our discussion here, it is sufficient to know that one of the samples (longitudinal) was randomly selected and represented a cross section of students of all reading abilities, two samples (Remedial I and Remedial II) consisted of students ages 10-12 who had received relatively intensive reading interventions, and the last two samples were of students who had received preventive reading interventions because they were identified as "at risk" in kindergarten or first grade. The intervention implemented in Prevention I extended from kindergarten through second grade, and the students were followed up at the end of fourth grade. Prevention II involved an intervention that lasted during first grade, and the students were followed up in second grade.

From Table 2, it is clear that our assessment of the size of children's sight word

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vocabularies and speed of recognition for individual words(Sight Word Efficiency) had the strongest and most consistent relationships with text reading fluency across these five samples. Given the number of factors that might potentially influence reading fluency, it seems remarkable that 4 of the 5 correlations approach the theoretical maximum possible correlation between two tests whose reliabilities are not perfect. Since all the predictor variables in this table are correlated with one another, we performed another set of analyses to determine which variables helped to explain variance in reading fluency beyond that explained by sight word efficiency. The results were as follows:

1. *Longitudinal sample*. Sight Word Efficiency accounted for 67% of the variance. Nonword Efficiency explained an additional 1% of the variance, and vocabulary an additional 6%. The combination of variables that explained the most variance was SWE and Vocabulary (73%).
2. *Remediation Study I.* None of the variables explained significant variance in reading fluency beyond that explained by Sight Word Efficiency.

3. *Remediation Study II*. Nonword Efficiency explained an additional 2% of the variance, and, in combination with Sight Word Efficiency, they explained 68% of the variance in reading fluency.
4. *Prevention I*. Nonword efficiency explained an additional 2% of the variance, and Rapid naming of digits explained an additional 1%. The combination that explained the most variance was Sight Word Efficiency and Nonword efficiency (80%).
5. *Prevention II*. Nonword efficiency explained an additional 1% of the variance, and Rapid naming of digits explained an additional 1%. The combination that explained the most variance was Sight Word Efficiency and Nonword efficiency (83%).

These results indicate that the additional contribution made by the other variables to explaining individual differences in reading fluency was quite small. One potentially interesting variation in the results across samples was the relatively substantial independent contribution of vocabulary knowledge to individual differences in reading fluency in the random sample of 5^{th} grade students (longitudinal sample). Among these students, fluency scores covered the full range from extremely dysfluent to extremely fluent. There is suggestive evidence within this sample that the richness of a child's semantic network (vocabulary) may be uniquely important to text reading fluency only in older children at higher ranges of fluency. For example, when children with above average fluency scores are eliminated from this sample, the correlation between verbal ability and fluency was cut in half (.62 to .31), and verbal ability no longer explained unique variance in text reading rate. In this same sample with restricted range of fluency scores, the correlation between sight word efficiency and fluency remained a relatively robust .74.

The idea that verbal/comprehension processes may be more important in explaining individual differences in fluency among more fluent than less fluent readers is consistent with the findings from a recent study by Jenkins, et al., (2003). Using a sample of students with a full range of reading ability, this these authors found that individual differences in student's ability to read isolated words was the most important factor accounting for differences in reading fluency at low levels of fluency. In contrast, differences among students in their performance on a reading comprehension measure accounted for the largest share of variance in reading fluency among the more fluent readers in the sample.

A remaining ambiguity in the analyses we have reported from our own research arises from the nature of the Sight Word Efficiency measure that was used. As explained earlier, individual differences in performance on this measure probably arise from two different sources. One of the sources is simple pronunciation speed for individual words, and the other is the range of words that can be recognized by sight. In one of the samples (Remediation I), we were able to more directly study the impact that the size of the students' sight word vocabulary had on their reading fluency.

In this study, reading fluency was assessed using the Gray Oral Reading Test-III (Wiederholt & Bryant, 1992). This test provides a "standard score" for reading fluency that is based on performance of students in a national standardization sample, with a score of 100 being average. We examined the rate at which children would have to read on the passages of the GORT-III 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 137-150 wpm on each of the first 7 stories.

