



# Dyslexia: A Brief for Educators and Parents

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## Purpose:

*Dyslexia is a term that has been applied since the early part of the 20th Century to many students with reading difficulties. The term comes from medicine, but its broadest application is within education. Many educators, however, remain confused about the term in spite of the fact that major advances in our understanding of dyslexia have been made through scientific research over the past 40 years. The purpose of this paper is to briefly describe what is currently known about dyslexia, focusing particularly on methods of early identification, prevention, and remedial instruction.*

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## What is Dyslexia?

The most widely accepted current definition of dyslexia is the following:

*Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.*

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This definition is the one used by the National Institutes of Child Health and Human Development which has sponsored the majority of recent research on dyslexia, and it was also adopted by the Board of the International Dyslexia Association in 2002. The individual elements of this definition will be discussed in turn.

*Dyslexia is a specific learning disability that is neurological in origin.*

Dyslexia is a term used to refer to a specific type of learning disability. It is important to acknowledge that students may struggle in learning to read for many reasons, including lack of motivation and interest, weak preparation from the pre-school home environment, weak English language skills, or low general intellectual ability (Snow, Burns, & Griffin, 1998).

In fact, the family and socio-cultural conditions associated with poverty actually contribute to a broader and more pervasive array of reading difficulties in school-aged children than do the neuro-biological conditions associated with dyslexia. Students with dyslexia represent a *subgroup* of all the students in school who experience difficulties learning to read.

The primary evidence that students with dyslexia have a problem that is inherent, and not the sole result of poor teaching or lack of experience, comes from twin studies showing that dyslexia is substantially heritable (Olson & Gayan, 2001), and from brain imagery studies showing differences in the way the brains of dyslexic students function (Shaywitz, 2003).

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Although students with dyslexia can show a variety of subtle or not-so-subtle language problems prior to entry in school (Catts & Kahmi, 2005), their problems become very noticeable once they begin learning to read. They have extreme difficulties acquiring accurate and fluent phonemic decoding skills (phonics), and this interferes with their ability to read text accurately or to read independently.

Dyslexic students struggle to acquire both knowledge of letter-sound correspondences and skill in using this knowledge to “decode” unfamiliar words in text. In first grade, their difficulties with accurate word identification quickly begin to interfere with the development of text reading fluency. Difficulties decoding unfamiliar words in text interfere with the development of fluency because, to become a fluent reader in the primary grades, students must learn to recognize large numbers of words automatically, or at a single glance.

Students learn to recognize individual words “by sight” only after they accurately read them several times (Ehri, 2002). Thus, the initial difficulties that students with dyslexia have in becoming accurate and independent readers interfere with the development of their “sight word vocabularies,” and they quickly fall behind their peers in the development of reading fluency.

*These difficulties typically result from a deficit in the phonological component of language that is often unexpected in*

relation to other cognitive abilities and the provision of effective classroom instruction.

The discovery that students with dyslexia experience difficulties processing the phonological features of language (Liberman, Shankweiler, & Liberman, 1989) was important in establishing the foundations of the current scientific understanding of dyslexia. The phonological processing problems of students with dyslexia are usually not severe enough to interfere with the acquisition of speech, but they sometimes produce delays in language development, and they significantly interfere with the development of phonemic awareness and phonics skills for reading.

Spoken words are composed of strings of phonemes, with a phoneme being the smallest unit of sound in a word that makes a difference to its meaning. Thus, the word *cat* has three phonemes, /c/-/a/-/t/. If the first phoneme is changed to /b/, it makes the word *bat*, or if the second phoneme is changed to /i/, it makes the word *bit*.

When students first begin to learn to read, they must become aware of these individual bits of sound within syllables so they can learn how our writing system represents words in print. The letters in printed words correspond roughly to the phonemes in spoken words. Once a child understands this fact, and begins to learn some of the more common letter/sound correspondences, he/she becomes able to "sound out" simple unfamiliar words in print. Skill in using phonemic analysis to identify words that have not

been seen before in print (and beginning readers encounter these words in their reading almost every day) is one of the foundational skills required in learning to read text independently (Share & Stanovich, 1995). Because of their phonological processing difficulties, students with dyslexia experience difficulties acquiring phonemic awareness, which is followed by the difficulties learning letter sounds and phonemic decoding skills that have already been described.

