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eHearsay

DYSLEXIA

OSLHA
Unlocking Communication
Ohio Speech-Language-Hearing Association

TABLE OF CONTENTS

Ohio Speech-Language-Hearing Association (OSLHA)

MISSION:
Empowering our members by providing opportunities for professional development, advocacy, and leadership development necessary to foster excellence in the services provided to individuals with communication and related disorders.

HISTORY:
Founded in 1945, the Ohio Speech-Language-Hearing Association (OSLHA) is a professional association representing speech-language pathologists and audiologists throughout Ohio. OSLHA is recognized by the national American Speech-Language-Hearing Association (ASHA) as the official professional organization for Ohio. OSLHA members provide services for the evaluation and rehabilitation of communicative disorders. Members work in a variety of settings including: clinics, health care facilities, hospitals, private practice, schools, and universities. Members must abide by the OSLHA Code of Ethics.

OSLHA
Unlocking Communication
Ohio Speech-Language-Hearing Association

eHearsay: Statement of Purpose

eHearsay, the electronic journal of the Ohio Speech- Language- Hearing Association, is designed to address the professional development needs of the state association.

Issues are may be developed around specific themes and can include invited papers, research articles, review, tutorial, research forum, letter to the editor, clinical focus/forum or viewpoints.

eHearsay is published as a web journal annually. Continuing education credits will be available for each issue.

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In this Issue:

Dyslexia

Welcome to the Dyslexia Issue of *eHearsay*! I would like to thank Laurie Sheehy and OSHLA for inviting me to be Issue Editor for this important topic. More than 15 years ago, I began to focus my continuing education studies on literacy, and quickly recognized the vital role that speech-language pathologists play in the early identification of children with reading disabilities, specifically dyslexia. After listening to numerous stories from frustrated and desperate parents who were seeking help for their child with dyslexia, I knew that there was a tremendous need for qualified specialists, and I was determined to be part of the solution. My goal from that point forward was to study and become certified in a structured literacy intervention approach while also taking continuing education courses in all aspects of academic language and literacy. Speech-language pathologists with expertise in dyslexia are an invaluable resource on literacy teams, and can make a significant difference in the lives of these bright and talented children. My hope is that this issue will support SLPs in identifying dyslexic children and provide options for appropriate intervention approaches.

When you embark upon the study of dyslexia, be prepared for a winding course! It is a multidisciplinary field comprised of research in neurobiology, psychology, genetics, speech-language pathology and education. This issue of *eHearsay* is a prelude to this, and begins with a comprehensive article by University of Florida researchers and speech-language pathologists, Drs. Laurie Gauger and Linda Lombardino, who clarify the definition of dyslexia from the research literature, and present how to use diagnostic information to differentiate dyslexia from other reading disorders in order to make informed treatment decisions. The next article from educational psychologist and memory interventionist, Dr. Milton Dehn, expertly peels back the layer of working memory weakness that is often part of the dyslexic profile, and offers strategies to help the dyslexic reader. Our next outstanding author, psychologist and researcher, Dr. Louisa Moats, analyzes the phonological, orthographic and morphological features of spelling errors and outlines the linguistic competency needed for adequate spelling development. To address the frequent co-occurrence of ADHD and dyslexia, Drs. Andrew and Cheryl Colvin, clinical neuropsychologist and psychologist, respectively, present a thorough review of the literature and provide implications for assessment and intervention. Next, Cleveland State University researcher and speech-language pathologist, Dr. Monica Gordon-Pershey, deepens the study of language and literacy by addressing the secondary consequences of dyslexia and the need for direct instruction in the semantic, syntactic and metalinguistic aspects of reading and writing. Finally, from their research and clinical work, three speech-language pathologists, Drs. Lauren Katz, Karen Fallon and Joanne Pierson, present an explicit instructional model for helping children with dyslexia learn *how to learn* from written text -- the ultimate goal of learning to read.

At the end of this issue are two articles that bring the research learning back home into the everyday world of living with and teaching dyslexic children. The first personal viewpoint is written by Steve Griffin, experienced school-based Ohio speech-language pathologist and K-6 Literacy Coordinator in Marysville City Schools. He creatively outlines and discusses nine practical principles for SLPs who are "in the trenches," working daily with struggling readers and striving to become more involved on school literacy teams. The second personal viewpoint is written by parent and Ohio dyslexia advocate, Cheryl Kleist, as she chronicles her own journey into understanding dyslexia -- from getting her son diagnosed appropriately and walking through the special education/IEP process to courageously testifying before the Ohio Senate Education Committee in support of Ohio's House Bill 96.

This issue involved the collaboration of a team of knowledgeable and talented professionals, donating countless hours of their time to prepare these articles for publication. I would like to personally thank the authors, peer reviewers and editorial consultants as well as the guidance and support of our *eHearsay Journal* editor, Laurie Sheehy. Working on this issue was truly a "labor of love" for many of us! After reading these articles, if you have questions about furthering your professional training in dyslexia, I would recommend the resources available through the International Dyslexia Association. My final words of encouragement are to listen to the stories that are shared about children with dyslexia, many of whom have amazing gifts and talents, and begin to envision how *you* can make a tremendous difference in their lives. Happy reading!

Sincerely,

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A Description of Dyslexia and Profiles of Children with Reading Disabilities

Laurie M. Gauger & Linda J. Lombardino

Abstract

The identification and diagnosis of dyslexia, a specific reading disability, continues to be a challenge for clinicians and educators in spite of the fact that specific reading disability was first identified over a century ago and it is the most commonly studied learning disability across cultures. These difficulties are largely related to the fact that learning disabilities that disrupt both spoken and written language often co-occur and that the degrees of impairments in both areas fall on a continuum of severity. In this paper, we describe the nature of dyslexia and provide guidelines for differentiating dyslexia from language disorders in which components of both spoken and written language are impaired. Further, we review various diagnostic profiles of children across grades to illustrate the range of strengths and weaknesses in the performance of children with dyslexia. Finally, we address the type of multisensory reading and writing instruction that has a long history of success in treating children with dyslexia.

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Learning Objectives

1) Describe the nature of dyslexia based on recent research literature
2) Discuss various diagnostic profiles that demonstrate heterogeneity in performance on various tests
3) State types of strategies and approaches optimal for the treatment of dyslexia

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There is a general consensus among most reading researchers that dyslexia, also known as developmental dyslexia, is foremost a specific type of developmental language disorder which manifests most prominently in difficulties with word identification, word decoding, spelling, and reading fluency (Fletcher, 2009; Vellutino, Fletcher, Snowling & Scanlon, 2004). Across languages, dyslexia affects approximately 5-10% of the school age population in literate countries (Chan, Ho, Tsang, Lee, & Chung, 2007; Georgiou, Papadopoulos, Zarouna, & Parrila, 2012; Shaywitz, Shaywitz, Fletcher, & Escobar, 1990). While a much higher percentage of children demonstrate difficulties with reading, only a subset of these children show profiles consistent with dyslexia.

The following definition of dyslexia was adopted by the International Dyslexia Association (IDA) Board of Directors in 2012 and is used by National Institute of Child Health and Human Development (NICHD) (IDA executive summary, 2010).

> *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* (Lyon, Shaywitz, & Shaywitz, 2003, p.2).

This definition underscores that dyslexia is a specific impairment in written language (Peterson & Pennington, 2012).

The universal hallmark of dyslexia is impaired oral reading accuracy and speed. In addition to deficits in component skills of reading, numerous cognitive processing deficits have been associated with dyslexia (Ramus & Ahissar, 2012). The two cognitive skills that have been most widely studied and consistently identified as behavioral markers associated with this specific reading disability are phonemic awareness and rapid automatic naming (RAN) (Denckla & Rudel, 1976; Manis, Seidenberg, & Doi, 1999; Wagner, Torgesen, & Rashotte, 1994). In the case of phonemic awareness, a metalinguistic skill, the demand is to isolate, manipulate and recall phonemic sequences in words (e.g., "Say the word "cat" without saying /k/."), while in the case of RAN, the demand is to retrieve specific phonological codes for familiar stimuli under timed conditions (e.g., record how long it takes for an individual to name several rows of alternating stimuli from a closed set of letters, digits, or colors). Because both skills predict reading ability, they are often cited to support the *phonological deficit hypothesis* of dyslexia, which posits that deficits of phonological processing (processing sounds) underlie the reading deficits that characterize dyslexia (Vellutino, Fletcher, Snowling & Hulme, 2005). However, the degree to which phonemic awareness and RAN contribute to the same phonological construct that underlies reading continues to be a subject of debate. While some researchers argue that rapid naming skills represent the storing and retrieval of phonological codes (Wagner et al., 1994; Shaywitz, Morris & Shaywitz, 2008), others posit that RAN skills reflect a specific deficit in orthographic processing (processing letters) that is distinct from phonological processing (Wolf & Bowers, 1999; Georgiou, Parrila & Kirby, 2009; Bowey, McGuigan & Ruschena, 2005); still others suggest that phonological and orthographic processing are developmentally intertwined (Ziegler & Goswami, 2005; Ramus, 2001) and cannot be clearly disentangled (Share, 2008).

It is quite commonly accepted that phonemic awareness is the strongest cognitive predictor of individual differences in reading development across all alphabetic languages (Melby-Lervag, Lyster, & Hulme, 2012). While the role of phonemic awareness is intuitively clear in alphabet languages that rely on some degree of letter-sound associations, the strength of contribution of phonemic awareness appears to vary with the degree of transparency of the language's orthography (i.e., degree to which there are consistent letter-sound mappings) (Seymour, 2005; Ziegler & Goswami, 2005; Ziegler, et al., 2010). For example, in an alphabetic language such as Finnish, which has highly regular transparency between grapheme and phoneme mapping, impaired phonological errors for reading words and pseudowords and spelling are less likely to occur than in far less transparent alphabetic languages such as English, which contains many instances of unpredictable examples of irregular grapheme-phoneme associations (e.g., nation, yacht). Even in Chinese, an ideographic language, phonological deficits have been found to occur (Ho, Law, & Ng, 2000) although deficits in visual-orthographic pattern recognition and differentiation are more common (Ho, Chan, Tsang, & Lee, 2002**)**. In recent reports of the causal mechanism that underlies dyslexia, Castles and Friedmann (2014) and Peterson and Pennington (2012) provide cogent discussions in support of the findings that not all children with dyslexia present with clear phonological processing deficits and that dyslexia manifests in multiple patterns of deficits. These papers underscore the variability of profiles in the cognitive-behavioral strengths and weaknesses in individuals with dyslexia.

It is important to note that impairments in phonemic awareness have been found to be a cause (Morais, 1991), as well as a result (Catts, Fey, Zhang, & Tomblin, 1999), of reading disabilities in children. Some children demonstrate marked deficits in phonemic awareness before receiving formal reading instruction, while other students' deficits in phonemic awareness are not evident until they begin to struggle with learning to read. Fortunately, children who receive training in phonemic awareness are typically responsive to phonemic awareness intervention, which, in turn, improves their word-level reading skills (Ehri, Nunes, Willows, Schuster, Yaghoub-Zadeh & Shanahan, 2001; for review).

Differentiating Types of Developmental Language Disorders

Different types of developmental language disabilities have been described in the reading research literature. Deficits in component skills of both spoken language and written language can vary on a continuum of skills that include phonological decoding (i.e., sounding out words), vocabulary knowledge, listening comprehension, reading comprehension and spelling (Cain, 2010; Catts & Weismer, 2006; Nation & Snowling,

1997). Children with reading disabilities are typically grouped into two main categories (1) Those who have dyslexia or specific reading disability and (2) Those who have both spoken and written (mixed) language disabilities (Aaron, Joshi, & Williams, 1999; Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Bishop & Snowling, 2004; Catts & Kahmi, 2005). In this latter group, a subgroup of children have been identified who " appear" to have adequate spoken language yet show deficits in reading comprehension only. However, upon close study, language-processing deficits have been shown to occur in this subgroup when higher-level language skills such as drawing inferences from text are studied. Children with primary deficits in reading comprehension often go unidentified until the 4th grade or beyond (Cain, Oakhill & Bryant, 2004; Nation, Clark, Marshall, & Durand, 2004; Nation & Snowling, 1997) and are more likely to have been diagnosed with specific language impairment during the preschool years (Catts, et al., 1999; Nation et al., 2004; Snowling, Bishop, & Stothard, 2000; Oakhill & Cain, 2007). This group of children with primary reading comprehension deficits does not have dyslexia. Their reading comprehension deficits result from weaknesses in oral language skills particularity in the semantic and syntactic domains. In contrast, the diagnosis of dyslexia is reserved for individuals whose primary difficulties with written language lie in phonological and word-level reading and spelling. Individuals with dyslexia demonstrate average to above average oral language abilities.

Distinguishing children with dyslexia from children with mixed spoken and written language impairment is crucial to determining the most effective course of treatment (Pennington & Bishop, 2009; Peterson & Pennington, 2012; Butterworth & Kovas, 2013). Two models of component language processes serve well to differentiate children with dyslexia from children with mixed language disorders. In their widely cited simple view of reading (SVR), Gough and Tunmer (1986) presented a simple yet elegant formula for describing the process of reading, ***R = D x C***, in which ***R*** represents reading comprehension, ***D*** represents decoding and ***C*** represents oral language comprehension. This formula posits that a deficit in either decoding or oral language comprehension will result in a deficit in reading comprehension. In a more expansive but parallel framework, Bishop and Snowling (2004) proposed a two-dimensional model to illustrate how different types of language strengths and weakness differentiate children with developmental reading disorders. In their model, language skills are divided into two domains, non-phonological (semantics, syntax, pragmatics) and phonological (sound categorization, sound blending, sound deletion) processes and are used to profile language strengths and weaknesses. Children can present with weakness in one domain or a weakness in both domains. In the Gough and Tunmer model, children with dyslexia are best characterized by a deficit in decoding and a strength in oral language comprehension. In Bishop and Snowling's model, children with dyslexia are best characterized as showing weakness in the phonological domains of language and strength in non-phonological domains. In contrast, children with mixed reading impairments exhibit weaknesses that extend beyond the decoding or phonological domains to include higher-level language processes.

Overall, children with dyslexia show strengths in their comprehension and production of oral language. Their deficits are most apparent in lower-level word processing skills that include word decoding, rapid word recognition, and spelling. Conversely, their strengths are apparent in their conceptual or "reasoning" abilities, which are often notably discrepant with their difficulties in reading and spelling (Snowling, 2000; Fletcher, 2009). Their spoken language is adequate and sometimes advanced in spite of instances where retrieving words or formulating sentences clearly may be slowed down by circumlocutions. Their listening comprehension is adequate except in some instances when their verbal memories are taxed by a series of temporally-ordered information for repetition and/or retention.