We then examined the speed of reading for students in our remediation study on the GORT-III story just prior to the last story on which they reached a ceiling (because of too many word reading errors). At the post-test in this study, maximum story levels ranged from Story 4 to

Story 9. The average reading rate for the group was 78.3 correct words per minute. Clearly, the students were reading at a rate well below expectations. These passages were difficult for the children, and the average number of errors indicated that they were at their instructional, rather than independent reading level. If we were to examine reading rate on passages where the children were reading at an independent level (2 errors or less), 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 2 or less errors (average story level was 4), 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, although it did not quite reach average levels. However, when they encountered words that 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-III before the examiner provides the word, it is easy to see how difficulty with just a few words could significantly impact reading rate.

Why is fluency so difficult to remediate in older struggling readers?

As mentioned at the beginning of this chapter, one of the consistent findings in our remedial research for children who begin the intervention with moderate or serious impairments in word reading ability is that the interventions have not been sufficient to close the gap in reading fluency. Although the students increase in fluency in an absolute sense (they become more fluent within passages of the same level of difficulty), the interventions do not bring the students to average levels of fluency for students their age, nor are students' percentile or standard scores for fluency nearly as high as they are for accuracy.

When teachers or other researchers see these results, they think immediately that there must be something wrong with the interventions we have studied. Perhaps the interventions have emphasized "phonics" too much, perhaps they focus on accuracy too much, or perhaps they do not provide enough practice in reading fluency itself. We do not entirely discount these possibilities, but we also have considerable evidence that the problem may lie in the nature of reading fluency itself, rather than with the interventions. First, in one study with severely impaired readers (Torgesen, Alexander, et al., 2001), one of the instructional interventions invested 50% of instructional time in reading connected text, while the other invested only 5%. There was no difference in fluency outcomes between the two methods.

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Second, we have reported a series of interventions with students who had moderate (10^{th} percentile) or mild (30^{th} percentile) impairments in word level reading skills, and which focused considerable instructional time in text reading activities with an emphasis on both modeling and practicing fluent reading (Torgesen, Rashotte, Alexander, Alexander, & MacPhee, 2003). Again, the students who began the intervention with moderate level (10^{th} percentile) word reading difficulties showed only small improvement in their age – based percentile ranking for fluency, although they increased substantially in other dimensions of reading skill.

Third, and probably most important, we have not obtained the same differences in outcomes between reading fluency and reading accuracy in our prevention studies as has occurred in the remedial studies. Figure 1 shows the percentile scores (a score of 50 is average)

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for reading accuracy and fluency outcomes for four samples of 9-12 year old children with severe (below 2nd percentile) to moderate (10th percentile) word level reading difficulties. Each sample is identified by their reading accuracy percentile at the beginning of the intervention. The leftmost data is from Torgesen, Rashotte, et al. (2001), next is from a severely impaired sample in Torgesen, et al. (2003) that received 133 hours of intervention, next is from a moderately impaired sample that received 51 hours of intervention from Torgesen, et al. (2003), and next is the moderately impaired sample that received 100 hours of intervention reported in the same paper.

Outcomes for text reading fluency and accuracy from two prevention studies are presented on the right side of Figure 1. The most obvious difference between the outcomes from the prevention and remediation studies is that the gap between reading fluency and reading accuracy is not nearly as large for the prevention as for the remediation studies. The first prevention study (Prevention 1; Torgesen, Wagner, Rashotte, Rose, Lindamood, & Garvan, 1999) provided 2 ½ years of instruction to children in 20 minute sessions four days a week from the second semester of kindergarten through second grade. The children were identified as the 10% most at risk for reading failure because of low scores in phonemic awareness and letter knowledge in the first semester of kindergarten. The data in Figure 1 show the performance of children in the most effective instructional condition at the end of fourth grade), two years after the intervention was concluded. The children's scores for both reading accuracy and fluency are solidly in the average range.

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In the second study (Prevention 2; Torgesen, Wagner, Rashotte, & Herron, 2003), we provided preventive instruction during first grade to children identified at the beginning of first grade as the 20% most at risk for reading failure. The children were taught in small groups using a combination of teacher led and computer assisted instruction in 50 minute sessions, four days a week from October through May. The data in Figure 1 show the performance of the children from the most effective condition at the end of second grade, one year after the intervention concluded. Again, both reading accuracy and fluency scores are solidly within the average range, and the gap between these scores is very small.