Phonological processing skills are only moderately correlated with general intelligence, so it is possible to have average, or above average general intellectual ability and still experience the kind of reading difficulties observed in students with dyslexia. A student can also have below average general intellectual skills and have the same kind of phonological processing disabilities.

Dyslexia is *not caused* by low general intellectual ability, but rather by special difficulties processing the phonological features of language, that can co-exist with above average, average, or below average general intellectual ability. This is one reason why previously used "discrepancy formulas" for the identification of students with learning disabilities were unfair to many students.

Children who had both low general intellectual ability and phonological processing difficulties were routinely denied learning disability services, even though their reading problem was not caused by low general ability, but rather by the type of phonological processing problems identified as the core cause of

dyslexia (Fletcher, Denton, & Francis, 2005).

It is important to note here that science has shown it is incorrect to think of dyslexia as an “all or none” phenomena. That is, the phonological processing abilities required for acquisition of early reading skills are normally distributed in the population, just like musical talent, athletic ability, or most other human abilities. It is possible to have extremely weak phonological processing skills, or to be only mildly impaired in this area. It is also possible to have above average skills in the phonological domain. If students have extreme phonological processing weaknesses, it is very, very difficult for them to acquire early reading skills, while students with mild difficulties in this area often require only a moderate amount of extra instruction to become good readers (Wagner & Torgesen, 1987).

*Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.*

One of the most serious consequences of early difficulties becoming an accurate, confident, fluent, and independent reader is that it affects the amount of reading that students do. For example, a study done a few years ago indicated that students reading at the 50th percentile (average) in 5th grade read about 600,000 words in and out of school during the school year. In contrast, students reading at the 10th percentile read about 50,000 words during the same period of time (Anderson, Wilson, & Fielding, 1988).

Large differences in reading practice emerge as early as the beginning of first grade (Allington, 1984).

In addition to directly affecting the development of reading fluency, these practice differences have a significant impact on the development of other cognitive skills and knowledge, such as vocabulary, reading comprehension strategies, and conceptual knowledge (Cunningham & Stanovich, 1998). This latter type of knowledge and skill, in turn, is important for comprehension of texts in upper elementary, middle, and high school (Rand, 2002).

Of course, other “secondary consequences” to the child’s self-esteem and interest in school can be just as important as the effect on intellectual skills in determining ultimate school success.

### **How can students with dyslexia be identified in school?**

Children likely to have difficulties learning to read can be identified as early as preschool or kindergarten, but it is frequently not possible to differentiate in preschool or kindergarten between students who have dyslexia, and students who are at risk for reading problems for other reasons. For example, the clearest indicators of dyslexia in kindergarten are difficulties acquiring phonemic awareness, learning letter/sound correspondences, and learning to decode print using phonemic decoding strategies (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001).

Unfortunately, many poor children, or those with limited exposure to Standard English in their homes, also manifest these same types of difficulties in kindergarten.

An accurate diagnosis of dyslexia in preschool or kindergarten is more likely when these problems occur in students who:

1. have strong abilities in other areas of language such as vocabulary;
2. come from homes that provide a language and print rich pre-school environment; and,
3. have a first or second-degree relative who experienced severe early reading difficulties. However, inherent phonological processing difficulties can also occur in poor children who come to school with limited vocabularies and knowledge of print. Although the phonological weaknesses of these students are most likely the result of lack of certain kinds of language experience in the home, they may also be the result of biologically based, inherent phonological processing weaknesses.

One group of researchers (Vellutino et al., 1996) has argued that because early reading difficulties can result from both inherent weaknesses in phonological processing ability and from poor instruction or lack of prior print/language experience, response to high-quality, intensive reading instruction may be the best way to identify students with inherent cognitive limitations. Theoretically at least, students who lag behind in the

development of early reading skills because of a lack of appropriate experience in the pre-school environment should respond rapidly to high-quality, intensive interventions.

In contrast, students with severe and inherent phonological processing weaknesses should respond more slowly if at all. Although response to this type of intervention would not identify as dyslexic a student whose inherent phonological difficulties were mild (because these students should respond well to explicit and intensive instruction), it will certainly identify students with the *most serious* reading difficulties, whether they be caused by inherent phonological weaknesses or by other factors.