As noted earlier in this paper, weaknesses in the phonological processing skills of children with reading impairments have been widely reported in the literature as a hallmark of dyslexia (Snowling, 2000; Vellutino, et al., 2004). The three phonological processing skills that are most closely associated with reading achievement include phonemic awareness, phonological working memory, and RAN (Wagner, et al., 1994). Most studies find that disabled readers, regardless of whether they have dyslexia or mixed language impairment, demonstrate *comparable deficits* in phonological processing skills (Catts, Adolf, Hogan & Weismer, 2005; Eisenmajer, Ross, & Pratt, 2005; Kim & Lombardino, 2013). Other studies have shown that

some impaired readers also show marked deficits in oral language skills and it is this difference that differentiates children with dyslexia from children with mixed spoken and written language disorders (Catts, Fey, & Tomblin, 1997; Catts, Adolf, & Weismer, 2006; Nation, et al., 2004; Kim & Lombardino, 2013).

Relationships between specific cognitive abilities such as language knowledge, reasoning, working memory, processing speed, attention, and reading ability are well established (Bishop, 1994; Johnson, Humphrey, Mellard, Woods, & Swanson, 2010). In fact, cognitive skills such as working memory, attentional capacity, and processing speed, have all been found to be deficient in children with language-learning disabilities (Weismer, Plante, Jones, & Tomblin, 2005; Archibald & Gathercole, 2006), including those with dyslexia (Berninger, Raskind, Richards, Abbott, & Stock, 2008; McGrath, et al., 2011). While a discrepancy between cognitive ability and reading achievement is no longer widely accepted as a singular way to diagnose learning disabilities, cognitive ability is seen as a "protective factor for academic success in students with learning disabilities" (Kim & Lombardino, 2013, pp. 471). More specifically, students who exhibit higher-level processing skills, often apparent in oral language comprehension, verbal reasoning abilities, and verbal working memory are those whose profiles are most characteristic of children with dyslexia.

Differentiating dyslexia and mixed language impairment may be challenging initially, even for seasoned clinicians. As noted by Snowling (2009), individuals who meet the criteria for dyslexia often demonstrate a continuum of skills. Some individuals demonstrate a "classic" case of dyslexia in which phonological deficits are prominent and occur without obvious spoken language deficits, while others with dyslexia may show subtle deficits in word finding, spontaneous recall of words, and pronunciation of complex words (Catts, 1986; Lombardino, Riccio, Hynd, & Pinheiro, 1997). Students with dyslexia should have age-appropriate language comprehension skills unless they have had diminished environmental experiences with language that would impact their oral language knowledge. However, many children with dyslexia exhibit difficulties in recalling sequences of directions due to difficulties with verbal working memory. In cases where children have both dyslexia and attention-deficit disorder, behavioral characteristics such as distractibility, impulsivity, and inattention may interfere with their processing of linguistic information in specific contexts. Further complicating the diagnosis of dyslexia is the fact that oral language skills can be considered both a cause and result of reading difficulties (Stanovich, 1986; Spear-Swerling & Sternberg, 1996). While it is quite clear that weaknesses in oral language result in reading comprehension problems, it is also important to keep in mind that for older elementary students and adolescents who struggle with reading, weaknesses in vocabulary often occur because of their lack of experience with reading diverse types of text (Paul & Norbury, 2012; Stanovich, 1986).

An unfortunate fact is that the majority of children with reading disabilities are failing at reading due to extrinsic factors associated with disadvantages in school and/or home environments, such as lack of exposure to early reading experiences at home prior to enrollment in school or lack of high quality instruction in the elementary grades. Without intensive and systemic classroom instruction for reading and writing, these students will often show reading achievement profiles that are similar to children with biologically-based reading disabilities (Spear-Swerling & Sternberg, 1996). This leads one to ask the question, "*Why attempt to differentiate types of reading problems instead of implementing the same high quality instruction for all children with depressed reading achievement?*" The answer to this question lies in the nature of the individual's reading difficulties. Differentiating between the types of reading problems is important when developing intervention plans. Children who demonstrate more broad-based language-learning problems (i.e., those that affect both spoken and written language) require intervention that addresses *both* higher-order oral language weaknesses, such as listening comprehension, and written language weaknesses (reading and writing). For these children, improving reading comprehension, which is the end goal of skilled reading, is dependent on improving oral language comprehension. On the other hand, intervention for individuals with dyslexia should focus on increasing lower-level phonological processing skills that underlie reading and writing.

For children with dyslexia, intervention should always target the phonological and orthographic dimensions of written language including sound-letter associations, word syllable structures, and spelling patterns. Weaknesses in reading comprehension in children who

have dyslexia are most often the result of impaired ability to accurately identify words in print. However, children with dyslexia who have not experienced the expected exposure to word knowledge (vocabulary, morphology) in their home and/or school environments will require intervention for word meanings as well.

As specified by the National Reading Panel (NRP, 2000), all reading instruction should include explicit and systematic teaching of and ensure grade-level performance in phonological awareness, phonics, vocabulary, fluency, and reading comprehension. If this were accomplished effectively, it would greatly diminish the number of poor readers. All children need to be provided with instruction that meets the NRP's criteria for academic standards and instructional frameworks such as the response-to-intervention model (RTI). The RTI model advocates a tiered model of instruction in which progress monitoring is consistently used to determine the efficacy of instruction (Fuchs & Fuchs, 2001; Wright & Wright, 2007). Children without learning disabilities should be expected to show an adequate trajectory in their acquisition of all dimensions of reading (decoding, word-recognition, morphological root word and affixes, comprehension) during the elementary school years when adequate reading instruction is provided. Children's developmental and familial histories, overall spoken language abilities for formulating and comprehending spoken language, overall academic abilities, trajectory of responses to intervention, behavioral test profiles, and information provided by parents, teachers etc. will contribute to determining the nature of the student's reading difficulties.

A lack of reading proficiency is unacceptable in societies for which literacy is a fundamental skill needed for academic success. Statistics from the National Assessment of Educational Progress (NAEP, 2014) show that on tests of reading proficiency in 2013, about one-third of 4th grade children performed at only the basic-level of knowledge indicating that they have only partially mastered the reading competencies for their grade-level. Most of these children do not have biologically-based reading disabilities and many come from impoverished socioeconomic backgrounds and are second language learners, placing them at great-risk for failing to keep pace with the literacy expectations for their grade levels.

Diagnostic Criteria

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM) is a long established classification and coding manual published by the Psychiatric Association and used internationally to diagnose a wide range of medical diseases and disorders including learning disabilities. In the recent updated version, DSM-5 (American Psychiatric Association, 2013), dyslexia is classified as a Specific Learning Disorder in a category that includes subtypes of learning disorders in reading, writing, and mathematics. According to the DSM-5, a specific learning disorder with impairment in reading includes deficits in word reading accuracy, reading rate or fluency and reading comprehension. A specific learning disorder with impairment in written expression includes deficits in spelling, grammar and punctuation, legible or fluent handwriting, and organization of written expression. Individuals with dyslexia therefore would have impairments in both reading and written expression. While students who have only reading comprehension problems are not typically considered to be reading disabled, under the DSM-5 classification they would fall under the umbrella diagnostic term "specific learning disorder with reading impairment". This is because the DSM-5 does not include disorders of spoken language as a diagnostic criterion. However, when evaluating an individual's reading skills, it is necessary to assess spoken language to determine the primary nature of difficulty for reasons already discussed. The importance of spoken language skills is highlighted in Gough and Tunmer's SVR model. In this model, reading comprehension is dependent on the ability to accurately and fluently decode words *and* the ability to understand spoken language.

Although a set of universal criteria for diagnosing dyslexia is emerging, there are none at the present time. Therefore, professionals who are not fully acquainted with the range of cognitive strengths and weaknesses that are characteristic of children with reading disabilities at different stages of development from kindergarten throughout adulthood may be baffled by the nature of the reading skills in this population. Dyslexia is often under-identified in children who generally perform well in school in spite of unusual difficulties in reading and other aspects of language arts. On the other hand, dyslexia may be over-identified as the result of classifying all reading difficulties as dyslexia (Francis, Fletcher, Shaywitz, Shaywitz, & Rourke, 1996; Shaywitz, 2004).

Tables' 1A-1C (adapted from Lombardino, 2012) highlight symptoms of dyslexia at three stages of development.

Table 1-A. Checklist of risk factors for dyslexia in late preschool and kindergarten

- Late talking with good comprehension
- Late talking with good comprehension and mild articulation errors that reflect an inability to pronounce multi-syllabic words
- Lack of concepts of print such as
    - Sequences of letters stand for a word
    - Letters have corresponding sounds
- Text is read from left to right
- Inability to understand that words that have the same rhyme (boy-toy) go together
- Inability to identify some letters in their names
- Spells using letter forms instead of random marks or scribble
- Spells using knowledge of letters names to represent letters (e.g., the name for the letter "b" contains the /b/) sound).
- Shows a strong preference for having parent/teacher read a book to child rather than trying to read words on the pages along with parents/teachers
- Showing a lack of interest in trying to read that is inconsistent with a strong desire to learn new information

Note: There is a lack of knowledge in these areas that may be due to lack of environmental opportunities or a more global impairment in language. These characteristics are not specific to dyslexia.

Table 1-B. Checklist of behaviors associated with dyslexia in first – through 3rd grade

- Difficulty remembering names of letters
- Difficulty remembering how to pronounce words in print that are familiar(unexpectedly problematic word recognition)
- Difficulty remembering how to decode words in print (unexpectedly problematic word-level decoding)
- Skipping over words while reading
- Difficulty with spelling, especially high-frequency words that should be mastered
- Markedly advanced receptive and expressive oral language skills compared to reading and spelling skills
- Listening comprehension is often a processing strength
- Slow, inaccurate oral reading fluency
- Impaired performance on (1) timed tests of word reading, (2) timed tests of pseudoword decoding, (3) timed tests of reading accuracy and speech (4) tests of spelling, (5) tests phonemic manipulation, (6) tests of rapid automatized naming (RAN), and (7) tests of processing speed

Table 1-C. Checklist of behaviors associated with dyslexia beyond grade 3

- Difficulty completing timed assignments that require reading and/or writing
- Great difficulty with spelling irregular and multisyllabic words
- Misspellings of the same word often vary
- Difficulties with writing conventions such as capitalizations and punctuation along with spelling errors
- Markedly advanced receptive and expressive oral language skills compared to reading and spelling skills
- Listening comprehension is often a processing strength
- Content of written language is in advance of writing mechanics
- Difficulties formulating language quickly to convey thoughtful ideas, concepts etc.
- Impaired performance on (1) timed tests of word reading, (2) timed tests of pseudoword decoding, (3) timed tests of reading accuracy and speech (4) tests of spelling, (5) tests phonemic manipulation, (6) tests of rapid automatized naming (RAN), and tests of processing speed.
- Difficulties with mathematical constructs that require rote memorization or recall of formulas
- Academic material associated with reading and writing is problematic to some degree
- Slow, inaccurate oral reading fluency

The Role of the Speech-Language Pathologist

While speech-language pathologists (SLPs) have a long and well established role in the diagnosis and treatment of spoken language impairments in children, our role in serving children with disorders of written language has not been established nearly as clearly or systematically. This is surprising given that dyslexia is foremost a disorder of language processing (Catts & Kamhi, 2005; Fletcher, 2009; Vellutino et al, 2004).

Specifications for those who are eligible to diagnose dyslexia vary from state to state and are often not determined solely by one specific professional discipline but rather by the expertise of the professional in the area of developmental reading disabilities. However, the American Speech-Language-Hearing Association (ASHA; 2015) specifically states that one of the SLP's roles in working with children with reading and writing difficulties is in administering and interpreting assessment measures to evaluate skills in spoken language, reading, writing and spelling (www.asha.org/advocacy/federal/nclb/How-SLPs-Can-Contribute/).

The teaching of decoding through multisensory methods is often a primary goal for professionals who treat students with dyslexia. While many SLPs, who are systematically trained in multisensory methods of reading instruction for students with dyslexia, provide excellent instructional therapies for children with dyslexia, some practitioners in our discipline believe that reading remediation of this nature should not fall within the purview of the SLP. For example, in her textbook on language disorders, Paul (Paul & Norbury, 2012) argues that direct teaching of sound-letter decoding for word reading should not fall within the scope of practice of the SLP. We strongly disagree with this perspective as we feel that SLPs have the most extensive academic backgrounds in the areas of phonology and morphology, the two domains of language that are foundational to learning the orthographic rules (e.g., syllabication patterns, spelling patterns, spelling rules, derivational morphology, etc.) necessary to continually advance the reading and writing skills of children with dyslexia (Lombardino & Gauger, 2014). ASHA supports this stance and specifically outlines the various roles of the SLP in the intervention of reading and writing disorders, as well as in the prevention and assessment of these types of disorders. In fact, ASHA (2015) refers to SLPs as the "early language and literacy experts" with the specialized knowledge and experience needed to identify the primary cause of reading and writing problems and help children develop literacy skills (www.asha.org/advocacy/federal/nclb/How-SLPs-Can-Contribute/).

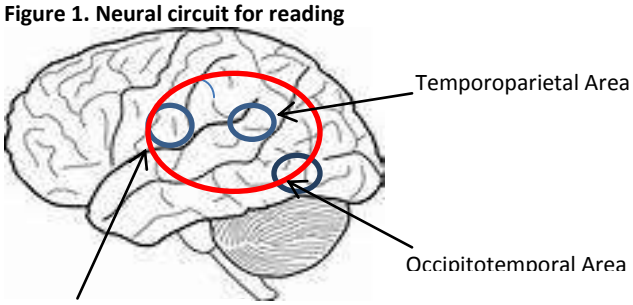
Neurobiological Bases of Dyslexia

There is strong support for the neurobiological basis of dyslexia and for other developmental language disorders from both *genetic* (Powers, Eicher, Butter, Yong Kong, Miller, Ring & Gruen, 2013; Keenan, Betjemann, Wadsworth, DeFries, & Olson, 2006; Pennington & Olson, 2005) and *brain imaging* (Cossu, 1999; Landi, Frost, Mencl, Sandak & Pugh, 2013; Ramus, 2006; Pugh, et al, 2001) studies in the current scientific literature. However, Butterworth and Kovas (2013) aptly note that the "complex genetic brain and cognitive processes underlying these conditions [developmental learning disorders] remain poorly understood "(p.300).