We have proposed elsewhere (Torgesen, Rashotte, et al. 2001) several possible explanations for the difficulty we have experienced in helping older children to "close the gap" in reading fluency after they have struggled in learning to read for several years. The most important factor appears to involve difficulties in making up for the huge deficits in accurate reading practice the older children have accumulated by the time they reach late elementary school. These differences in reading practice emerge during the earliest stages of reading instruction (Allington, 1984; Beimiller, 1977-1978) and they become more pronounced as the children advance across the grades in elementary school. Reading practice varies 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 (Cunningham & Stanovich, 1998).

One of the major results of this lack of reading practice is a severe limitation in the number of words the children with reading disabilities can recognize automatically, or at a single glance (Ehri, 2002; Share & Stanovich, 1995). This limitation of "sight word" vocabulary is a principle characteristic of most children with reading disabilities after the initial phase in learning to read (Rashotte, MacPhee, & Torgesen, 2001, Torgesen, Alexander, et al., 2001; Wise, Ring, & Olson, 1999). The limitation arises because children must read specific words accurately a number of times before they can become part off their sight vocabulary (Reitsma, 1983; Share & Stanovich, 1995). As Ehri (2002) points out, “sight words include any word that readers have practiced reading sufficiently often to be read from memory.” (p. 10).

We have already provided evidence in this chapter 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. 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, reliance on analytic processes will not produce the kind of fluent reading that results when most of the words in a passage can be recognized “by sight.”

What other factors may limit fluency in children with reading difficulties?

Maryanne Wolf (Wolf, 2001a; Wolf and Bowers, 1999) and Patricia Bowers (Bowers, Golden, Kennedy, & Young, 1994; Bowers & Wolf, 1993) have proposed that some children with reading difficulties may have special difficulties forming the orthographic representations that are the basis for recognizing words from memory. In their conceptualization, this problem exists independently from the common problems that most children with reading disabilities have in becoming accurate readers through the use of alphabetic reading skills, and can constitute a “double deficit” for many students. Children with this second type of processing deficit perform extremely poorly on measures of rapid automatic naming, which require them to name series of familiar digits or letters as rapidly as possible. In Wolf’s and Bowers’ conceptualization of the processes common to both rapid naming and fluent word reading, they focus on the need for a "precise timing mechanism" that is important in the formation of the visually-based representations of words that allow them to be recognized as whole units in text (Wolf & Bowers, 1999). They hypothesize, “…that slow letter (or digit) naming speed may signal disruption of the automatic processes which support induction of orthographic patterns, which, in turn, result in quick word recognition (Bowers & Wolf, 1993, p. 70)." If this conceptualization is correct, it means that, even after students with this second type of deficit become accurate readers, they will still struggle with reading fluency because it is much more difficult for them to learn to recognize words by sight than for other children.

Linnea Ehri (2002) has recently developed a compelling theory of the way that sight word representations are formed that does not require a “double deficit” to explain the special difficulties that some students with reading disabilities may have in learning to recognize words from memory. Her theory also helps to explain the lingering problems with reading fluency experienced by dyslexic students in Germany, even after they have become relatively accurate readers. In developing this theory, Ehri sought to understand how children are able to acquire very large numbers of precise orthographic representations (representations in memory that contain information about a word’s spelling) so rapidly.

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Ehri (1998; 2002) suggested that, in order to understand the speed with which children form orthographic representations for previously unknown words, we need a "mnemonically powerful" system. One of the central ideas of her theory of sight word development is that "readers learn sight words by forming connections between letters seen in spellings of words and sounds detected in their *pronunciations already present in memory* (Ehri, 2002, p. 11, italics added)." In other words,

> readers learn to process written words as phonemic maps that lay out elements of the pronunciation visually. Beginners become skilled at computing these mapping relations spontaneously when they read new words. This is the critical event for sight word learning. Grapho-phonemic connections provide a powerful mnemonic system that bonds written words to their pronunciations in memory along with meanings. Once the alphabetic mapping system is known, readers can build a vocabulary of sight words easily (p. 12).