If students are still struggling to master early reading skills by the end of kindergarten, even though they have had exposure to relatively intensive interventions, then they should be provided with additional intensive intervention in first grade (or longer) until they are able to master all reading skills appropriate to their grade level. This, of course, is true for all children, regardless of the exact cause of their reading difficulties.

To summarize, we currently understand how to identify students at risk for reading failure with a relatively high degree of accuracy as early as preschool or kindergarten. Reliable tests of phonemic awareness, letter/sound knowledge, or phonemic decoding will show these students to be substantially behind their peers, unless they have already received powerful instructional interventions.

At present, however, we have neither the equipment nor the scientific knowledge to use brain imaging as a way of diagnosing dyslexia in young children, particularly if the goal is to differentiate them from other students who are struggling in learning to read for different reasons.

In first grade, reliable tests of phonemic awareness, phonemic decoding, and text reading accuracy and fluency will also identify these students accurately. In later grades, dyslexic students who have not received powerful interventions may still remain relatively impaired in phonemic awareness, and will always perform poorly on tests of phonemic decoding, text reading fluency, and spelling. In late elementary, middle, and high school, the reading comprehension performance of these students is likely to be below average (in spite of intellectual abilities that are frequently average or above average), but their reading comprehension performance is usually not quite as low as their word-level reading scores. Particularly in cases where these students have average or above average general intellectual skills, they can often compensate for their poor ability to read the words on a page by "filling in the gaps" through reasoning and use of their background knowledge.

We currently have no scientific evidence that effective prevention of reading difficulties in students with dyslexia depends on accurate differential diagnosis of the disorder in kindergarten or first grade. What is critical is that difficulties learning to read are identified as early as possible, and that intensive and well-targeted interventions be

provided to students who are lagging behind, no matter what the cause. This approach to early assessment and intervention is exemplified in the "response to intervention" (RTI) approach which is currently being proposed as a replacement for discrepancy models as a method of identifying students with learning disabilities (Burns, Jimerson, & VanDerHayden, 2007; Fletcher, Lyon, Fuchs, & Barnes, 2006).

The RTI approach is both a method that can be used to diagnose learning disabilities (dyslexia included), and a way of organizing early instruction in reading. When used as a diagnostic approach, it assigns the diagnosis of disabilities like dyslexia to students who show continued inability to acquire grade appropriate reading skills in spite of high quality initial instruction and appropriately intensive intervention support.

The major weakness of the RTI approach (which is also true of discrepancy approaches) to diagnosis is that the number of students who will be diagnosed as having "dyslexia", or "learning disabilities", depends directly on the quality and intensity of instruction students receive. If schools provide only weak initial instruction and minimal interventions, then a large number of students will end up in third grade (or any grade) as poor readers who could be diagnosed as having "dyslexia" because of their failure to respond to weak instruction.

However, if schools provide consistently strong initial instruction along with sufficient amounts of high-quality,

well-targeted, and intensive interventions, then relatively few students will end up being diagnosed as having dyslexia because of continued poor reading skills.

The model for instruction prescribed by the RTI approach involves three elements:

1. Classroom teachers that provide high quality initial instruction along with small group instruction that is differentiated according to student needs. Classroom teachers are encouraged to differentiate instruction in multiple ways (time, group size, focus of instruction, lesson structure) in order to more effectively meet the needs of all students in their classroom.
2. Reliable screening and progress monitoring tests to identify students falling behind in reading growth. Any system that provides reliable assessment of emerging reading skills several times a year would identify all students with dyslexia in the system as well as other students who are struggling in reading for different reasons.
3. Interventions for struggling readers that are sufficiently powerful to accelerate their reading development toward grade level standards. Sometimes these interventions are provided by classroom teachers, sometimes by reading specialists (including special educators), and sometimes by paraprofessional tutors. Data from ongoing progress monitoring of student growth is used to guide adjustments to interventions so that

all students receive instruction that effectively accelerates their reading growth. In many schools, the classroom teacher, by herself, will not be able to provide sufficiently intensive interventions to meet the needs of all her students, so a school level system for allocating intervention resources will be required (Torgesen, 2006).

The most important point of this section is that we can, using tests currently available, accurately identify students who are likely to struggle with reading starting in preschool or kindergarten.