Numerous researchers have established that dyslexia runs in families (Pennington & Olson, 2005; Keenan et al., 2006) with a heritability rate ranging from 44-75% on the basis of behavioral test profiles (Plomin and Kovas, 2005). Genes have been found to hold codes for patterns of neural migration that result in a continuum of developmental language disorders (Marino, Meng, Mascheretti, Rusconi, Cope, et al., 2012; Meng, et al., 2005; Poelmans, Buitelaar, Pauls, & Franke, 2011). Marino et al. (2012) state that "compelling genetic linkage and association evidence supports a quantitative trait locus in the 6p21.3 region that encodes a gene called DCDC2" (p. 25). In a recent paper on the genetics of dyslexia and language impairment, Powers et al. (2013) found that specific molecular interactions of the DCDC2 gene with a binding protein (READ1) influences risk for reading and language disorders.

Research conducted using functional magnetic imaging of the brain (fMRI) has identified a neural circuit in the brain that subserves word-level reading (Pugh, et al., 2000; Shaywitz, et al., 1998; Shaywitz, 1998). Increased blood flow in specific areas of the brain while performing orthographic, phonological, and semantic tasks have led to the identification of critical areas for word-level reading. The primary areas of the brain that participate in word reading are shown in Figure 1.

Figure 1. Neural circuit for reading



The reading circuit is comprised of three primary areas of the brain in the left hemisphere. The temporoparietal region, around Wernicke's area, is where the greatest activation takes place when subjects are required to map graphemes onto phonemes. The occipitotemporal region, often called the word form area, is activated strongly during tasks of word recognition. Lastly the inferior frontal gyrus region, around Broca's areas, is activated during a range of tasks including word retrieval, speech production, and syntax judgments. Studies using fMRI technology to

compare brain activation in children and adults with dyslexia with typical reading peers have revealed that subjects with dyslexia show decreased activation in the posterior neural circuits in the left hemisphere. While the neurobiological bases of reading comprehension has received far less attention, Landi et al. (2013) note that fMRI studies of reading and listening comprehension show "a largely overlapping language circuit for single-word reading, reading comprehension, and listening comprehension, with notable differences being largely quantitative…" (p. 158). In summary, the neural signature of dyslexia is reduced activation in the posterior portion of the left hemisphere on simple word-level tasks of reading (Landi et al., 2013; Pugh et al., 2000; Shaywitz et al., 1998; Shaywitz, 1998).

Dyslexia was described as early as the 1880s by two German physicians, Oswald Berkhan and Rudolf Berlin (Chakravarty, 2009). Over the past two decades, large-scale studies of individuals with dyslexia support the assertion that dyslexia can manifest in multiple patterns of deficits and these deficits often overlap with other classifications of learning disabilities (Pennington, 2006; Pennington & Bishop, 2009; Peterson & Pennington, 2012).

Profiles

The following section of this paper is designed to show the multiple and varied patterns of deficits in reading and reading-related skills for five children diagnosed with dyslexia and one child diagnosed with a mixed spoken and written language disability. All testing was completed by the first author, using a battery of tests compiled by the second author. These profiles illustrate the students' strengths and weaknesses in (1) spoken language, 2) written language, and 3) phonological processing as tested on tasks of phonemic awareness, phonological memory, and rapid serial naming. The tests used across these evaluations are shown in Table 2. Individual test data for all six subjects are shown in Table 3.

Profile 1: Kayla is a 7-year-old female who is repeating first grade. She receives the regular curriculum and is currently not receiving any special instruction in school. Kayla's medical history is significant for Attention Deficit/Hyperactivity Disorder (ADHD) for which she takes Focalin daily. Kayla's mother reported that Kayla did not start using words until she was three years of age, but soon later caught up and has had no difficulty with oral language since. Kayla's maternal family history is positive for learning disabilities. Kayla's mother reported that Kayla learned the alphabet and corresponding sounds without difficulty in kindergarten, but began to exhibit difficulties with decoding (sound blending) and learning sight words first grade.

Table 2. Tests and test description for instruments used to evaluate the students included in the profiles below:

Comprehensive Test of Phonological Processing-2 (CTOPP-2; Wagner, Torgesen, Rashotte, & Pearson, 2013)
Phonological Awareness Composite
• Elision
• Blending Words
• Phoneme Isolation
Phonological Memory Composite
• Memory for Digits
• Nonword Repetition
Rapid Naming Composite
• Rapid Digit Naming
• Rapid Letter Naming
Test of Word Reading Efficiency-2 (TOWRE-2; Torgesen, Wagner, & Rashotte, 2012)
• Sight Word Efficiency
• Phonemic Decoding Efficiency
Gray Oral Reading Mastery Test-5 (GORT-5; Weiderholt & Bryant, 2012)
• Rate
• Accuracy
• Fluency
• Passage Comprehension
Woodcock-Johnson Normative Update Tests of Achievement-3rd Edition Form A (WJ-ACH-III-Nu; Woodcock, McGrew, & Mather, 2008)
• Spelling
Clinical Evaluation of Language Fundamentals-5 (CELF-5; Wiig, Semel, & Secord, 2013).
• Recalling Sentences
• Formulated Sentences
• Understanding Spoken Paragraphs
Oral and Written Language Scales-II (OWLS-II; Carrow-Wolfolk, 2011)
• Listening Comprehension
• Oral Expression

Kayla's phonological processing skills were variable on the CTOPP-2. She demonstrated difficulty on phoneme manipulation (Elision 16th %) and memory for digits 9th %) tasks but performed in the average range for her age on the phoneme isolation (25th %) and sound blending (50th %) subtests and on the nonword repetition task (50th %).

Table 3. Individual test data for all subjects.

	CTOPP-2 Subtests							TOWRE-2 Subtests	
	Elision	Phoneme Isolation	Blending Words	Memory for Digits	Nonword Repetition	Rapid Digit Naming	Rapid Letter Naming	Sight Word Efficiency	Decoding
Kayla	7* (16)	8 (25)	10 (50)	6* (9)	10 (50)	8 (25)	8 (25)	70** (2)	74* (4)
Gavin	9 (37)	11 (63)	12 (75)	8 (25)	6* (9)	7* (16)	7* (16)	70** (2)	57** (<1)
Emily	11 (63)	9 (37)	9 (37)	8 (25)	4** (2)	7* (16)	7* (16)	73* (3)	68** (1)
Dylan	6* (9)	11 (63)	8 (25)	16 (98)	5* (5)	6* (9)	6* (9)	80* (9)	67** (1)
Kennedy	8 (25)	6* (9)	12 (75)	4** (2)	10 (50)	7* (16)	8 (25)	85* (16)	84* (14)
Brandon	5* (5)	7* (16)	4** (2)	5* (5)	9 (37)	8 (25)	9 (37)	67** (1)	66** (1)

- *Standard score is equal or greater than one standard deviation below the mean.
- ** Standard score is equal or greater than two standard deviations below the mean.
- Standard scores (percentiles) based on normal curve equivalents of:
  - 1 SD – SS = 85, percentile = 16 or for subtest scores, SS = 7, percentile = 16
  - 2 SD – SS = 70, percentile = 2; subtest scores SS = 4, percentile =

	GORT-5 Subtests				CELF-5 Subtests			OWLS-2 Subtests		WJ ACH Subtest
	Reading Rate	Reading Accuracy	Reading Fluency	Reading Comprehension	Recalling Sentences	Formulated Sentences	Understanding Spoken Paragraphs	Listening Comprehension	Oral Expression	Spelling
Kayla	6* (9)	5** (5)	7* (16)	7* (16)	6* (9)	8 (25)	8 (25)			84* (14)
Gavin	3** (1)	7* (16)	7* (16)	8 (25)	9 (37)	16 (98)	12 (75)			83* (14)
Emily	8 (25)	9 (37)	8 (25)	5* (5)				104 (61)	104 (61)	67** (1)
Dylan	7* (16)	6* (9)	6* (9)	6* (9)	12 (75)	9 (37)	9 (27)			79* (8)
Kennedy	9 (37)	6* (9)	8 (25)	10 (50)				126 (96)	121 (92)	96 (39)
Brandon	5* (5)	5** (5)	5* (5)	6* (9)	5* (5)	7* (16)	6* (9)			71* (3)

- *Standard score is equal or greater than one standard deviation below the mean.
- ** Standard score is equal or greater than two standard deviations below the mean.
- Standard scores (percentiles) based on normal curve equivalents of:
  - 1 SD – SS = 85, percentile = 16 or for subtest scores, SS = 7, percentile = 16
  - 2 SD – SS = 70, percentile = 2; subtest scores SS = 4, percentile =3

Kayla's rapid automatized naming of numbers and letters (25th %) was within expected levels for her age.

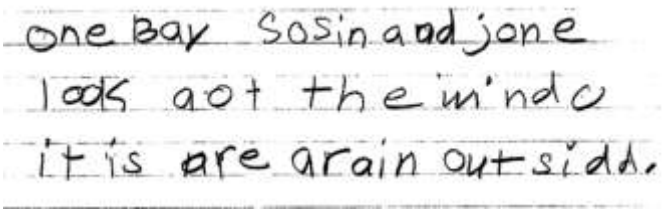
On the TOWRE-2 Kayla demonstrated severely depressed sight word reading (2nd %) and decoding (4th %) skills. While Kayla seemed to have memorized some sight words, she read them very slowly. In addition, Kayla was unable to read most of the nonsense words. Her letter-sound and orthographic pattern knowledge was significantly reduced for her age level.

Kayla's reading fluency (16th %) and comprehension (16th %) were depressed for her age level on the GORT-5. Her reading fluency was better than her timed sight word reading and decoding on the TOWRE-2, although still depressed for her age, indicating that she was able to take advantage of contextual cues to identify words in the passages. She read the passages slowly and with little accuracy. When she came to a word that she did not immediately know, she usually substituted a word that looked like the target word or made sense in the sentence. Examples of her word reading errors include **with** for **we**, **got** for **goes**, **then** for **when**, **gone** for **goes**, **with** for **when** and **in** for **it**.

Kayla's spelling and writing skills were depressed for her age. On the WJ-ACH-III-NU her spelling (14th %) was just below the average range for her age. Kayla was able to spell vowel-consonant, consonant-vowel and some consonant-vowel-consonant words, but unable to spell words with vowel teams and consonant clusters. In a spontaneous writing sample, Kayla's spelling skills were even more impaired. Examples of her spelling errors include **Bay** for **day**, **jone** for **Jane**, **aot** for **out**, **windo** for **window, arain** for **rain** and **outsidd** for **outside**. Examination of her spelling errors indicates that Kayla is not using any particular spelling strategy to spell words and does not have strong knowledge for spelling patterns and orthographic rules. In addition, Kayla's writing lacked appropriate sentence structure, capitalization and punctuation. See Figure 2 for a copy of Kayla's spontaneous writing sample and the transcription.

In contrast to these weak reading and writing skills, Kayla's oral language skills were at appropriate levels for her age on the CELF-5. Kayla's listening comprehension (as measured on the Understanding Spoken Paragraphs subtest: 50th %) and ability to use vocabulary correctly in complete sentences (Formulated Sentences: 25th %) were appropriate for her age.

Figure 2. Sample of Kayla's writing



Transcription (as read by Kayla to the examiner):

One day Susan and Jane look out the window. It is raining outside.

Kayla did however demonstrate a weakness in repeating sentences (9th %). A weakness on this type of task is often seen in children with dyslexia who have otherwise good language skills and is thought to be a symptom of impaired phonological memory. It is also interesting to note the stark discrepancy between Kayla's reading comprehension (16th %) and listening comprehension (50th %). This type of discrepancy where listening comprehension is at least in the average range and reading comprehension is depressed is a hallmark sign of dyslexia.

Profile 2: Gavin is an 8-year-old male who is in the second grade. He receives regular education with part-time Exceptional Student Education (ESE) instruction for Learning Disabilities. Gavin's mother reported that Gavin's difficulty began in kindergarten when he had problems learning the sounds that correspond to letters. He currently is earning good grades in school in all subjects except reading and writing. It was reported that Gavin excels in math. Gavin's older brother was diagnosed with dyslexia.

Gavin's phonological processing skills on the CTOPP-2 were impaired in the areas of phonological memory (nonword repetition 9th %) and rapid naming (both letters and numbers 16th %). His phonemic awareness skills were appropriate for his age.

Gavin's sight word reading (2nd %) and decoding (<1st %) skills were significantly impaired on the TOWRE-2; more so than would be predicted from his phonological processing skills. Gavin's sight word vocabulary was

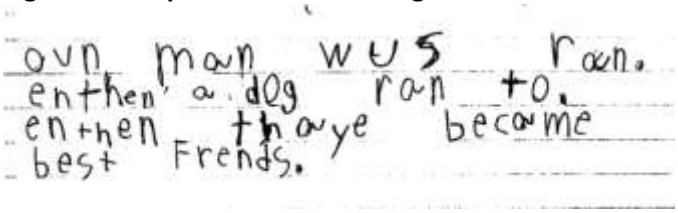
limited to words such **go**, **dog**, **in** and **it**. He could decode only consonant-vowel and consonant-vowel-consonant words.

On the GORT-5 Gavin was found to be a very slow (1st %) and somewhat inaccurate (16th %) reader of text, which is consistent with his depressed single word reading. Despite his very weak reading speed and accuracy, Gavin's comprehension (25th %) of the paragraphs was within expected levels for his age. This discrepancy between reading fluency (speed and accuracy) and comprehension is often seen in individuals with dyslexia who are able to use their stronger oral language skills and world knowledge to gain meaning from paragraphs that they have difficulty fluently reading aloud.

Gavin's spelling and writing skills were very depressed for his age. Gavin's errors on the spelling (14th %) subtest of the WJ-ACH-III-NU indicate weaknesses in sound-letter correspondence, knowledge of spelling patterns and orthographic rules. Gavin was able to spell the words **in**, **he**, **six** and **green** correctly. His errors included **wus** for **was**, **undr** for **under**, **hawse** for **house**, **rane** for **rain** and **wen** for **when**. Gavin's spelling weaknesses were more obvious on a spontaneous writing sample. His writing sample was difficult to read not only because of his weak spelling, but also errors in sentence structure, morphological endings and capitalization. Examples of his spelling errors include **oun** for **one**, **wus** for **was**, **en** for **and**, and **thaye** for **they**. The pattern seen in Gavin's spelling errors reflects a general reliance on a phonetic strategy and an inability to recall spelling rules or orthographic information. This pattern is supported by his strength in phonological awareness scores and relative weaknesses in his RAN and phonological memory scores. See Figure 3 for a copy of Gavin's spontaneous writing sample and transcription.

