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CORE Reading Expert

Misconceptions About Dyslexia

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You might know that earlier this year CORE produced an informative white paper on dyslexia. In this edition of the Reading Expert, we will explore in more depth the misconceptions that surround dyslexia.

To begin, dyslexia is a language-based disorder rooted in challenges discerning the sound components of language, making it difficult for those affected to connect letters and sounds to decode words. To quote from a portion of the agreed upon definition of dyslexia used by researchers (Lyon, Shaywitz, & Shaywitz, 2003) and the International Dyslexia Association:

> Dyslexia is a specific learning disability that is neurobiological 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.

One of the most common misconceptions about dyslexia is that it is a visual processing problem characterized by letter reversals or letters "dancing around" the page (Hudson, High, & Al Otaiba, 2007; Rayner et al., 2001). In fact, letter reversals are common among children with or without difficulties learning to read. Dyslexic children exhibiting letter reversals is an indicator of the phase of word reading development they are in rather than an indicator of dyslexia. Reversals really are a sign that letters and sound/spellings have not been fully learned but need to be.

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Misconceptions About Dyslexia (cont.)

Another common misconception is that children will outgrow dyslexia if just given more time. There is ample evidence to suggest that reading difficulties persist in adolescence and into adulthood without evidence-based interventions (Francis et al., 1996; Shaywitz et al., 1999, 2003). Intervention studies confirm that it is crucial to provide solid instruction in the earliest grades to prevent problems from becoming entrenched and to intervene early at the first signs of reading difficulty (pre-K–2). However, it is still possible and in fact vital to provide intervention to older struggling readers. With older struggling readers, intense intervention can improve their word reading accuracy but most likely they will remain slow in reading rate (Torgesen, Rashotte, & Alexander, 2001).

Two common misconceptions also persist about who is affected by dyslexia. Boys are diagnosed with dyslexia more often than girls. However, this is due more to diagnostic practices rather than an actual gender difference in dyslexia rates. In other words, longitudinal research has shown that approximately equal numbers of boys and girls have dyslexia, but often boys are identified more frequently due to behavioral issues (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990). Another misconception is that dyslexia affects only English speakers. Researchers have studied reading difficulties and dyslexia across many cultures and languages, and the evidence is clear that dyslexia exists across languages. Because English is a complex orthography, or spelling system, accurate decoding poses the major challenge along with fluent reading. In other languages such as German and Spanish, where the spelling system is more consistent, the main problem is not accurate decoding but rather fluent reading (Ziegler & Goswami, 2005).

Finally, another common misconception that has yet to be completely debunked but has definitely lost traction over the years is the idea that dyslexia can be treated with colored overlays or lenses. This idea stems from the once widely held belief that dyslexia is primarily a visual problem. In fact, "there is no strong research evidence that intervention using colored overlays or special lenses has any effect on the word reading or comprehension of children with dyslexia" (Hudson, High, & Al Otaiba, 2007).

In closing, children diagnosed with dyslexia are not forever doomed to reading failure. Only a very small percentage of reading disabled students—the most challenging cases (2–3%)—may continue to have severe difficulty learning to read despite receiving high-quality, evidence-based intervention. Research has suggested that 97–98% of children can learn to read. If those with difficulties are caught early (pre-K–1) and provided with systematic, intense instruction, their reading problems will be limited (Hudson, High, & Al Otaiba, 2007). Unfortunately, currently we have fewer than half of our students nationwide reading proficiently (NCES, 2017). Providing expert instruction and equally expert intervention, therefore, is a moral imperative.

Misconceptions About Dyslexia (cont.)

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Marvelous Mathematician

Fluency and Number Sense Work Together

by Dean Ballard, Director of Mathematics, CORE, Inc.

I had just stepped on a fluency land mine when I said to a class of sixth graders last week, "I say 76, you say . . ." Students hesitated, got quiet, and less than half the class ventured to respond. The half that responded were equally split between "24" and "26." I had given the class a target number of 100, and students had to figure out what number must be added to my number to get a sum of 100. This is a fluency activity my colleague Mary Buck taught me called "I Say, You Say." When I said to the class "I say 75, you say . . ." they quickly and correctly responded "25." However, when I next said, "I say 76, you say . . ." most of the class floundered. This example is where real number sense is critical for fluency, and the students' weakness in both of these areas "blew up" my activity. Students had forgotten the basic idea of one more and one less from the primary grades. Therefore, I immediately adapted the activity to build in the needed number sense. I went back to "I say 50, you say . . ." to get the full class on the same sound footing, and through visual modeling, connections to equations written on the board, small group discussion, and additional practice, I guided all students to make sense of the mathematical relationships involved in these problems.