What these tests cannot do this early is to differentiate students with dyslexia from other students who will struggle in learning to read for reasons other than dyslexia. The goal of every school should be to provide interventions for all struggling readers that are sufficiently powerful to bring their reading skills up to grade level standards. If this is accomplished for all struggling readers, then it will automatically be accomplished for all students with dyslexia.

### **What type of instruction is most effective for students with dyslexia?**

Prevention of reading difficulties in students with dyslexia requires both effective classroom instruction during the regular "reading block" and powerful intervention support for children with the most severe phonological processing difficulties (Forman & Torgesen, 2001). From their classroom teacher, children with dyslexia need engaging, systematic, and explicit instruction in all the critical

components of literacy development (i.e. phonemic awareness and phonics, fluency, comprehension, vocabulary, spelling, and writing), and they will also need extra support during the time when small group instruction is differentiated based on student needs.

If classroom teachers are not skilled in providing this type of instruction, many schools will simply have too many students requiring extra interventions, and school resources will be overwhelmed. Another way of saying this is that regular classroom teachers should be able to meet the instructional needs of many students with dyslexia who are only *mildly impaired* in phonological processing. If their instruction is not strong enough to meet the needs of mildly impaired students, those with more severe processing difficulties may not be able to receive the much more intensive instruction they require (Foorman, Breier, & Fletcher, 2003).

At this point, it is useful to remember that children with dyslexia are only *one subgroup* of all the students in a school that that may be at risk for reading failure. Many students with dyslexia come to school with well developed vocabularies, strong reasoning and thinking skills, and excellent language comprehension abilities. The most efficient approach for these students will usually be to provide intervention support focused on their areas of primary difficulty which would typically be phonemic awareness, phonemic decoding, and text reading accuracy and fluency. Of course, like all other students, children with dyslexia need instruction in vocabulary and reading comprehension strategies,

but the instruction they receive from their regular classroom teachers in these areas will typically be sufficient.

In many schools, there will be another large group of students "at risk" for reading difficulties. These children come largely from families of lower socio-economic or minority status, or they are English Language Learners, and they enter school significantly delayed in a much broader range of pre-reading skills (Whitehurst & Lonigan, 1998; Hart & Risley, 1995). These children have weaknesses in both the broad oral language knowledge that supports reading comprehension and in the phonological and print-related knowledge required in learning to read words.

Classroom instruction that explicitly teaches how letters and sounds relate with ample opportunities to practice these relations by reading text are important for such children (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998), as well as outreach to parents to build language and literacy experiences in the home (Foorman, Anthony, Seals, & Mouzaki, 2002). Although it is theoretically possible for a child to enter school weak in vocabulary and conceptual knowledge, but strong in the phonological skills and knowledge required in learning to read words, these children are, in fact, quite rare. This pattern of abilities is not commonly observed because the same pre-school environmental conditions that are associated with limited vocabulary growth also have a negative impact on the growth of print-related knowledge and skills like phonemic awareness and letter knowledge.

Children with general oral language



weaknesses plus phonological weaknesses will require interventions in a broader range of knowledge and skill than those who come to school impaired only in phonological ability. However, because both groups have weaknesses in the phonological and print-related domain, *both kinds of children* will require special support in the growth of early word reading skills if they are to get off to a strong start in learning to read. As was mentioned earlier in the section on identification of students with dyslexia, the screening, progress monitoring, and diagnostic tests used with young children should be able to help target interventions on areas of greatest need in all students requiring special reading interventions. The same, is true, of course, for older students with dyslexia who continue to have reading difficulties.

The primary differences between instruction appropriate for all children in the classroom and that required by children with relatively severe dyslexia are related to the manner in which instruction is provided. Specifically, instruction for children with severe dyslexia must be more *explicit and comprehensive*, more *intensive*, and more *supportive* than the instruction provided to the majority of children. Interventions provided to students with dyslexia should also be targeted on the specific types of skill and knowledge that are interfering with their reading growth.

Explicit instruction is direct, systematic, and leaves nothing to chance. Most of the knowledge that is acquired in the process of *typical* reading development is discovered by the child during interactions with print. As children read,

they notice useful generalizations about print-sound relationships, and they also learn to recognize many words “by sight” which is the first step toward fluent reading (Share & Stanovich, 1995).