In contrast to these written language measures, Gavin's oral language skills were well developed for his age. On the CELF-5 he performed in the high average to superior range in listening comprehension (Understanding Spoken Paragraphs: 75th %) and sentence production (Formulated Sentences: 98th %). On a sentence repetition task (Recalling Sentences: 37th %) Gavin performed in the average range yet lower than would be expected given his other scores. His weakness in this area is most likely due to impaired phonological memory. Gavin also demonstrates a significant discrepancy between his very strong listening comprehension (75th %) and reading comprehension (25th %), which is a clear indicator of developmental dyslexia.

Figure 3. Sample of Gavin's writing



Transcription (as read by Gavin to examiner):

One man was running.
And then a dog ran too.
And then they become best friends

Profile 3: Emily is a 9-year-old female who is in the third grade. She was retained in first grade due to below grade level reading skills. Emily has a history of ear infections. Emily's mother reported that she was a late talker who received speech and language intervention between the ages of 2 and 4 years. Emily was diagnosed with ADHD but does not take medication. She has a positive family history of late talking, and speech and language problems in her parents and siblings. In school, Emily receives the regular curriculum and daily small group reading comprehension instruction in the classroom. Emily's mother reported that Emily has difficulty with reading, writing, spelling, and math word problems.

Emily demonstrated depressed phonological processing skills on the CTOPP-2. Her phonological memory was very depressed due to weak nonword repetition (2nd %). Emily also performed in the below average range in the rapid naming of letters and numbers (16th %). Emily's phonological awareness skills were adequately developed for her age.

On the TOWRE-2, Emily's single word reading skills were depressed for her age. Both her sight word reading (3rd %) and decoding (1st %) were depressed. While she read most sight words correctly, she read them very slowly. In addition, she was unable to correctly decode most of the nonsense words. She demonstrated difficulty reading closed syllables with short vowels, as well as consonant clusters and vowel teams. Emily's

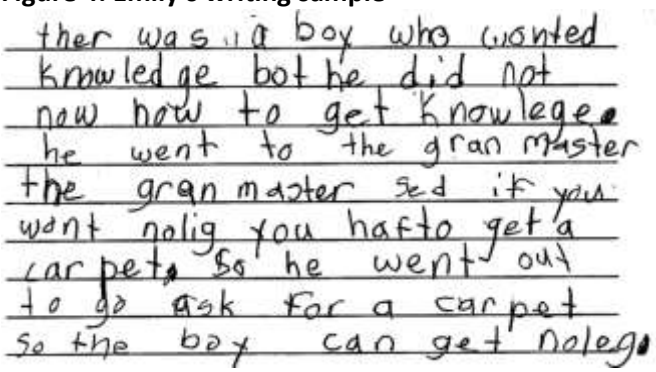
performance indicates that she has many sight words memorized but does not have strategies to read unfamiliar words.

On the GORT-5, Emily's reading of text was better than expected given her very weak single word reading. She obtained average reading rate (25th %) and accuracy (37th %) scores, indicating that she was most likely using context to help her identify the words. Emily's comprehension (5th %) of the paragraphs however was very depressed, suggesting that she exhausted her cognitive resources to read the words in the passages, leaving little energy to devote to the content of the passages.

Emily's spelling and writing skills were very depressed for her age. On the spelling (1st %) subtest of the WJ-ACH-III-NU Emily demonstrated depressed sound-letter and orthographic knowledge. She used a phonetic strategy to spell most words. Examples of her errors include **grin** for **green**, **whas** for **was**, **hows** for **house**, **ran** for **rain** and **wen** for **when**. Examination of Emily's spontaneous writing indicates very depressed spelling as well as lack of capitalization and punctuation. Her sentence structure was adequate. Examples of Emily's spelling errors include **ther** for **there**, **wonted** for **wanted**, **bot** for **but**, **now** for **know**, **sed** for **said** and **hafto** for **have to**. Emily's spelling (encoding) was as depressed as her reading (decoding). One characteristic in Emily's spelling that is often seen in individuals with dyslexia is a lack of consistency in spelling. Emily spelled the word **knowledge** correctly once, and then spelled it as **knowlege**, **noleg** and **nolig**. When reading her writing sample to the examiner she did not seem to notice these inconsistencies. A copy of Emily's spontaneous writing sample and transcription is provided in Figure 4.

Emily demonstrated well-developed oral language skills on the OWLS-II. Her listening comprehension (61st %) and oral expression (61st %) both fell in the average range for her age level. Emily's scores in listening comprehension (61st %) and reading comprehension (5th %) are highly discrepant and indicate a specific difficulty with written language. This type of discrepancy where listening comprehension is at least in the average range and reading comprehension is depressed is a hallmark sign of dyslexia.

Figure 4. Emily's writing sample



Transcription (as read by Emily to the examiner)

There was a boy who wanted knowledge but he did not know how to get knowledge. He went to the grand master. The grandmaster said if you want knowledge you have to get a carpet. So he went out to go as for a carpet so the boy can get knowledge

Profile 4: Dylan is a 10-year-old male who is in the fifth grade. Dylan was born at 32-weeks gestation. His health history is unremarkable except for allergies. Dylan reached his motor milestones at the appropriate age, but his communication milestones were delayed. Dylan received articulation therapy from 4 years of age through third grade. His brother also has a history of speech difficulties. There is no other family history of learning and speech/language problems. Dylan receives regular education with small group reading instruction in his class. Dylan's mother reported that he has struggled with reading and spelling since first grade. Despite failing the Florida Comprehensive Assessment Test in reading and writing in third and fourth grades he was not retained because he attended summer school and passed his portfolio. Dylan's grades are Cs and Ds in reading, writing and spelling and As in all other classes.

Dylan demonstrated weaknesses in all three areas of phonological processing. He demonstrated difficulty on a phonemic awareness task that required him to take away specific sounds in words (Elision 5th %), but did well on a phonemic awareness task that required him to identify the specific sounds in words (e.g., "Say the first sound in the word **find**."; Phoneme Isolation 63rd %) and blend sounds into words (Sound Blending 25th %). His performance on the phonological memory tasks ranged

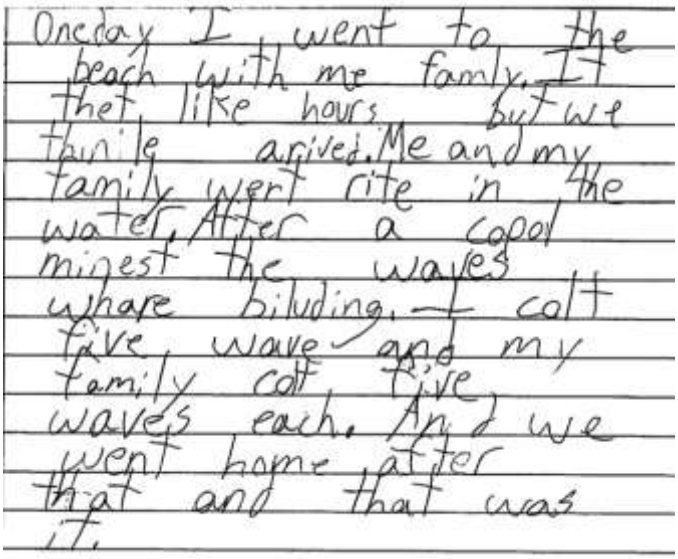
from depressed nonword repetition (5th %) to superior digit repetition (98th %). Dylan's rapid naming was depressed for both digits (9th %) and letters (9th %).

Dylan's single word reading was depressed for both sight word reading (9th %) and decoding (1st %) on the TOWRE-2. Dylan read most of the sight words correctly, but very slowly. His decoding skills were more severely impaired. He was unable to read open syllable and closed syllables and had specific difficulty with short vowels. Dylan was unable to apply letter-sound knowledge to read unfamiliar regularly spelled words.

Dylan's reading of text was depressed for both rate (16th %) and accuracy (9th %) on the GORT-5. His reading comprehension (9th %) was equally depressed. Dylan's oral reading was characterized by additions and omissions of words and morphological endings. When he approached a word that he did not immediately know, he usually was unable to sound it out correctly. On many occasions he guessed the target word based on the initial letter and context of the paragraph. Examples of Dylan's errors include **perching** for **perched**, **lamb** for **limb**, **fown** for **flown**, **around** for **down**, **dried** for **dry** and **swinging** for **swings**. Dylan's reading comprehension was commensurate with his reading fluency and below expected levels for his age.

Dylan's spelling and writing skills were depressed for his age. His spelling (8th %) on the WJ-ACH-III-NU indicates that he uses primarily a phonetic strategy to spell words. Dylan had difficulty spelling common words indicating a lack of accurate or limited phonetic memories. Examples of his errors include **tabel** for **table**, **whin** for **when**, **secind** for **second** and **eray** for **early**. Dylan's spontaneous paragraph writing was characterized by adequate organization, capitalization and punctuation. His sentence structure was weak as well as his spelling. Examples of his spelling errors include **me** for **m**y, **thinile** for **family**, **whare** for **were**, **rite** for **right**, **copol** for **couple** and **minest** for **minutes**. Dylan also showed inconsistencies in his spellings. On one occasion he spelled the word **family** correctly, yet on another he did not. A copy of Dylan's spontaneous writing sample with a transcription is in Figure 5.

Figure 5. Dylan's writing sample



Transcription (as read by Dylan to the examiner):

> One day I went to the beach with my family. It felt like hours but we finally arrived. Me and my family went right in the water. After a couple minutes the waves were building. I caught five waves and my family caught five waves each. And we went home after that and that was it.

Dylan demonstrated well-developed oral language skills for his age on the CELF-5. His listening comprehension (37th %), sentence repetition (75th %) and sentence formation (37th %) all fell within expected levels for his age. Dylan also demonstrates a clear strength in listening comprehension (37th %) over reading comprehension (9th %). This type of discrepancy where listening comprehension is at least in the average range and reading comprehension is depressed is a hallmark sign of dyslexia.

Profile 5: Kennedy is an 11-year-old female who is in sixth grade in a gifted program. Her health history is unremarkable. Kennedy's mother reported that Kennedy met all of her communication and developmental milestones at the appropriate ages. She has a history of speech delay and a positive family history of speech and learning problems. Kennedy's mother reported that Kennedy has demonstrated weaknesses in reading, spelling and writing since kindergarten. However because she has always earned

good grades she has not received any intervention in school.

Kennedy demonstrated depressed phonological processing skills on the CTOPP-2. She demonstrated weak phonemic awareness (Phoneme Isolation 9th %). Her phonological memory was weak on a task of digit repetition (2nd %). Kennedy also demonstrated depressed rapid digit naming (16th %).

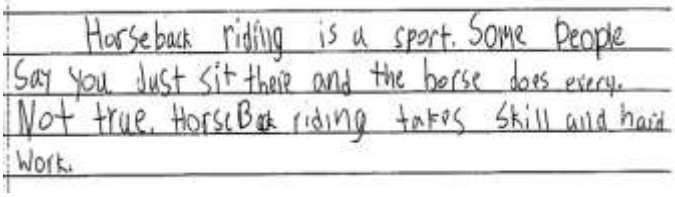
Kennedy's single word reading on the TOWRE-2 fell below levels expected for her age on sight word reading (16th %) and decoding (14th %). She had difficulty reading opened and closed syllable words as well as consonant clusters and vowel teams. Her performance suggests that she has memorized many words by sight, but does not have well developed strategies to read unfamiliar words.

On the GORT-5, Kennedy's reading rate (37th %) was at expected levels for her age, while her reading accuracy (9th %) was depressed for her age. Her errors were characterized by skipping words, leaving off endings of words, adding endings to words or substituting words that looked like the target words and/or made sense in the paragraph. Examples of her word reading errors include **to** for **from**, **the** for **a**, **when** for **then**, **had** for **having**, **in** for **on** and **the** for **then**. Kennedy's reading comprehension (50th %) was better than her reading fluency (25th %) and fell within expected levels for her age.

Kennedy's spelling was adequately developed for her age. She obtained an average spelling (39th %) score on the WJ-ACH-III-NU. Her spontaneous writing sample however was not consistent with her age or cognitive skills. Although Kennedy could orally produce a narrative that was complete and thorough on the topic of her choosing when speaking with the examiner, her written narrative was very short with little elaboration. She refused to write any more when prompted. She did however use adequate spelling, sentence structure, punctuation and capitalization. This type of reduced writing is typically seen in gifted students with dyslexia. See Figure 5 for a copy of Kennedy's spontaneous writing sample and transcription.

Kennedy's oral language skills were very well developed. On the OWLS-II she obtained listening comprehension (96th %) and oral expression (92nd %) scores that fell in the superior range for her age. The discrepancy between Kennedy's listening comprehension (96th %) and reading comprehension (50th %) is significant and indicates unexpected difficulty comprehending written information over oral information. Kennedy demonstrates a very clear specific difficulty with reading with more subtle difficulty with writing, specifically in unexpectedly, lower writing and spelling skills. This type of discrepancy where listening comprehension is much stronger than reading comprehension is a hallmark sign of dyslexia.

Figure 6. Kennedy's writing sample



Transcription (as read by Kennedy to the examiner):

Horseback riding is a sport. Some people say you just sit there and the horse does everything. Not true. Horseback riding takes skill and hard work.

Profile 6: Brandon is a 9-year-old male who is in the second grade. He was retained in first grade and is at risk for being retained again this year. His mother reported an unremarkable pregnancy and delivery. He reportedly had a healthy childhood and met his communication and developmental milestones at the appropriate ages. Both Brandon's father and brother have histories of stuttering. Brandon's mother reported that Brandon is having difficulty with decoding, sight word reading, reading comprehension, writing, following directions, math computation and math word problems.

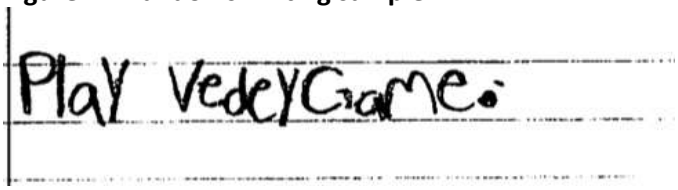
Brandon demonstrated significant phonological processing weaknesses in phonological awareness and memory on the CTOPP-2. His phonemic awareness was significantly impaired with percentiles ranging from the 2nd to the 16th. He also demonstrated impaired memory for digits (5th %), although his nonword repetition (37th %) was adequately developed. His rapid naming skills were adequately developed for his age.

Brandon's single word reading skills on the TOWRE-2 were very depressed. His sight word reading (1st %) and decoding (1st %) skills indicate that Brandon does not have many stored sight words nor does he have strategies to read words that are unfamiliar to him.