This classroom episode from last week illustrates how number sense and fluency are intertwined, and how we can adapt activities designed to build fluency to deepen important number sense. Fluency is an important part of number sense, and activities that are focused on quick retrieval of facts, computations, or procedures should be viewed as opportunities to build both fluency and number sense.

The Common Core State Standards for Mathematics (2010) describe procedural fluency as "skill in carrying out procedures flexibly, accurately, efficiently, and appropriately" (p. 6). This description portrays fluency with several aspects: 1) flexibility and adaptability with numbers and procedures; 2) accuracy with mental and written calculations, both in terms of correct use of procedures, algorithms, and facts, and in terms of correct results; 3) efficiency when working on problems, such as choosing methods that promote speed and accuracy; and 4) appropriate use of procedures, algorithms, and facts—choosing the best method for a given context. This description takes fluency well beyond simply memorizing math facts and selected algorithms, and into the realm of real number sense.

Although fluency is more than memorization, it is important to recognize that memorization is an important part of fluency. Research highly recommends practice that builds automaticity. The IES Practice Guide, Assisting Students Struggling with Mathematics (Gersten et al., 2009), recommends providing 10 minutes of daily practice to strengthen needed fluency with facts and procedures (pp. 79–83). John Hattie, Douglas Fisher, and Nancy Frey (2017) support this recommendation noting that spaced practice, repeated practice of previously learned knowledge over "a long period of time," has a high effect size of 0.71 (p. 129). In addition, the National Mathematics Advisory Panel (2008) found that fluency with whole numbers and fractions are part of a critical foundation for learning algebra (pp. 17–18).

Fluency and Number Sense Work Together (cont.)

Age (Years)	Average Capacity Range (Chunks of Information)	Average Time Limit for Retention
Younger than 5	2 ± 1	Unknown
From 5 to 18	5 ± 2	5 to 10 minutes
Older than 14	7 ± 2	10 to 20 minutes

An important purpose for maintaining quick retrieval of facts and procedures is to keep our working memory free to focus on new information. Brain researcher David Sousa (2008) explains that working memory has limits, as shown on the chart to the right (pp. 51–52). Although these limits increase over time, the amount of information we can hold and process at one time remains low over the course of our lifetimes.

Daniel Willingham (2004) states,

> Our ability to think would be limited indeed if there were not ways to overcome the space constraint of working memory. One of the more important mechanisms is the development of automaticity. When cognitive processes . . . become automatic, they demand very little space in working memory, they occur rapidly, and they often occur without conscious effort.

Memorization of math facts and algorithms allows more working memory to focus on new concepts and skills as they arise in math lessons.

There are two types of practice or rehearsal with new information: rote rehearsal and elaborate rehearsal. Both types of practice are important. Rote rehearsal is memorization without continuing to think through an idea or fact. This provides opportunities to continue to build long-term memory of facts and procedures that are already understood. For example, when my youngest daughter was learning about multiplication, I checked to make sure she understood the concept. She modeled for me the meaning of 3 × 5 and 6 × 7. Once I was satisfied she understood what was going on with multiplication, I knew she did not need to spend more time thinking through or visualizing every single-digit multiplication problem. I then guided her to engage in memorization activities to reach automaticity with all the multiplication math facts.

Elaborate rehearsal is practice and processing that involves making sense of ideas and information. The learner processes and reprocesses information to connect it together, to connect it to prior learning, and to assign meaning to it. Elaborate rehearsal is necessary for students to probe the deeper meaning and interrelationships of mathematical concepts. Elaborate rehearsal also increases retention. The classroom experience I shared at the beginning of this article is an example of this type of rehearsal or practice. Sousa states (p. 53),

> When students get very little time for, or training in, elaborative rehearsal, they resort more frequently to rote rehearsal for nearly all processing. Consequently, they fail to make the associations or discover the relationships that only elaborative rehearsal can provide.

There are many fluency activities, such as "I Say, You Say," KenKen puzzles, and Sprints, that provide concurrent opportunities for building fluency and deepening number sense. The key is taking advantage of these opportunities by focusing students' attention on mathematical relationships.