However, because of their weaknesses in the area of phonological processing (specifically their delayed development of phonemic awareness), children with dyslexia require explicit and systematic instruction to help them acquire the knowledge and strategies necessary for decoding print. As Gaskins, Ehri, Cress, O’Hara, and Donnelly (1997) have pointed out, “First graders who are at risk for failure in learning to read do not discover what teachers leave unsaid about the complexities of word learning. As a result, it is important to teach them procedures for learning words” (p. 325).

Not only do children with dyslexia require more explicit instruction (meaning that more things must be directly taught), they also acquire skills and knowledge in the phonological domain more slowly than average students. Both of these teaching/learning challenges make it necessary to provide students with dyslexia much more *intensive instruction* than other students in order to maintain normal growth patterns in reading. The most practical method for increasing instructional intensity for highly at-risk students is to provide small group instruction both during, and in addition to, the instruction the students receive during the reading block. Although there are many different ways to organize this instruction (Greenwood, 1996; Fuchs, Fuchs, Mathes, & Simmons, 1997; Torgesen, Houston, Rissman, & Kosanovich, 2007), there can be no

question that children with dyslexia will learn more rapidly under conditions of greater instructional intensity than they will in typical classroom settings.

Effective early interventions, as well as remedial instruction that is powerful enough to accelerate students' rate of reading growth, almost always involve extra small group or 1:1 instruction for periods of time varying from 20 minute a day to 90 minutes a day, four or five days a week (Elbaum, Vaughn, Hughes, & Moody, 1999, Scamacca, et al., 2007, Torgesen, 2005). To provide effective preventive or remedial instruction for students with severe dyslexia, schools need to develop the capacity to provide substantial amounts of skillful and targeted small group instruction to these students for as long as it takes to help them acquire grade level reading skills.

The last characteristic of effective instruction for students with dyslexia that differentiates it from instruction sufficient for most children is that it must be more supportive, both emotionally and cognitively. Because acquiring the basic skills required for accurate and fluent reading is so difficult for children with dyslexia, their need for more positive emotional support in the form of encouragement, feedback, and positive reinforcement is widely understood. However, their potential need for more cognitive support, in the form of carefully "scaffolded" instruction, is less widely appreciated. Instruction for at risk or children with reading disabilities typically involves two types of scaffolding.

One type of scaffolding involves careful sequencing so that skills build very

gradually—children are always systematically taught and practiced on the skills required for any task they are asked to do (Swanson, 1999). Another type of scaffolding involves finely tuned interactions between teacher and child that support the child in accomplishing a task that he/she could not do without the teacher's help (Stone, 1989). The dialogue between teacher and student leads the child to discover what kind of processing, or thinking, needs to be done in order to complete the task successfully. The point of this type of instructional interaction is that the child is led to discover the information or strategies that are critical to accomplishing the task, rather than simply being told what to do. As Juel suggested (1996), the ability to offer scaffolded support while children are acquiring reading skills may have increasing importance as the severity of the child's disability increases.

### **Can reading difficulties in dyslexic students be prevented?**

The best answer to this question from current research is that serious reading difficulties can be prevented in most students with dyslexia if the right kind of instruction is provided with sufficient intensity early in development. For example, in one study conducted in Florida several years ago (Torgesen, et al., 1999), the 12 percent of students most at-risk for reading difficulties were identified in kindergarten based on their performance on measures of letter knowledge and phonemic awareness. Students received 1:1 intervention in reading for 20 minutes a day, four days a week, starting in the second semester of

kindergarten and extending through the end of second grade. However, by today's standards, these students' regular classroom teachers did not provide systematic and explicit instruction in phonemic awareness and phonics during the regular reading block.

At the conclusion of instruction, children in the strongest instructional condition performed in the average range on measures of phonemic decoding (average score = 48th percentile) and reading accuracy (average score = 45th percentile). However, there was substantial variability in response to the instruction, and 30% of the group scored below the 30th percentile in phonemic decoding at the end of the study. The corresponding figure for reading accuracy was 39 percent.

Since the children in this study were selected to be the 12% most at risk for reading failure, the authors estimated that, if the strongest condition from this study were available to all students who needed it, approximately 4% of all children would remain weak in phonemic decoding ability and 5% would perform below the 30th percentile in sight word reading at the end of second grade.