On the GORT-5, Brandon read the passages aloud with very depressed reading rate (5th %) and accuracy (5th %). Brandon's comprehension (9th %) of the paragraphs that he read was equally depressed. Brandon read the paragraphs very slowly and inaccurately. When he came to a word that he did not immediately know, he guessed the target word based on the shape of the word. Examples of his errors include **can** for **come**, **stripes** for **stars**, **slows** for **goes**, **to** for **it**, **party** for **pretty**, and **plane** for **plan**.

Brandon's spelling and writing skills were very depressed for his age. On the WJ-ACH-III-NU, examples of Brandon's spelling (3rd %) errors included **houes** for **house**, **tabol** for **table**, **win** for **when** and **floore** for **floor**. His errors indicate a phonetic spelling strategy and inadequate phonological memories for the spellings of common words. Brandon was asked to write a paragraph or a few sentences on a topic of his choosing. He chose to write about what he likes to do, which is play video games. When prompted by the examiner to say what he liked about video games or which games he liked, he was unable to respond with much detail. Brandon wrote three words, which did not form a complete sentence. He was prompted to write more but did not. See Figure 7 for a copy of Brandon's spontaneous writing sample and transcription.

Figure 7. Brandon's writing sample



Transcription (as read by Brandon to the examiner):
I like to play video games.

Brandon's oral language skills were measured using the CELF-5. Brandon demonstrated significant impairment in listening comprehension (9th %) and remembering sentences (5th %). His ability to formulate sentences using specific vocabulary (16th %) was better, but still depressed for his age. Brandon's listening comprehension (9th %) and reading comprehension (9th %) were equally depressed, a defining characteristic in children with mixed oral and written language impairments.

Overall, these profiles show that students with dyslexia demonstrate variable weaknesses in phonological processing with skills in the areas of automatic word recognition, decoding, reading fluency and spelling most consistently depressed. Skills in reading comprehension vary from depressed to above average in children with dyslexia depending on the individual's level of oral language, level of cognitive development, and opportunities for listening to and generating spoken language. The greater the student's skills in these three areas, the more capable he or she is in using context and world knowledge to comprehend text. The major characteristic differentiating children with dyslexia from those with mixed spoken and written language disorder is oral language skill. Children with mixed language disorder may have similar reading deficits in the areas of phonological processing, sight word reading, decoding, reading fluency and reading comprehension as children with dyslexia, but also have significant difficulty in listening comprehension, as well as in other areas of oral language including vocabulary and grammar.

The patterns of strengths and weaknesses presented here for children with dyslexia are consistent with the IDA's definition of dyslexia. The IDA definition states that dyslexia is characterized by difficulties in word recognition, decoding, and spelling, which each of our subjects show. It states that these difficulties usually result from a deficit in phonological processing which is unexpected in relation to other cognitive abilities or classroom instruction. In the included profiles, oral language skills, specifically listening comprehension, were used as a measure of cognitive ability and in each case a discrepancy between reading and oral language was noted. Finally, the IDA definition states that secondary consequences of depressed word recognition, decoding and spelling *can* include problems

in reading comprehension, which we saw in some of our cases.

Reading Intervention for Children with Dyslexia

The *Knowledge and Practice Standards for Teachers of Reading* was published by the IDA (2010) for teachers and other professionals in order to provide information on oral and written language and specific educational practices that are needed for treating children who have dyslexia. This is an essential guide for all professionals who provide literacy instruction to children who have dyslexia or mixed spoken and written language disabilities. This document outlines the knowledge and effective instructional practices necessary to teach reading and writing to all students, including those who are at risk for reading difficulty.

There is a considerable body of research on the remediation of reading difficulties in young children. The consensus in the literature is that children with reading disabilities, including those with dyslexia, can improve their phonological processing and decoding skills with the right intervention (Torgesen, Alexander, Wagner, Rashotte, Voeller, Conway & Rose, 2001; Torgesen, Wagner, Rashott, Lindamood, Rose & Conway, 1999; Vellutino, Scanlon, Sipay, Small, Pratt, & Chen, 1996). However, research indicates that gains in phonological processing and decoding do not always generalize to reading fluency and reading comprehension (Lovett, Ransby, Hardwick, Johns & Donaldson, 1989; Torgesen et al, 2001). For example, reading speed is one area that often remains slow after remediation; in fact, slow rate of reading tends to be a residual deficit even in high functioning college students with dyslexia (Shaywitz, 2004). The persistence of reading rate problems in children with reading disabilities is evident in the Torgesen et al. (2001) study of children with severe reading disability who received instruction in phonemic awareness and decoding. At follow up, the children's scores were in the average range for reading accuracy and comprehension, while reading rate continued to be below average levels for their ages. Even when accurate, slow reading can have negative consequences on academic success, especially when tasks are performed under timed constraints. These findings underscore the need for effective treatment and appropriate class and test accommodations, such as extended-time.

The literature clearly states that for a reading instruction/remediation program to be effective it must address multiple components of oral and written language in an integrated manner (Lombardino, 2012). According to the IDA *Position Statement on Dyslexia Treatment Programs* (March, 2009), effective reading programs should include instruction in phonological awareness, sight word recognition, decoding, spelling, reading fluency, text comprehension, grammar, syntax and written composition. In addition, recent research indicates that orthographic and morphological awareness are necessary components of a reading program for individuals with impaired reading skills (Berninger & May, 2011).

Inclusion of each of these components in a remediation program is not enough however. The IDA states that for maximum reading outcomes, these components should be taught in a way that is explicit, structured, systematic, cumulative and intense. In addition, instruction should be multisensory, which means that visual, auditory, and kinesthetic-tactile pathways are stimulated simultaneously to facilitate memory and learning (Birsh, 2011). Multisensory learning encourages "links between the visual (*language we see*), auditory (*language we hear*), and kinesthetic-tactile (*language symbols we feel*) pathways in learning to read and spell" (IDAa, 2014, p.1). Few well designed experimental studies have been employed that demonstrate the effectiveness of multisensory intervention for treating children with dyslexia (Oakland, Black, Stanford, Nussbaum, & Balise, 1998), however, anecdotal evidence supporting multisensory instruction has been widely reported by classroom teachers and reading specialists who have worked extensively with students who have reading impairments (Henry, 1998; Foxe & Molholm, 2009). As with any treatment approach, reading intervention programs should be designed based on the individual needs of the student, taking into account their specific strengths and weaknesses. Berninger and May (2011) reviewed case studies of children identified as treatment nonresponders to reading intervention and concluded that identifying individual instructional needs through differential diagnosis is an important factor to an effective reading program. Lorusso, Facoetti and Bakker (2011) compared different types of intervention in three groups of individuals with dyslexia (accurate, slow readers; fast, inaccurate readers; and slow and inaccurate readers). Positive treatment outcome for

each group was dependent on the type of intervention they received.

Multisensory Approach to Reading Intervention

In the early 1900s, neurologist Samuel T. Orton and psychologist Anna Gillingham were the first to use multisensory techniques with individuals with reading disabilities. Their approach, called the Orton-Gillingham (OG) Approach, combined multi-sensory instruction with instruction in the structure of the English language, specifically sounds, prefixes, suffixes, root words, and spelling rules, as well as grammar and sentence structure (Gillingham & Stillman, 1997). Despite its' widespread use over the years, the OG approach has not been the subject of many scientific studies. Ritchey and Goeke (2006), in their review of the literature of studies using OG and OG-based reading instruction programs, found only twelve studies that met their inclusion criteria (published in peer-reviewed journals or completed as a doctoral dissertations). Four of twelve studies reported improved word reading, spelling and reading comprehension. The authors acknowledge that additional support for OG and OG-based reading instruction may be found in other forms, such as at professional conferences.

Most multisensory reading programs are based on the OG approach, but not all. The IDA advocates the use of a multisensory, structured language approach to teach individuals with dyslexia to read and write. According to the IDA (2014a), effective multisensory instruction is based on six key principles. The first principle states that instruction should be *simultaneous and multisensory*, which means the material should be taught through visual, auditory, and kinesthetic-tactile pathways simultaneously. The second principle states that instruction must be *systematic and cumulative*. This means that instruction should progress in a typical developmental sequence, with skills building from easiest to more difficult. The third principle states that instruction must be *direct*; that is, specific targets must be taught directly by the instructor. The fourth key principle states that instruction should include *diagnostic teaching*, where teaching is based on a student's individual needs with on-going assessment. The fifth principle is the instruction should be *synthetic and analytic*. Synthetic instruction focuses on teaching students to blend segments of words together, while analytic instruction focuses on breaking down words into its component pieces. Finally the sixth principle states that instruction should be *comprehensive and inclusive*, such that all levels of language are targeted (i.e., phonemes, morphemes, graphemes, semantics, syntax, discourse and pragmatics) in an integrated fashion.

While the IDA does not endorse any specific multisensory reading program, it has published the *Matrix of Multisensory Structured Language Programs* for comparison of the various multisensory programs that are widely used in the United States (IDA, 2014b). Unfortunately, the matrix is no longer available on the IDA website, but it can be found at the following website: www.winsorlearning.com. The Matrix compares the *Orton-Gillingham Approach*, *Alphabetic Phonics*, *Association Method*, *Language!* and the *Lexia-Herman Method* on variables such as areas of instruction (e.g., phonemic awareness, phonics, fluency, comprehension, written expression, handwriting etc.) and type of delivery (individual, group, classroom). According to the IDA, these programs were selected for inclusion in the matrix because of their long history of use and success in helping students to read and write. More information about specific multisensory programs can be found on the IDA website (www.ida.org), as well as the LD Online (http://www.ldonline.org/article/6332/) and Wrights Law http://www.wrightslaw.com/info/read.msl.ida.pdf) websites.

Summary and Conclusions

The IDA defines dyslexia as a specific learning disability that is characterized by difficulties in word recognition, decoding and spelling that typically results from a deficit in the phonological component of language. The fact that phonological deficits are a core factor underlying the reading and spelling deficits in most children with dyslexia is undisputable (Catts, 1989; Stanovich, 1988; Wolf & Bowers, 1999). However, as discussed previously, recent studies show that not all children with dyslexia present with clear phonological processing deficits and that dyslexia manifests in multiple patterns of deficits (Castles & Friedmann, 2014; Peterson & Pennington, 2012). Children with dyslexia show strengths in their comprehension and production of oral language, with weaknesses in lower-level word processing skills that include word decoding, rapid word recognition, and spelling. Conversely, children with mixed spoken and written language impairment demonstrate more broad-based language-

learning difficulties that encompass both oral and written language modalities. The profiles presented in this paper are consistent with the IDA's definition of dyslexia.

ASHA specifies that the SLPs' scope of practice include the assessment, identification and intervention of reading and writing disorders. A set of universal criteria for diagnosing dyslexia is still forthcoming. However from what we know about dyslexia it is clear that an evaluation should assess the students' skills in oral language, as well as phonological processing, sight word reading, decoding, reading fluency, reading comprehension, spelling, and writing. Only a comprehensive battery, like the one used in our profiles, will provide the clinician with the information needed to make an accurate diagnosis that will sufficiently guide intervention.

Too often children with dyslexia, especially those who are bright and fortunate enough to experience rich language environments, are ineligible for specialized instruction in school because they manage to compensate well enough to maintain adequate grades and high-stake test scores. The SLP, with his or her depth and breadth of knowledge in language processing, should be front and center when assessing skills in the domains of phonology, morphology, orthography, language comprehension, and language production, all processes needed to determine if a student has a language learning disability and to differentiate between dyslexia and more global language disorders.

The differential diagnosis of a reading disability is the first step in helping to insure that children receive the most effective type of intervention to improve their language skills. Children with dyslexia should receive intervention that focuses on increasing the lower-level phonological processing skills that underlie reading and writing. Intervention should target the phonological and orthographic dimensions of written language including sound-letter associations, word-syllable structures, and spelling patterns. On the other hand, children who demonstrate mixed spoken and written language impairment require intervention that addresses higher-order oral language weaknesses (such as listening comprehension) along with specific component skills of reading and writing.

The IDA has created the *Knowledge and Practice Standards for Teacher*s and Educators (KPS) to guide professionals in the instruction and remediation of reading and writing disorders. According to the IDA (2009), effective reading programs should include instruction in phonological awareness, sight words recognition, decoding, spelling, reading fluency, text comprehension, grammar, syntax, and written composition. In addition, recent literature indicates that orthographic and morphological awareness are necessary components to help students with reading impairments (Berninger & May, 2011). The IDA further stipulates that these components should be taught in a way that is explicit, structured, systematic, cumulative and intense. Moreover, the IDA advocates the use of a *multisensory*, structured language approach to teach all students with dyslexia to read and write. The SLP possesses the ideal academic and clinical backgrounds to excel in the explicit, systematic, intensive, and multisensory instruction that, to date is the optimal type of intervention for children with this specific phonologically-based reading disability (IDA, 2014).

The IDA uses their KPA standards to review and certify university and independent teacher training programs and to certify individuals. SLPs who are interested in working with individuals with dyslexia are encouraged to explore the IDA website (www.interdys.org) to get a list of programs certified by the IDA. The International Multisensory Structured Language Education Council (www.imslec.org) and the Academy of Orton-Gillingham Practitioners and Educators (www.ortonacademy.org) are two organizations that provide training to professionals interested in multisensory structured language instruction. ♦

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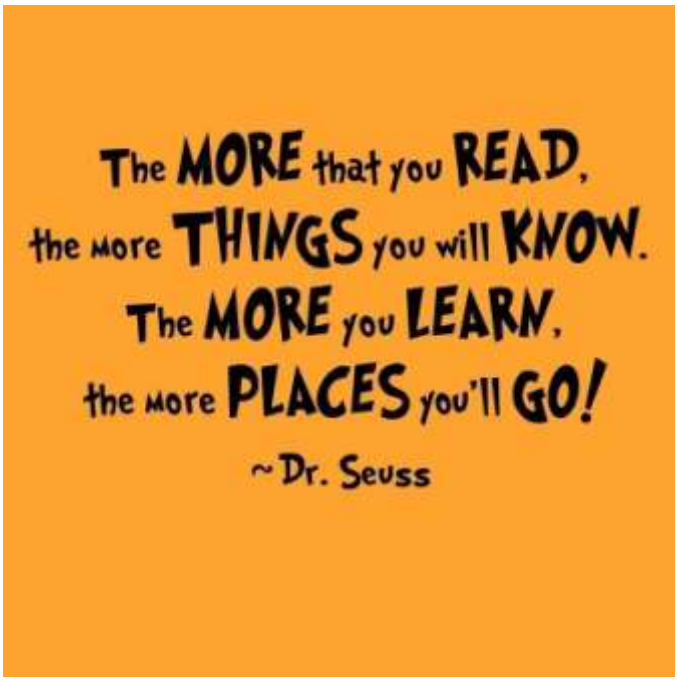

Working Memory and Dyslexia

Milton J. Dehn

Abstract

Working memory deficits can account for decoding and comprehension difficulties experienced by readers with dyslexia. A weakness in the short-term storage of phonological information disrupts decoding by making it difficult to remember a sequence of phonemes until they are blended, and adequate short-term storage of visual-spatial information is necessary for the retention of graphemes. Deficits in executive working memory contribute to reading comprehension challenges because the reader has difficulty inhibiting, updating, switching, and error monitoring. Also, too much cognitive load reduces the working memory capacity that is available for reading comprehension. Practicing and applying evidence-based strategies such as rehearsal can strengthen and support working memory, leading to improved decoding and comprehension. Readers with dyslexia can be directly supported during the decoding process by repeating phonemes just prior to blending and comprehension can be facilitated by minimizing cognitive load.