In order to use a word's phonology as a mnemonic for helping to remember its orthography, children need to be able to fluently apprehend the phonological structure of words as they compute the "mapping relations" between the letters and sounds in words. Thus, children with highly fluent and easily applied phonemic segmentation skills (skill in identifying all the individual phonemes in words) should be able to form orthographic representations more easily than children who are less phonemically fluent. This suggests that individual differences in the fluency and accuracy of phonemic segmentation processes should be related to the development of sight word representations and reading fluency.

This relationship, however, is not powerfully supported in the current research literature. For example, a recent longitudinal study by Schatschneider, Fletcher, Francis, Carlson, and Foorman (2004) examined the relative importance of phonemic awareness, rapid naming of letters, rapid naming of objects, letter naming, letter sound knowledge, vocabulary, and visual discrimination measured in kindergarten in predicting reading accuracy, fluency, and comprehension at the end of 1st and 2nd grades. The combination of phonemic awareness, rapid naming of letters, letter naming and letter sound naming was a strong and significant predictor of all three outcomes at both grades. However, in this study, as in others (eg., reviewed in Allor, 2002), rapid naming of letters was a stronger predictor of fluency than was phonemic awareness when the variables were considered separately.

A number of studies have directly compared the predictive power of phonemic awareness and rapid automatic naming speed, and some have suggested that the importance of individual differences in phonemic awareness may diminish because other factors become more important in predicting reading fluency as reading skills develop (e.g., Allor, Fuchs, & Mathes, 2001; Bowers & Wolf, 1993; Catts, Gillispie, Leonard, Kail, & Miller, 2002; Sprugevica & Hoien, 2004; Sunseth & Bowers, 2002;). Allor's (2002) review of 16 studies that included both phonemic awareness and rapid naming measures found mixed results as to whether both contributed uniquely with the other in the predictive model. Findings varied based on whether reading was measured as single word reading accuracy, comprehension, or fluency. In general, however, rapid automatic naming tasks were found to be better predictors of reading fluency than were measures of phonemic awareness.

One unexamined possibility in these longitudinal/predictive studies is that rapid automatic naming tasks may be better predictors of reading fluency than measures of phonemic awareness because they assess the *fluency* of fundamental cognitive processes required for construction of sight word representations, while measures of phonemic awareness have measured only the accuracy of these processes. The model of sight word development considered here would predict that there should be strong relationships between measures of rapid automatic naming for letters (assuming that speed of identifying letter names is highly correlated with speed of identifying letter sounds) and reading fluency. Rapid computation of mapping relationships between the orthographic and phonological structure of words would require highly automatic associations between letters and the sounds they typically represent. However, the model would also predict strong relationships between individual differences in fluent access to the phonological structure of words and individual differences in the speed and ease with which orthographic representations are formed. A more complete test of this hypothesis must await the development of reliable and valid measures of fluency of access to the phonological structure of words.

Let us now return to the findings mentioned in the introduction that children with reading disabilities in Germany and other countries with regular orthographies have more serious problems with reading fluency than they do with reading accuracy. In the context of Ehri's (2002) theory of the way sight word representations are formed, it is interesting that Landerl, Wimmer, & Frith (1997) found their sample of German dyslexic students to perform equivalently to a sample of American dyslexic students on a difficult measure of phonemic awareness, in spite of the stronger decoding skills of the German students. This finding mirrors that of de Jong and van der Leij (2003) who found that Dutch 4th grade children with significant reading fluency problems had average decoding skill and performed competently on relatively easy measures of phonemic awareness, but were impaired relative to grade level control students on a more difficult phonemic awareness measure. These authors view these results as suggesting that, whereas in regular orthographies deficits in phonemic awareness may not influence older student's decoding skill, their effect is still felt on reading fluency.

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Summary and conclusions

The basic premise of this chapter has been that the reading fluency problems of children with reading difficulties occur primarily as the result of their difficulties forming large vocabularies of words that they can recognize "by sight" or at a single glance. Without powerful early interventions to support the development of independent and accurate reading skills, these students do not read accurately or extensively enough to learn to recognize thousands of words from memory. Thus, when they are asked to read a passage at grade level, two kinds of problems are likely to be observed. First, they will not be able to instantly, or automatically, recognize as many of the words in the text as average readers. There will be many words they stumble on, guess at, or attempt to "sound out." The second problem is that their attempts to identify words they do not immediately recognize will produce many errors. They will not be efficient in using letter-sound relationships (phonics) in combination with context to identify unknown words.