In a follow-up study conducted by the same research team (Torgesen, Rashotte, Wagner, & Herron, 2001), students who were the 18% most at risk for reading failure at the beginning of first grade (based on performance on letter knowledge and phonemic awareness) were provided with small group (3 students) reading instruction for 50 minutes a day, four days a week, from October through May. This study was

conducted only in schools in which the classroom teachers provided systematic and explicit instruction in phonics (also vocabulary, fluency, and comprehension) during the regular reading block, and the interventions were offered in addition to that instruction.

At the end of first grade, students in the strongest instructional condition scored at the 74th percentile on a measure of phonemic decoding (they had scored at the 4th percentile at the beginning of the year) and at the 67th percentile on a measure of reading accuracy. The percent of children obtaining scores below the 30th percentile on these measures was 12% (phonemic decoding) and 10% (reading accuracy). Using calculations similar to those applied to the previous study, the authors estimated that, if interventions and classroom instruction as strong as those provided in this study were available for all students who needed them, only 2% of students would remain seriously impaired in phonemic decoding and reading accuracy at the end of first grade.

Other recent intervention studies tell a roughly similar story. If strong interventions are provided to "at risk" students as early as kindergarten and first grade, the overall percentage of students who continue to struggle with basic reading skills can be reduced to under 5% (Mathes et al., 2005; Scammacca, et al., 2007; Torgesen, 2002). Of course, becoming a proficient reader by the end of third grade involves much more than learning to read words accurately and fluently. The ultimate goal of reading instruction is to enable students to comprehend the meaning of what they

read. However, the examples provided in this section are relevant to a discussion of the prevention of serious reading problems in students with dyslexia because the “core difficulty” these students face involves learning to read text accurately and fluently.

These examples demonstrate that, if sufficiently powerful interventions are available, it is possible to maintain the word level reading skills of most students with dyslexia at roughly average levels during the early primary grades.

As another example of what can be accomplished in preventing reading difficulties with powerful instruction provided in the early primary grades, the experience of schools in the Kennewick, Washington, school district is instructive (Fielding, Kerr, & Rosier, 2007). In 1995, the 13 elementary schools in this district were challenged to have 90% of their students reading at grade level (as assessed by a good measure of reading comprehension) within three years. In the year prior to the initiative, the percent of students in 3rd grade reading at grade level was 48% in the district, and within 9 years, 9 of the 13 schools had accomplished the 90% goal. One of the stronger schools (Washington Elementary) accomplished the goal in 5 years, and in 2006, 98% of students at Washington were reading at grade level at the end of third grade. Washington had to make radical changes in the way they organized and delivered reading instruction in K-3 in order to accomplish this goal. They teach reading to all students in an uninterrupted two-hour block, and some students in first and second grade receive an additional 60 to 90 minutes of small group

intervention in addition.

They accomplished part of their goal by aligning instruction and working harder at third grade, but they didn't achieve their ultimate results until they began carefully monitoring reading growth in kindergarten through second grade and providing intensive interventions to students who were lagging behind.

### **How effective is remedial instruction for older students with dyslexia?**

Unfortunately, there are many students with dyslexia currently in our schools who did not receive timely and sufficiently powerful interventions to prevent the emergence of serious reading difficulties. When children with dyslexia have been in school three or four years and have not had sufficiently strong preventive instruction, they will show two obvious difficulties when asked to read text at their grade level.

First, they will not be able to recognize as high a proportion of the words in the text fluently or “by sight” 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 phonemic analyses in combination with context to identify unknown words. It also is the case that a small number of children with the most severe form of dyslexia will show these same weaknesses despite the provision of timely and powerful interventions.

Several years ago, a large study of special education in the state of Texas reported that students receiving reading interventions did not fall further behind with each year in special education, but neither did they close the reading gap to any meaningful degree (Hanushek, Kain, and Rivkin, 1998). This finding echoed earlier studies (Foorman, Francis, Fletcher, Winikates, & Mehta, 1997; Kavale, 1988; McKinney, 1990; Schumaker, Deshler, & Ellis, 1986; Zigmond, et al., 1995) showing that, at best, students receiving remedial reading instruction in special education make one year's growth for each year of instruction, but rarely do they make the substantial improvements (two or three years growth) that are required in order to help them eventually "close the gap" with their same-age peers.