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Learning Objectives

1) Identify the three main components of working memory
2) List strategies that would help a reader with dyslexia
3) Describe how a phonological short-term memory weakness specifically impacts reading

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Working memory ability is highly associated with all aspects of academic learning and performance (Gathercole & Alloway, 2004). The relationship is so strong that working memory is widely recognized as one of the best predictors of academic achievement (Alloway & Alloway, 2010). Learning to read, write, and calculate all depend heavily on adequate working memory capacity (Dehn, 2008). Skills such as reading decoding, reading comprehension, math problem solving, and expressing ideas in writing rely on working memory. Academic performance, such as assignment completion, is also correlated with the learner's level of working memory. Consequently, individuals with working memory deficits or impairments are at-risk for learning problems and disabilities. For instance, Gathercole, Brown, and Pickering (2003) found that children with a working memory score at the 10th percentile or lower had an 80% chance of having a significant learning problem or disability.

The relationship between working memory deficiencies and dyslexia is well established in research (Pickering, 2006). Working memory deficits are now viewed as one of the major defining characteristics of dyslexia (Fischbach, Konen, Rietz, & Hasselhorn, 2014; Smith-Spark & Fish, 2007). After phonological processing, working memory is the most important cognitive process required for proficient reading. All aspects of working memory—phonological, visual-spatial, and executive—play essential roles during reading. It is therefore extremely important that teachers, reading specialists, psychologists, and speech –language pathologists understand specifically how working memory processes are involved with reading processes. The purpose of this article is to help these professionals acquire more expertise on this subject so that they can better understand, diagnose, and treat readers with dyslexia.

What is Working Memory?

Working memory is the limited cognitive capacity to retain information while simultaneously processing the same or other information. In daily life, frequent demands are placed on working memory. For example, remembering what one was going to say during a conversation depends on working memory. In the typical classroom, high demands on working memory are unrelenting, and even learners with typical working memory capacity often lose information from working memory before they can complete a thought or commit

new information to long-term memory. For instance, expressing ideas in writing places high demands on working memory.

What is referred to as *short-term memory* is part of working memory. Short-term memory is the brief storage of information within working memory. According to Baddeley's theory (1986, 2006), there is a phonologically based storage component and a visual-spatial storage component. These storage components are managed by a higher-level component known as *executive working memory*. Short-term storage can function in an unconscious and automatic manner without direct, conscious manipulation from the executive aspect of working memory, but the short-term stores do no actively process information. Processing the information held in brief storage is the responsibility of executive working memory. The key functions of executive working memory include shifting, updating, and inhibition, as well as allocating available attentional resources and applying strategies.

The basic equation is that short-term storage *plus* information processing *equals* working memory. The classic digit span test illustrates the distinction: digits forward requires mainly short-term memory, whereas digits backward requires working memory because one must hold and manipulate the digits in order to reverse the sequence.

Working memory capacity is limited in all individuals, not just in those individuals with working memory deficits. The typical adult individual can maintain only a few items for a few seconds. Consequently, even normal working memory capacity is easily overwhelmed in daily functioning, especially in a learning environment or while reading. For example, nearly everyone finds it challenging to take notes while listening to a presentation. Due to normal working memory limitations, the note-taker may not hear everything the presenter was saying or not remember what he or she was going to write down. If individuals with a normal working memory capacity are frequently struggling to cope with information-processing demands, then it is understandable why children with below average ability in working memory have nearly constant difficulties simultaneously retaining and processing information, such as trying to comprehend what they are reading.

Capacity is usually measured by span, the number of items that can be recalled in sequence. Immediate sequential recall of items such as numbers, letters, or words is known as *simple span*, and is considered a fairly direct measure of phonological short-term memory. The typical simple span in adults is seven items. Tasks that require processing while retaining information measure working memory, and the amount retained is known as *complex span*. Processing information reduces the amount of information that can be retained. Thus, complex span in typical adults is shorter than simple span. Cowan's research (2001) documents that the typical adult can retain four pieces of information during working memory processing. The simple verbal span of children at an age when they are learning to read is usually about 2-4 items and their complex span ranges from 1-3 items. Visual-spatial span limitations are similar to phonological spans; however, not all visual-spatial information needs to be remembered in sequence.

Information is retained in working memory for only a few seconds. The only way to extend the interval is to repeat the information over and over, a process known as *rehearsal*. After a few seconds without repetition, the information has either been encoded into long-term memory (LTM) or has been forgotten.

Phonological Short-Term Memory

Phonological short-term memory, also referred to as the *phonological loop*, is a speech-based store of auditory and verbal information. Phonological short-term memory continually receives information from auditory and phonological processing and then automatically activates or associates related sounds held in long-term memory. It is named phonological because it is mainly processing phonological codes and recognizing the words they create. According to Baddeley (1986), phonological short-term memory also includes an automatic, subvocal rehearsal process that serves to extend the brief storage interval. When individuals are prevented from rehearsing, their span is reduced significantly (Henry, 2001). However, rehearsal has its limitations. Regardless of age, one's simple span is limited to the number of sounds or words one can articulate within two seconds (Hulme & Mackenzie, 1992). Thus, speech rate partly determines the amount of information than can be rehearsed and retained in short-term memory. Unfortunately, children with dyslexia often are slower in both overt and covert

articulation speed (Pickering, 2006), thereby reducing their effectiveness of rehearsal and the amount of information they can retain in phonological short-term memory.

Phonological short-term memory is intricately linked with phonological processing and phonetic decoding of words (Hulme & Mackenzie, 1992). Studies (Wagner & Muse, 2006) have found measures of phonological awareness and phonological short-term memory span to be highly correlated (as high as .88) with each other. Adequate phonological short-term memory is necessary for proficient phonological processing; conversely, phonological processing affects short-term memory span. When both are weak, the reader is facing a serious challenge.
Consequently, professionals who evaluate children for reading disorders should closely examine the child's phonological short-term memory whenever phonological processing is a concern. Tasks that involve immediate sequential recall of letters, sounds, digits, words, and non-words are all appropriate measures of phonological short-term memory (Dehn, 2014a). Difficulties with nonword recall are especially predictive of language impairments and word reading difficulties (Wagner & Muse, 2006).

Visual-Spatial Short-Term Memory
Visual-spatial short-term memory, also known as the *visuospatial sketchpad,* briefly stores information for objects and their locations. Visual-spatial information can be either *static* or *dynamic.* Static information does not need to manipulated, such as simply recalling the color or shape of items. Dynamic information consists of stimuli that are in motion or stimuli that the individual must manipulate, such as imagining how puzzles pieces will fit together. Measures of visual-spatial short-term memory, especially for static materials are abundant in cognitive tests. There is continual updating of information held in visual-spatial short-term memory. Rehearsal of visual-spatial information is accomplished by re-imaging.

Until recently, the role of visual-spatial short-term memory in reading has been downplayed, but it obviously plays an essential role by retaining the graphemes (printed letters) that represent the sounds long enough for phonetic decoding to take place. Also, visual-spatial short-term memory is linked with its phonological counterpart because visual stimuli, patterns, and images are typically recoded verbally when they are named.

Executive Working Memory
Executive working memory, also referred to as the *central executive,* is the processing dimension of working memory. As its name implies, executive working memory takes on many executive processes, making it as much an executive or metacognitive function as it is a cognitive function (Dehn, 2014d).

Strategic management of limited working memory capacity is one of its key functions. Conscious, effortful retrieval from long-term memory is another responsibility of executive working memory. Executive working memory processes both phonological/auditory/verbal information and visual-spatial information, often integrating the two. What is referred to as *verbal working memory* occurs when executive working memory is processing verbal information, and the same is true for *visual-spatial working memory.*

The most essential executive working memory functions are inhibition, switching, and updating (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Without these operations, an individual would not be able to manage or make sense of the constant flow of information, such as when reading. Inhibition involves suppressing information which is no longer pertinent to the immediate task or thought. An example of inhibition would be suppressing an earlier comment in a conversation so as to focus on constructing a response to the current comment. Switching involves switching between two processing tasks. A common type of switching involves going back and forth between the process at hand and rehearsing the necessary information which is being held in short-term storage. Updating is the constant process of revision whereby newer, more pertinent information replaces, no longer relevant information.

Cognitive Load
The processing aspect of working memory is referred to as *cognitive load* (Van Merrienboer, Kirschner, & Kester, 2003). Effortful cognitive processing and storage of information both draw from the same limited working memory capacity. Effective sharing of this limited resource requires rapid, back-and-forth switching between processing and rehearsing, which maintains

the necessary information in short-term storage. Memory items are lost when the processing requirements are such that the switching cannot occur or cannot occur in time to prevent loss of information. Therefore, as cognitive load increases, the amount of information that can be retained is diminished. This relationship is bi-directional. Focusing on maintaining information can impede processing, slowing it down or causing processing errors.

In the classroom, high cognitive load is caused by numerous variables arising from the environment, the nature of the materials, instructional variables, and the learner's own internal processing (Dehn, 2014c). Overly high cognitive load not only impairs performance but reduces learning. For example, an overloaded working memory may not have enough capacity to retain new pieces of information long enough to comprehend them and associate them with prior knowledge. Consequently, the new information is not comprehended, is not encoded into long-term memory, and is not learned (Dehn, 2010).

The level of cognitive load during reading determines the extent of comprehension. Reading decoding is a process that contributes to cognitive load. The less automated reading decoding is the more cognitive load it creates. When there is too much cognitive load dedicated to reading decoding, there is not enough working memory capacity left for reading comprehension. Thus, the acquisition of reading fluency (automaticity) frees up more processing capacity for reading comprehension.

Language Development and Working Memory

The connection between language development and literacy is well established (Goff, Pratt, & Ong, 2005). Language delays often precede and are associated with developmental dyslexia. What is less known is that a deficit in working memory may be the common underlying cognitive weakness that accounts for both types of disorders (Baddeley, 2003). Thus, it is important to understand working memory's role in language development.

Several studies have reported that individuals with language impairments perform poorly on verbal working memory tasks, especially tasks involving phonological processing (Masoura, 2006). For example, Gutierrez-Clellen, Calderon, and Weismer (2004) found that children with a specific language impairment have a verbal (phonological) span two standard deviations below the mean for their age.

In particular, poor language development seems to be directly connected with impaired functioning of phonological short-term memory (Baddeley, 1996). Children with delayed language development often have a deficit in the ability to retain unfamiliar words. If young children are unable to retain the phonological sequence that makes up a new word, they will require more exposures to the word before they acquire its phonetic and semantic representation (Leonard et al., 2007). Accordingly, vocabulary learning has been directly linked with phonological short-term memory capacity (Gathercole & Baddeley, 1990).

Oral expression places high demands on working memory, especially during the conceptualizing and sentence formulation stages. Not only must the speaker retrieve words that convey the intended meaning, but he or she also must plan for correct syntax. For example, accurate production of subject-verb agreement depends on verbal working memory processes. Even in normal speakers, sentence planning is hindered when speakers have insufficient verbal working memory capacity (Hartsuiker & Barkuysen, 2006), such as when there is a secondary processing task.

Working memory also plays a crucial role in listening comprehension by constructing and integrating ideas from a stream of successive words (Just & Carpenter, 1992). To understand the meaning of a sentence, an individual must be able to remember previous words in order to relate them to later-occurring words. Difficulties in processing individual sentences have been related to deficient working memory capacity (Moser, Fridriksson, & Healy, 2007). In addition to adequate executive working memory, adequate phonological storage is also important for oral language comprehension because it stores word sequences long enough for the individual to decode them into their constituent meaning (Baddeley, 1990).

Working Memory and Reading

Numerous studies (Smith-Spark & Fisk, 2007; Swanson & Jerman, 2007) have reported strong relations between working memory capacity and reading skills. Each type of reading skill draws from short-term and working memory processes somewhat differently. Reading decoding and fluency are primarily related to

phonological and visual-spatial short-term memory, whereas reading comprehension is primarily related to executive working memory (Swanson, Howard, & Saez, 2006).

Reading Decoding

To convert graphemes (printed letters) into phonemes, reading decoding first depends on visual-spatial processing and visual-spatial short-term memory capacity. Readers must recode visual stimuli by matching the graphemes with the phonemes they represent. Graphemes need to be retained long enough for the recoding to occur. Next, phonological short-term memory retains the accumulating sequence of phonemes until the last letter is converted and the full sequence of sounds is blended into a complete word (Palmer, 2000). If the reader has normal phonological short-term memory capacity but is still struggling to decode, it may be that he or she is not using phonological short-term memory effectively; for example, the reader may not be subvocally rehearsing (repeating) the sequence of phonemes. Finally, executive working memory becomes involved, especially during the blending stage. Efficient recoding and blending also require adequate phonological processing ability (National Reading Panel, 2000).

Of the executive working memory functions, there is strong evidence that updating of verbal information is the most essential for reading decoding (De Jong, 2006). Some studies have also documented the importance of inhibition. For instance, Palmer (2000) found that good readers were able to better inhibit visual representations (orthographic representations) and focus on the phonological coding. As a reader becomes fluent and basic reading decoding becomes automated, short-term and working memory play a less critical role in reading decoding.

Reading Comprehension

To comprehend text, a reader must hold words and sentences in consciousness until there is enough information to complete an idea (De Beni, Borella, & Carretti, 2007). Most aspects of reading comprehension place a heavy cognitive load on executive-working memory. Studies (Just & Carpenter, 1992) have found that individuals with greater executive-working memory capacity are more successful at integrating information across longer readings. The capacity of the phonological and visual-spatial short-term storage components seems to have little to do with reading comprehension (Swanson & Berninger, 1995). In individuals who do not have decoding problems, reading comprehension problems are more highly associated with processing deficits in executive working memory (Goff et al., 2005).