If older students with these types of word-level reading problems receive powerful and appropriately focused interventions, many of them can become accurate readers, and their reading comprehension improves as a result of being able to correctly identify more of the words in text (Torgesen, et al., 2001; Torgesen, in press). However, when compared to average readers of their same age, the "sight word" vocabulary of these students will still remain severely restricted because "sight words" must be acquire one at a time through multiple correct reading trials over time. Since average level readers are adding new words to their sight word vocabulary through reading practice almost every day, it is very difficult for reading disabled students, even if they begin reading more accurately, to close the enormous gap between them and their same-age peers in the numbers and extent of words that can be read fluently from memory. Thus, it is not easy for these students to become "fluent readers" if the standard of reading fluency is based on the ability to fluently identify almost all of the words in *text appropriate for their age*. This difficulty in recovering the "lost ground" in development of one's sight word vocabulary that results from several years of minimal and inaccurate reading is the simplest current explanation for the enduring reading fluency problems of students even after they become more accurate readers through strong reading interventions.

We have also considered the possibility that many students with reading disabilities may have special difficulties acquiring fully developed orthographic representations, even after they become accurate readers. Although the precise nature of the underlying difficulty associated with this problem is not clear at this point, the problem itself would mean that these students would require even more accurate practice trials than normal readers in order to create reliable orthographic representations. They also may require different kinds of instructional support, particularly support that makes the phonological structure and grapheme-phoneme connections in unfamiliar words more explicit.

In this chapter, we have said nothing about effective instruction for reading fluency, anticipating that this topic will be covered by other chapters in this volume. What should be clear from the analysis presented here, however, is that effective interventions for students struggling with reading fluency must substantially increase the number of opportunities these students have to accurately practice reading previously unknown words. Both techniques that provide reading practice in connected text (Hudson, Lane, & Pullen, in press; Myer & Felton, 1999) and those that provide practice reading words in isolation (Levy, 2001; Levy, Abello, & Lysynchuk, 1997; Tan & Nicholson, 1997) have been shown to improve reading fluency in struggling readers. Another possible avenue for the development of more powerful interventions in the future lies in the use of "engineered" text that provides systematic and frequent exposures to high utility words as a way to help build children's sight word vocabularies (Hiebert, 2004). Finally, it may be useful to experiment with ways to enhance student's awareness of the match between the orthography and phonology of unknown words as a way to stimulate the use the words' phonology as a mnemonic for their orthography (Ehri, 2002).

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Table 1: Average performance of 3rd grade students on measures of reading and verbal ability who achieved different levels of proficiency on the FCAT

Skill/ability	FCAT Performance Level (N)				
	1 (47)	2 (26)	3 (54)	4 (63)	5 (17)
WPM on FCAT	54	92	102	119	148
Fluency Percentile[1]	6th	32nd	56th	78th	93rd
Phonemic Decoding[2]	25th	45th	59th	74th	91st
Verbal knowledge/reasoning[3]	42nd	59th	72nd	91st	98th

[1]Fluency was measured with the Gray Oral Reading Test, 4th Edition (Wiederholt & Bryant, 2003)
[2]Phonemic Decoding Efficiency was measures with the Test of Word Reading Efficiency (Torgesen, Wagner, and Rashotte, 1999)
[3]Verbal knowledge/reasoning were measures with the Vocabulary and Similarities subtests of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1974)