A recent review of remedial instruction for older students with severe reading disabilities (Torgesen, 2005) indicated that we do know how to accelerate reading growth in older students with dyslexia, but that it is exceedingly difficult to bring them to grade level standards in all areas of reading skill. Further, the instructional conditions in studies that accelerate reading growth in older students are universally more powerful (smaller groups, more instructional time, highly trained teachers) than those typically available to students receiving special education services in our public schools.

One of the most powerful intervention studies to date with older dyslexic students was conducted in Gainesville, Florida, through the Morris Child Development Center (Torgesen et al., 2001). Sixty students with severe reading

disability in grades 3-5 who had been receiving special education services for an average of 16 months were provided 8 weeks of very intensive reading instruction. They were taught 1:1 by highly skilled teachers in two, 50-minute sessions, five days a week for 8 weeks, for a total of 67.5 hours of instruction. During this time, in the strongest instructional condition, their scores in phonemic decoding increased from below the 1st percentile to the 39th percentile, their scores in text reading accuracy increased from the 4th to the 25th percentile, and their scores in reading comprehension increased from the 13th to the 27th percentile.

After the study, about 40% of the students were "staffed out" of special education, while the rest remained with no further intervention from the study. At the two year follow-up point, the students scored at the 29th percentile in phonemic decoding, the 27th percentile in text reading accuracy, and the 36th percentile in reading comprehension. The reading comprehension of these students was slightly higher than would have been predicted from the level of their general verbal ability, which was at the 29th percentile.

A finding from this study, which has been observed in other studies as well (Torgesen, 2005), is that the students' percentile rank in reading fluency did not improve nearly as much as the scores for other reading skills. At the beginning of the study, the students' reading fluency fell at the 3rd percentile, while at the two year follow up, it was at the 4th percentile. Although their fluency for lower grade level passages did increase

dramatically (from 38 to 101 words per minute), when the students were asked to read passages at their grade level, there were still too many words that they could not recognize "by sight" so, although they could read them much more accurately following intervention, they still had to stop and "sound out" too many words. If students with dyslexia remain essentially "non readers" during the early part of elementary school, they miss out on enormous amounts of reading practice, and it is very difficult to close this practice gap once they become older, because their classmates are reading at such high volumes by that time.

To summarize, it is clear that we currently understand how to provide more powerful interventions to older dyslexic students than they may frequently receive in special education. It is also clear that it is possible for them to acquire useful phonemic decoding skills after third grade, if the instruction they previously received was not sufficient to help them in this area. Another recent review of interventions with older disabled readers has indicated that it can also be very helpful to directly teach these students reading comprehension strategies (Scammacca, 2007). Both lack of early reading practice, and difficulties with word-level reading skills apparently interfere with dyslexic students' ability to acquire the range of strategies that good readers use to increase their comprehension. Although it is challenging to provide appropriately targeted instruction for older students with dyslexia who continue to struggle in reading, it may be even more challenging to provide *sufficient amounts of instruction, in small enough groups* to accelerate their

development.

For older students with severe reading disability, assistive technology in the form of devices that decode print may be helpful in allowing them to acquire information from content classes such as social studies and science. It is important to continue to work to improve their functional reading skills, yet it does not make sense to allow a severe bottleneck in reading to preclude maximal acquisition of the knowledge about the world that is required to be an independent participant in society.

### Conclusion

Scientific research has contributed substantially to our understanding of dyslexia and other forms of reading difficulty over the past 40 years. We now have a widely agreed upon definition, and we also have assessments that can accurately identify children with dyslexia as early as kindergarten. We also understand many of the instructional conditions that must be in place to prevent the emergence of the early word-level reading difficulties that are characteristic of students with dyslexia.

Further, we have demonstrations from successful schools and districts that illustrate ways to provide these conditions on a large scale. We also have research-based knowledge about the conditions required to accelerate the development of reading skills in older students with dyslexia, although the nature and duration of instruction required to "normalize" the reading ability of these students is not currently known. We clearly have enough knowledge about "what

works" for these children to apply it on a large scale.

The most pressing problems at present are related to the twin challenges of implementing high-quality initial reading instruction in every classroom and identifying the resources and personnel to provide intensive reading interventions for all students that need them in schools. Within this broad set of challenges, a shortage of highly skilled intervention specialists and a lack of financial resources to support the additional instructional time and smaller instructional groups required by many students may be the most difficult.

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