Of the specific executive functions, inhibition is one that has been directly linked with reading comprehension (Savage, Lavers, & Pillay, 2007). Discarding information that is no longer relevant and preventing the entry of unnecessary or irrelevant information affect the ability to engage in processes that are crucial for good comprehension (De Beni & Palladino, 2000). Adults and children with deficient inhibitory processes are more likely to remember irrelevant words and information, resulting in weak reading comprehension (De Beni & Palladino).

Specific Working Memory Weaknesses in Readers with Dyslexia

Readers with dyslexia are deficient in nearly all aspects of working memory. They also commonly have weaknesses in other related memory and cognitive processes (See Table 1).

Table 1. Specific Weaknesses Associated with Dyslexia

- Phonological processing
- Phonemic awareness
- Executive working memory
- Phonological short-term memory
- Visual-spatial short-term memory
- Long-term memory encoding
- Verbal rehearsal
- Speech rate
- Sequencing
- Updating
- Inhibition
- Switching
- Error monitoring
- Strategy use
- Naming speed

Phonological Deficits

The most consistent working memory deficit found among readers with dyslexia is in the storage capacity of phonological short-term memory (Smith-Spark & Fish, 2007). Readers with dyslexia simply cannot retain as much sequential, verbal information, such as letters, phonemes, words, and phrases, as normal readers do. The result is a breakdown in the reading process and

slow acquisition of reading skills. Examples of how a phonological storage deficit is manifested during reading include: (1) a failure to store phonemes long enough to successfully blend them into a word; (2) forgetting the sequence of the phonemes; (3) forgetting phonemes that were early in the decoding sequence; (4) a failure to store words long enough for comprehension to occur; (5) forgetting words and the phonemes that comprise them before they are encoded into long term memory, and (6) a failure to update during decoding, such as not changing a vowel from a short to a long sound when a silent "e" is encountered at the end of a word.

Visual-Spatial Deficits

There has been conflicting evidence regarding the possibility of a visual-spatial storage deficit in dyslexia. For the most part, visual-spatial storage capacity has been found to be normal in children with literacy disorders. However, recent investigations have uncovered a weakness in this working memory component, at least in one aspect of visual-spatial processing. Fischbach et al. (2014) report that children with dyslexia have a significant weakness in the processing and storage of dynamic visual-spatial information, such as when they need to reverse the sequence of movement. At the same time, subjects in the study had normal ability for storage of static visual-spatial information. In contrast, another recent study (Menghini, Finzi, Carlesimo, & Vicari, 2011) discovered that developmental dyslexia is related to weaknesses in both aspects of visual-spatial storage.

One explanation for the inconsistences in this avenue of research is that visual-spatial storage capacity by itself may be normal, but information may be lost when concurrent processing takes place. The relationship between storage and cognitive load explains this phenomenon. Some visual-spatial information will be lost during processing because cognitive load reduces the amount that can be retained. Evidence in support of this explanation was provided by Swanson and Sachse-Lee (2001) who found that their dyslexic group's weakness in visual-spatial storage disappeared when executive working memory ability was controlled for.

Executive Deficits

Many working memory researchers (e.g., Pickering, 2006; Swanson & Jerman, 2007) believe that executive working memory is the core deficit in dyslexia. The fact that both domain-specific storage components have been implicated in dyslexia supports this claim because a limited executive working memory that is easily overloaded when processing information will reduce the amount of information that can be maintained in storage. For example, the recently discovered weakness in dynamic visual-spatial storage can be explained by a weak executive component. A lack of a capacity for simultaneous processing and storage will impact nearly all aspects of working memory.

Furthermore, a dysfunctional executive working memory or one that is easily overloaded may include poor functioning of updating, inhibition, and error monitoring, all of which are crucial for successful reading. Individuals with weak executive working memory also tend to be less strategic, in part because implementing a strategy adds to cognitive load (Swanson, 2000). This is unfortunate because consistent use of effective strategies enhances reading performance.

Long-Term Memory Encoding Differences

The use of different long-term memory encoding and rehearsal strategies is another difference between readers with and without dyslexia that was discovered by Miller and Kupfermann (2009). Graphemes can be encoded and rehearsed phonologically or visually. Normal readers focus on the phonological code of written material and verbally rehearse the phonemes and words in sequence. However, readers with dyslexia are more likely to use visual encoding and rehearsal. The problem is that visual encoding and rehearsal is less efficient and effective. Fewer letters, sounds, and words are remembered or remembered in sequence when the encoding and storage is visual-spatial, resulting is more reading errors. Phonological encoding, storage, and rehearsal are more efficient because they maintain the sequence of the information, whereas visual-spatial encoding is not necessarily sequential. It may be that those with dyslexia prefer the visual-spatial route because they possess weak phonological processing and storage abilities while having normal visual-spatial processing and storage. Another possibility is that a weak executive working memory underlies this inefficient coding and storage. That is, one responsibility of the executive component is to inhibit visual-spatial processing and storage in favor of phonological processing and storage.

Sequential Processing Deficits

A weakness in sequential processing, also known as *successive* or *serial* processing, is also common among individuals who suffer from dyslexia. This particular processing weakness may account for observed weaknesses in working memory storage components (Fischbach et al., 2014). For example, a weakness in sequencing may underlie storage weaknesses in both phonological and dynamic visual-spatial information, because sequences need to be maintained in both domains when the task involves reading. Poor sequencing ability might also explain why readers with a disability seldom use verbal rehearsal as a strategy. Verbal rehearsal is also challenging when an individual has a slow speech rate, another characteristic of readers with dyslexia. Finally, slow naming speed, another marker for dyslexia, may be related to a dysfunctional working memory. Naming speed involves retrieval of common names from long-term memory, and working memory is involved in conscious retrieval.

Evidence-Based Working Memory Interventions

Over the past two decades numerous empirical investigations have documented the efficacy of working memory training, strategies, and accommodations (see Dehn, 2015 for a comprehensive review). Unfortunately, a review of the research and detailed instructions for implementing these procedures are beyond the purview of this introductory article. A few examples and suggestions and how they will benefit readers with dyslexia are provided below.

Rehearsal Training as an Intervention

Children with disabilities often fail to develop or use verbal rehearsal strategies. Some children may know the strategy but be unable to maintain items in sequence during a series of repetitions. Given that individuals with dyslexia do not rehearse as much as normal readers, rehearsal training may be especially beneficial for them. Rehearsal allows more information to be maintained in working memory for a longer period of time (Gathercole, 1999), allowing processing of the information to be completed. In readers with normal working memory ability, rehearsal can be carried out semi-automatically without a very concentrated use of attention or working memory.

Rehearsal, simply repeating information over and over, is the first and most basic memory strategy acquired. It usually develops without any explicit instruction or training. Children may begin using a simple rehearsal strategy as early as 5 or 6 years of age, but rehearsal is not a widespread or consistently used strategy until the ages of 7 to 10 (Gill, Klecan-Aker, Roberts, & Fredenburg, 2003). The development of subvocal rehearsal strategies is as least partially responsible for increased verbal working memory span as children develop (Minear & Shah, 2006). Children as young as 5 years of age can be trained to use rehearsal and this has been found to improve their recall and their academic learning (Henry & Millar, 1993).

Teaching rehearsal strategies to individuals, in small groups, or to an entire classroom of students is relatively easy (Dehn, 2011). Cumulative rehearsal involves training children to name the first item after it is presented, then the first and second items together after the second item is presented, and so on until all items in the series have been presented and rehearsed. For example, the subject (S) is taught to overtly repeat successively longer sequences as each word is spoken by the instructor (I) (e.g., I-foot, S-foot; I-bird, S-foot, bird; I-house, S-foot, bird, house; and so on). An alternative is to present the entire list at once and have the child repeat the entire list a few times. At first, students should be directed to say the words aloud to make sure they are rehearsing correctly, but as the practice progresses they should whisper the words and eventually subvocalize.

For children with normal cognitive ability, lists constructed of randomly chosen monosyllable words should be used. Begin with a list of only two or three items. As training progresses, the difficulty level can be adjusted by increasing the number of words to be recalled. Students may benefit from rehearsal training sessions of only 10 minutes per day over a period of 10 days, but daily training over a period of several weeks may produce better long-term change (Dehn 2008). Readers with dyslexia should benefit from rehearsal training because better rehearsal extends the number of phonological items (phonemes, syllables, and words) that can be retained, as well as the duration of the retention interval. Thus, they will be able to retain phonemes and syllables until blending is completed. Also, their reading comprehension will benefit because they will be able to retain decoded words and phrases long enough to make associations and understand the text.

Internet-Based Working Memory Training

Many cognitive and working memory training programs are offered on the internet. Examples include Cogmed®, Jungle Memory, Lumosity, and Brain HQ. These programs and other exercises that challenge working memory usually produce significant gains in working memory performance (Dahlin, Nyberg, Backman, & Neely, 2008). Although there is consistent evidence that performance will improve on untrained measures of working memory, transfer to improved reading and other academic skills is found only periodically. For example, Loosli, Buschkuehl, Perrig, and Jaeggi (2012), reported significantly enhanced reading performance in typically developing children aged 9 to 11 after online working memory training. Similarly, improvements in reading comprehension were reported by Dahlin (2011). One reason why internet-based training is seldom found to improve reading is that the training primarily involves visual-spatial working memory, whereas, the primary deficits for most readers with dyslexia are phonological and verbal. That's why face-to-face verbal rehearsal practice may be more beneficial that computer-based training. Another explanation for inconsistent transfer is that online training needs to be consistently challenging (adaptive) over an extended period of time (Klingberg, 2009).

Supporting a Reader with Dyslexia

Until reading fluency and decoding automaticity are attained, working memory deficient readers will benefit from direct support with processing and storage. Support is especially needed for recognizing, storing, and blending phonemes. When the reader does not recognize a word and does not attempt to decode the word, saying the first phoneme of the word may serve as a prompt. Especially with longer words, some readers with dyslexia have difficulty remembering the sequence of sounded-out phonemes when they are ready to blend them. For these readers, the person assisting the reader can serve as the reader's phonological short-term storage. That is, the assistant should repeat the separated phonemes in sequence, allowing the reader to blend them without having to start over.

Another way to support a working memory impaired reader with dyslexia is to minimize cognitive load during reading (Dehn, 2014e). There are several ways of doing this: (1) a quiet environment with limited distractions is important because noise and distractions add to cognitive load; (2) reading about a familiar subject is also helpful because the novelty and complexity of the material adds to cognitive load; (3) reducing verbalizations by providing non-verbal cues is important because verbalizations from the reading assistant add to cognitive load; and (4) taking frequent breaks while reading is helpful because they reduce cumulative interference and the need to inhibit that interference, which also adds to cognitive load.

Finally, a reader with working memory impairments will need more exposures to new words before they become encoded and consolidated in long-term memory. Additional exposure should begin with immediate re-reading of a passage, even when it was read fluently. New sight words should then be reviewed on a systematic basis (Bahrick, 2000). Reviews that occur with longer and longer intervals between them are the most effective (Karpicke & Roediger, 2007). For students with working memory deficits, an ideal review schedule might be: (1) at the end of the lesson; (2) the next day; (3) after a delay of two or three days; (4) after another delay of a week; and (5) after two weeks have passed since the last review.

Summary

In addition to the primary deficit of phonological processing, deficits in one or more aspects of working memory contribute significantly to dyslexia. Adequate short-term storage and simultaneous processing of information in working memory are both required for successful reading. Furthermore, the executive dimensions of working memory---inhibition, switching, and updating---play crucial roles during reading decoding and comprehension. Also, high cognitive load due to such factors as novel material and distractions impairs working memory performance and makes reading more challenging. In readers with dyslexia, working memory deficits are typically manifested by difficulties converting graphemes into phonemes, maintaining the sequence of phonemes long enough to blend them, and maintaining the words, phrases, and sentences long enough to finish the thought processes necessary for comprehension. Evidence-based interventions, such as rehearsal, may not only enhance working memory performance but lead to improved reading skills in individuals with dyslexia. ♦

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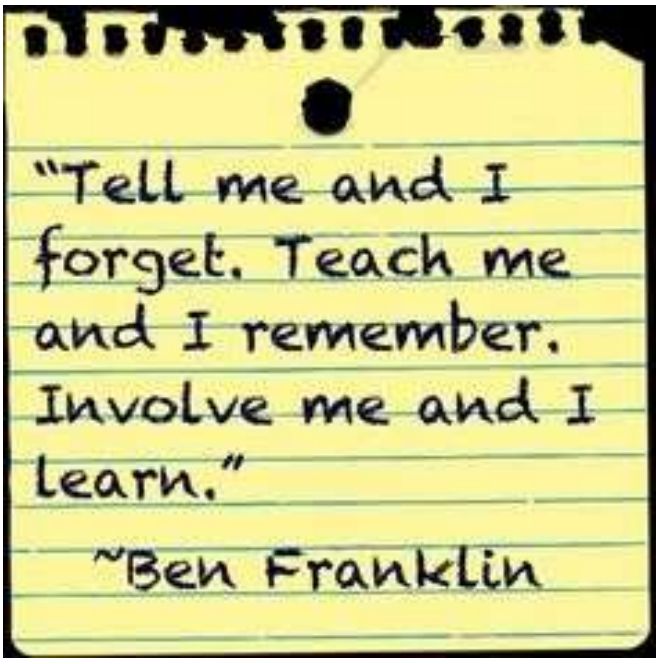

What We Can (and Cannot) Learn from Spelling Errors in Dyslexia

Louisa C. Moats

Abstract

The overall purpose of this paper is to inform speech-language pathologists about the usefulness of spelling as a diagnostic tool. First, it provides a context for evaluating the distinctiveness (or lack thereof) of spelling errors in dyslexia, including a brief description of English orthography and summary of the linguistic competencies required in learning to spell. Then, it reviews research on the nature of children's developmental spelling errors so that "normal" can be defined. Next, it describes an error classification system that includes types of phonological, orthographic, and morphological errors commonly found in students' writing. It reviews research comparing the spelling errors of older students with dyslexia to younger, spelling-matched controls reporting consistently that while dyslexic students make many more errors, those errors are not unique to dyslexia. The paper concludes with suggestions for spelling assessment relevant for instruction, arguing that spelling errors, while informative, must be interpreted in relation to a student's writing abilities, prior instruction, and broader testing profile.

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Nonfinancial – Consultant Advisor to Sopris West Educational Services. for literacy research and professional development. Developed Language Essentials for Teachers of Reading and Spelling (LETRS). Served as a contributing writer of the Common Core State Standards for the National Governors' Association and the Council of Chief State School Officers. Has published many influential scientific journal articles, books, and policy papers on the topics of reading, spelling, language, and teacher preparation. Has been awarded the prestigious Samuel T. and June L. Orton award from the International Dyslexia Association, for outstanding contributions to the field.