Table 2

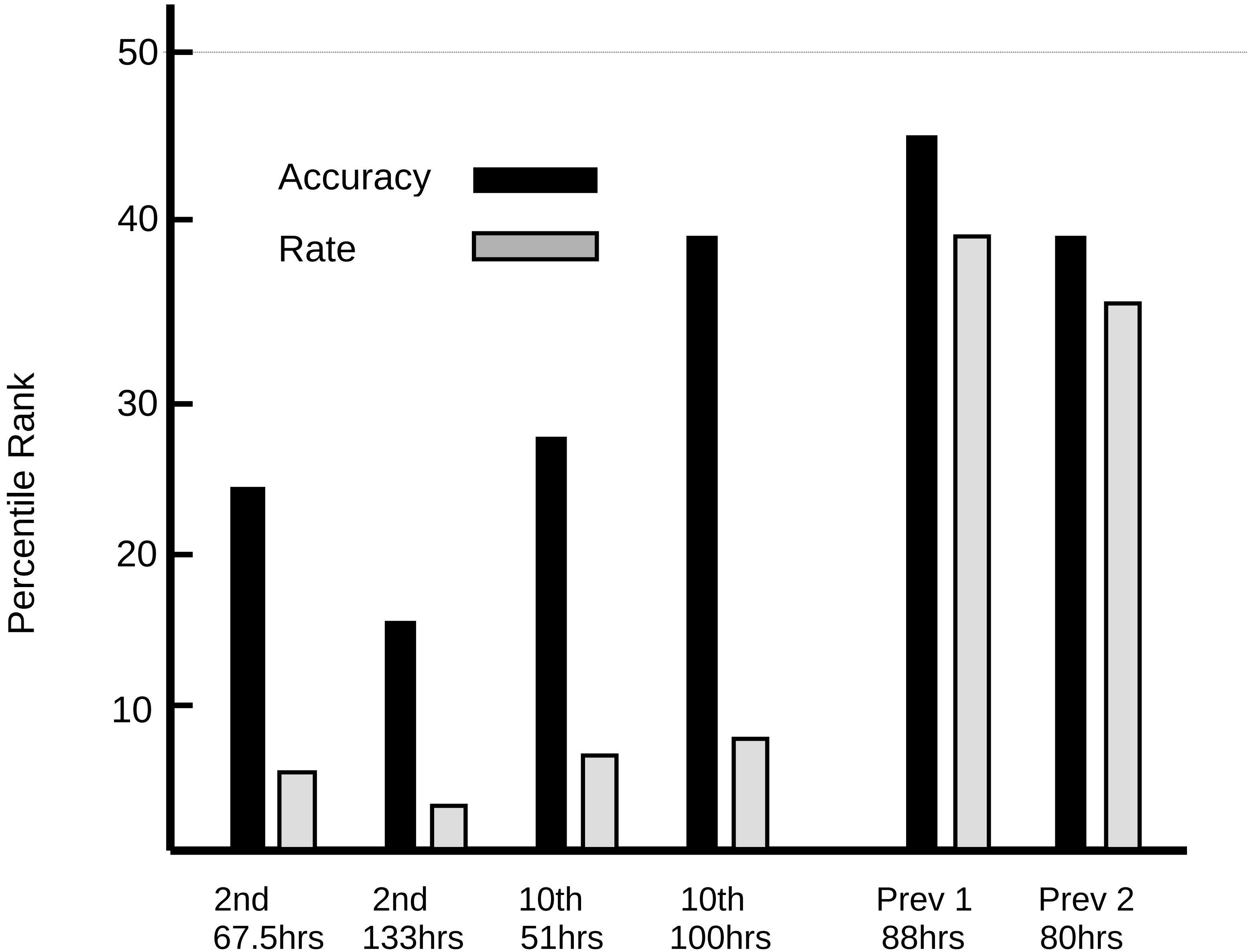
Correlations between text reading rate and component reading skills, processing speed, and general vocabulary knowledge

	Longitudinal (5th grade)	Remediation I (5th-7th grade)	Remediation II (3rd-6th grade)	Prevention I (4th grade)	Prevention II (2nd grade)
Nonword Eff.	.75**	.55**	.73**	.87**	.81**
Sight Word Eff.	.82**	.71**	.81**	.88**	.89**
Rapid Naming	.44**	.28	.53**	.66**	.63**
Vocabulary	.62**	.13	.33*	.44**	.07
Text Fluency Range[1]	55-145	55-95	55-115	55-140	70-130

Adapted from Torgesen, J.K., Rashotte, C.A., Alexander, A. (2001). Principles of fluency instruction in reading: Relationships with established empirical outcomes. In M. Wolf (Ed.), *Dyslexia, Fluency, and the Brain.* pp. 333-355. Parkton, MD: York Press.

[1]This 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.

Figure Caption:
Figure 1: Outcomes for reading accuracy and reading rate from remedial and preventive studies of children with reading disabilities.


50
40
30
20
10
Percentile Rank
Accuracy
Rate
2nd
67.5hrs
2nd
133hrs
10th
51hrs
10th
100hrs
Prev 1
88hrs
Prev 2
80hrs