For example, Sprints, developed by Bill Davidson and incorporated into EngageNY/Eureka Math, provide the opportunity for students to see connections between problems and make sense of math properties and numerical relationships. Sprints are worksheets with 30–44 problems focused on practice with facts and skills. Problems are arranged so they increase in complexity incrementally from the first problem to the last problem. The teacher may use Sprints in many ways, such as a timed classroom activity in which the time and number of problems to be completed are set as goals and adjusted based on the fluency level of the students.

Fluency and Number Sense Work Together (cont.)

Students may use Sprints for practice at home or as untimed practice in class. When doing Sprints, it is helpful to focus on and celebrate students improving their personal speed or accuracy from one round to the next. Sprints are excellent tools for rote rehearsal.

To engage students in elaborate rehearsal requires stepping out of the Sprint delivery process and asking students to think and talk about the progression of a concept and skill within a Sprint. This promotes students engaging in sense making and connecting ideas in math. When students examine problems, look for patterns, compare one problem to another, discuss which problem was the most difficult and why, and in other ways think about the math they are practicing, they deepen number sense and build fluency together.

Conclusion

Daniel Willingham (2008) states that "Memories are formed as the residue of thought. You remember what you think about, but not every fleeting thought—only those matters to which you really devote some attention" (p. 18). Many fluency activities, whether mental math, computer/online, or paper-and-pencil activities, can be adapted to provide opportunities for students to think about the mathematics. CORE math consultants frequently model fluency activities in K–12 classrooms. Our modeling includes using activities for rote rehearsal and selective elaborate rehearsal. The key for adapting fluency activities to deepen number sense is to pause from solving problems and to focus on understanding the mathematics. This often requires asking a few timely questions that promote reasoning and discourse about mathematical relationships, and/or providing multiple methods for visualizing and understanding ideas and connections. Rote and elaborate rehearsal are possible within the same activity. For this to happen, we must be alert to the needs of our students and the opportunities within an activity, and familiarize ourselves with techniques to build both fluency and number sense together.

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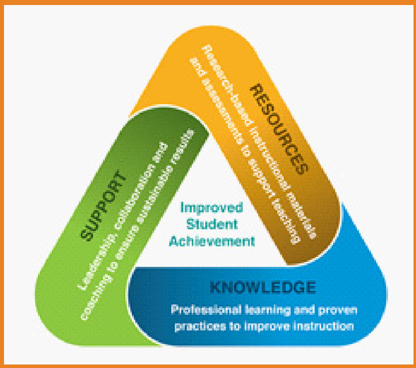
CORE Leadership Corner

A central tenet of CORE's work is the connection among three big ideas that result in student achievement: knowledge, resources, and support. All three must be in place to realize improved student achievement. Teachers need **knowledge** of effective, evidence-based practices to teach literacy and math. Teachers also need to use high-quality instructional materials and assessments as their professional tools and **resources**. And teachers need coaching and administrator **support** to help them implement these tools and resources.



For the past eight years, the Common Core State Standards (CCSS) have been viewed as a lynchpin for improving student achievement. Many school districts across the country saw the advent of the CCSS as an opportunity to move away from specific curriculum materials and have teachers create their own curriculum, in part due to the lack of curriculum offerings that were aligned to those standards. However, many are recognizing that this approach is failing our students and causing much frustration for teachers. Recent research, however, bolsters the importance of implementing well-designed and effective curricula. Implementation of an evidence-based, standards-aligned curriculum with integrity is a value-add for improving student achievement. Much better standards-aligned curriculum offerings now exist. In addition, equity is best addressed when a common curriculum is implemented across a school system, rather than a more eclectic and haphazard approach.

We would like to share three informative resources that can help you as a district or site leader to "make the case" for a systematic implementation of a standards-aligned, evidence-based curriculum (as called for in the Every Student Succeeds Act [ESSA]) system-wide or school-wide.

- The report by the Aspen Institute titled *Practice What You Teach: Connecting Curriculum and Professional Learning in Schools* discusses how systems can support teachers in rising to the challenge by helping them become experts in the curriculum they are using.
- The article "Louisiana Threads the Needle on Ed Reform" from *Education Next* discusses the curriculum-driven reform efforts led by the Louisiana Department of Education.
- The 15-minute podcast *A Better Curriculum in the Bayou State* offers an interview with Rebecca Kockler, Assistant Superintendent at the Louisiana State Department of Education, about her state's curriculum initiative.

About CORE

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