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Learning Objectives

1) Identify phonological, orthographic, and morphological errors in spelling
2) Identify the linguistic processes and competencies required for learning to spell.
3) Explain spelling errors of students with dyslexia in the larger contexts of normal spelling development, novice learners, and learners with generally poor language abilities.

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Spelling difficulty always occurs with dyslexia and sometimes occurs in relatively isolated form as a specific spelling disability, with and without handwriting problems (e.g., dysgraphia; Berninger & Wolf, 2009; Lyon, Shaywitz, & Shaywitz, 2003; Siegel, 2013). Poor spellers with dyslexia commonly demonstrate confusion about written language symbols in general, including punctuation, capitalization, spacing, and signs for mathematical operations. Once intensive intervention is successful, dyslexic individuals may progress much more rapidly in reading than they do in spelling (Moats, 1996), as spelling requires more precise and complete memories for printed words than reading. It is not uncommon for a student's spelling test scores to plateau at a third or fourth grade level even if years of structured literacy instruction have been provided.

If spelling is intrinsically more difficult than reading, should we expect that the errors made by individuals with dyslexia are qualitatively and/or quantitatively distinct from errors made by other novice spellers or students with other kinds of language-based learning problems? Is there such as thing as a tell-tale pattern of errors in the spelling of students who demonstrate characteristics of dyslexia? If clinicians develop a diagnostic eye for spelling, should they be able to diagnose dyslexia on the basis of spelling and writing samples? What contribution does spelling assessment and error analysis make to diagnosis and instructional planning for students with dyslexia? These questions are important because beliefs about the distinctiveness of dyslexia often drive guidelines for assessment and treatment, and their validity should be examined in light of research.

What Must Students Learn about Language When They Learn to Spell?

Analysis of spelling errors is most relevant to diagnosis and instructional planning if it is informed by understanding of the relationship between speech and print in English (Moats, 2010). In the alphabetic writing system of English, the correspondences between phonemes and graphemes are more varied and complex than in fully transparent alphabetic systems. Graphemes, which are functional representations for phonemes, may include up to four letters. For example, the *eigh* in the word *weigh* corresponds to the "long a" vowel, /e/, and the *dge* in the word *wedge* corresponds to the affricate /ǰ/. The word *fight* has three speech sounds (/f/, /ɑj/, /t/) and three graphemes (f, igh, t) used to spell those three sounds. The word *thrill* has four phonemes (/θ/, /r/, / ɪ/, /l/) and four graphemes (th, r, i, ll). There are about 80-90 high utility graphemes, composed of single letters and letter groups, that commonly represent the 25 consonant phonemes and 15-19 vowel sounds of English (Moats, 2008).

In addition, English orthography often represents inflectional morphemes and derivational morphemes consistently even though their phonetic realizations vary (Carlisle, 1987, 1988; Henry, 2010; Nagy, Berninger, & Abbott, 2006). One ubiquitous example of this phenomenon is the past tense "ed" in English that is spelled consistently and pronounced variously as /t/ (*missed*), /d/ (*hummed*), and /əd/ (*wanted*). Another are the words *defined*, *definition*, and *definitive* that all include the root *fin* pronounced with three different vowel sounds, or *nature*, *national*, and *nativity*, all with the root *nat* spelled consistently but realized in speech as three different vowel sounds and three pronunciations for "t". The tendency for English to represent morphemes regardless of a word's phonetic features in spoken language renders it a "deep" orthography where meaning is represented in spelling in preference to surface phonetic details of speech (Henderson, 1990; Moats, 2010; Venezky, 1999).

English spelling often reflects the language from which a word originated or was borrowed. Modern English can be traced most often to its Germanic base language, Anglo-Saxon, but also to French, Latin, and Greek, with a smattering of many other languages (Henry, 2010; Moats, 2010; Venezky 1999). For example, it is often (but not always) true that "ch" represents /č/ in words of Anglo-Saxon origin, such as *church* and *chin*, /š/ in words of French origin such as *machine* and *cache*, and /k/ in words of Greek origin such as *chorus*, *character*, and *Christmas*. Direct borrowings from French, such as *unique*, *baguette*, and *ballet*, retain their French spellings, as do words borrowed from other languages including Italian (spaghetti, piano), and Spanish (fajita, conquistador).

Although phoneme-grapheme correspondences form the base layer of our alphabetic writing system, many of those correspondences are position based (Hanna, Hanna, Hodges, & Rudorf, 1966). How we spell a speech sound can depend on where it occurs in a word – in initial, internal, or word-final position. For example, /ǰ/ is spelled "j" in initial position (*jam, jump, joy*), "ge" after any vowel other than a short vowel (*wage, stooge*), and "dge" right after short vowels (*dredge, lodge, badge*). The vowel long *a* (/e/) can be spelled with single letter *a* in open syllables (*ba-by, sta-ble*), with vowel team *ai* when it is in medial position in a syllable (*tail, train, bait*) and *ay* at the end of a syllable (*stay, pray, delay*). Young spellers must develop knowledge of many position-based spelling constraints, beyond simple letter-sound associations, either by intuiting them through repeated exposure to print, or learning them through explicit instruction.

The meaning and use of words in context also governs how they are spelled. English has many homophones (words with the same pronunciation and different spellings and/or grammatical properties) such as *passed* and *past*; *site, cite*, and *sight*; and *to, too*, and *two*, that require a writer to distinguish the words' meanings and morpho-syntactic properties (Bahr, Silliman, Berninger, & Dow, 2012). For example, to distinguish *cite* from *site*, a successful speller can remember that the verb *cite* is related to the noun *citation* and the verb *site* is related to the noun *situation*. Thus, learning to spell includes developing awareness and sensitivity to phoneme-grapheme correspondences, position-based spelling patterns in orthography, word origin, and word meaning (Bahr, Silliman, Berninger, & Dow, 2012; Bourassa & Treiman, 2014). Without implicit or explicit understanding of the complex correspondence system that is English, the learner cannot progress very far by trying to memorize strings of letters that represent whole words (Joshi, Treiman, Carreker, & Moats, 2008-2009).

English spelling also appears to have a high proportion of irregular words that cannot be easily explained on the basis of these representational principles. However, objective analyses of English orthography have demonstrated that it is more regular than often depicted (Chomsky, 1979; Hanna, Hanna, Hodges, & Rudorf, 1966; Henderson, 1990; Treiman, 1993; Venezky, 1999). If English were indeed irregular, then the most efficacious organization of a spelling program would emphasize the frequency of words in our writing vocabulary and rote visualization of letter strings. On the other hand, if recurring patterns of sound–symbol correspondence and other orthographic patterns are dominant, then instruction will be most effective if it emphasizes the system of patterns and regularities. Recent summaries of spelling instruction research clearly support the superiority of structured language approaches over rote visual memorization approaches (Graham & Santangelo, 2014; Wolter & Squires, 2014). Students who develop insight into how letters are used to represent aspects of language are more likely to remember letter strings. While straightforward memorization techniques have a role in learning some words, better outcomes are associated with methods emphasizing phoneme-grapheme mapping, understanding of letter patterns in the English orthographic system, and association of letter patterns with meaning.

Are "Regular" and "Irregular" Words Learned Differently?

Some spelling assessments include word lists divided into "regular" and "irregular" words, implying (1) that these categories of words exist and (2) that the learning process for each word type is sufficiently distinctive that we should expect some students to show a significant preference for spelling one type of word over the other. It is important to clarify this issue before a discussion of spelling error analysis can occur. Belief in this dichotomy may lead a clinician to look no further than accuracy scores on each type of word list. If apparently irregular words are misspelled more often, the diagnostician might recommend a "visual" approach to word study, even though experimental support for such an inference is non-existent (Joshi, Treiman, Carreker, & Moats, 2009; Wolter & Squires, 2014).

A small percentage of words such as *does*, *women*, and *of* are clearly irregular. Many more are only somewhat odd or non-conforming to orthographic principles. Words in English are not easily categorized as regular or irregular; rather, regularity of word spelling exists on a continuum and is affected by several factors. For example, words like *dove*, *love, shove, give*, and *sieve* have short vowels but silent e's. They do not follow the vowel-consonant-silent e, long vowel spelling pattern, but they do follow the orthographic rule that no word shall end in single letter v. The words *he, she, we*, and *me* are irregular because a double e is more common in one-syllable words (e.g., *see, thee, tee, bee, tree*), but the group of words follows an open syllable spelling convention. When words make a family or belong to group with several familiar "cousins," learners remember those patterns, even though one pattern may pertain to fewer words than another. The words *cold*, *sold*, and *mold* or *most*, *ghost*, and *host* are other examples of words that do not comply with the most common sound–symbol correspondence rules, but that do comprise a word family that follows a pattern. As students learn basic sound-symbol correspondences and begin to establish a memory bank of known words, they can begin to learn new words by analogy (Ehri, 2014).

Linguistic Processes Underlying Spelling Ability

The approach to spelling error analysis offered in this paper will place less importance on whether a target word itself is regular or irregular, and more emphasis on determining which aspects of language and memory seem to be blocking student progress. Development of those linguistic competencies can then be targeted during instruction. The human brain draws upon phonological, orthographic, semantic, and syntactic processing networks, working reciprocally, as it forms word memories. People with poor spelling skills, however, are likely to exhibit a relative weakness in one or more of those processing systems. At beginning levels, generating a word's spelling requires analysis of and working memory for speech sounds (Bourassa & Treiman, 2014; Ehri, 2014; Tangel & Blachman, 1995). Students with the most severe and intractable spelling problems usually demonstrate severe deficits in phoneme discrimination, sequencing, segmentation, and/or recall (Cassar, Treiman, Moats, Pollo, & Kessler, 2005; Friend & Olson, 2008; Treiman, 2014). Students with somewhat less severe difficulties, who are able to represent words phonetically by using decipherable but

incorrect graphemes, are demonstrating faulty orthographic memory and, often, insensitivity to the letter pattern constraints of English orthography. They may do relatively well on tests of phoneme awareness and phonological memory, but poorly on tests of orthographic sensitivity and recall. For example, students with a poor sense of English orthography might not recognize that spellings such as *vixxen*, *ckloths*, or *purviw* are impossible within the letter order constraints of English. At a more advanced level, students may spell phonetically but demonstrate very underdeveloped awareness of morphological structures and the relationships among word form, meaning, and spelling (Bourassa & Treiman, 2008; Silliman, Bahr, & Peters, 2006). These students have less severe, but nevertheless debilitating problems coping with writing from the intermediate grades onward. Spelling error analysis is an excellent tool for evaluating where the learning process is breaking down.

The First Concern: Adequacy of Phonological Foundations for Spelling

Spelling ability depends first on the strength and clarity of phonological representations in memory. Without identifiable speech sound segments serving as anchors for graphemic representations, the student is left with an ineffective strategy: imprinting letter sequences onto memory by rote. Students with phonological deficits typically (but not always) are also impaired in both real and nonsense word decoding and develop reading skills slowly and with great effort (Kamhi & Hinton, 2000). Phonological processing weaknesses will interfere with spelling of all kinds of words – frequent and infrequent, regular and irregular. Even the spelling of odd or somewhat irregular words is facilitated by conscious comparison of the discrepancies between a word's sound and its letters – something that the student with phonological deficits has difficulty doing.

The first question for the clinician should be this: Is the child able to represent individual phonemes and phoneme sequences in a reasonable (decipherable) way? If the answer is "yes", then it is quite likely that the student's phoneme awareness is developing well and that the student does not require a strong emphasis on oral-verbal phoneme identification and segmentation during instruction. If the answer is "no", then the student requires direct, systematic teaching to bolster phoneme identification, sequencing, and segmentation during a comprehensive spelling lesson. In so doing, the clinician enables the student to construct a mental "phonetic skeleton" (Bahr et al., 2012) on which to hang the word's letters in the lexicon. Judging whether or not spelling is phonetically accurate, however, requires understanding of early spelling development and the influence of phonological processes on young children's spelling attempts. Before that discussion ensues, we must first consider why phonemes are elusive and understand the challenges facing all novice learners of English orthography.

Phonemes are Elusive, Even for Normally Developing Students

Students must be able to identify the speech sounds in words before they can match symbols to those sounds in reading and spelling. If teaching students to be aware of phonemes in words were as simple as listing them and pronouncing them, however, instruction and remediation would be very straightforward. Unfortunately, phoneme identification is difficult for many novice learners; the phonetic features of spoken phonemes change as they are coarticulated and some, such as /r/, /l/, /w/ and /y/ are difficult to isolate and pronounce out of the context of a whole word (Liberman, 1999).

A phoneme is an abstraction, a category of sounds perceived to be one linguistic unit. Phonemes belonging to any language system are shaped or altered in speech production, but recognized by the listener as sounds that can change the meaning of words. The letters we use to represent phonemes are self-contained symbols existing in space, unlike phonemes, which do not exist as isolated units. The features of phonemes spoken together as words spread from one to the other, like unfixed dye in fabric; the resulting variations in each phoneme are allophones. For example, consider the slight variations that occur in the short e vowel in these words:

engine: The /ɛ/ is nasalized before /n/.
egg: The /ɛ/ sounds like long a (/e/) because the tongue pushes the vowel upward when it is followed by /g/.
edify: The /ɛ/ is closest to its "pure" form.

Even though we as listeners ignore allophonic variation as we process the meanings of the words we hear (Liberman, 1999), novice spellers' transcriptions of speech often reveal how sensitive they can be to surface phonetic features (Chomsky, 1979; Read, 1986; Treiman

& Bourassa, 2000).

Allophonic variations that most commonly influence young children's spellings are the following:

Aspiration and deaspiration of voiceless stop consonants. The voiceless stop consonants, /p/, /t/, and /k/, are pronounced with aspiration in the beginnings of syllables and before vowels. However, if /k/, /p/, or /t/ are inside a cluster, as in *skin, spun,* or *stem,* there is no aspiration. Young students are likely to mistake them for their voiced cognates /g/, /b/, and /d/. Thus, young students may make these spelling substitutions:

SBYDR/spider SBESL/special
SDASHN/station SDRT/start
SGIN/skin SGARY/scary

Final consonants /p/, /t/, and /k/ are also deaspirated and are more likely to be confused with their voiced counterparts in final position. Thus, stop consonants in initial position are generally easier for students to perceive than phonemes in medial or final position.

Automatic nasalization of vowels before nasal consonants. Every vowel that occurs before a nasal consonant in English (e.g., /m/, /n/, or /ŋ/) is nasalized. This allophonic variation is systematic and automatic. The variation can be readily noticed by holding one's nose and saying the contrasting pairs, *bad, band; said, send; dote, don't; sick, sink; puck, punk*.

Spelling words with the final nasal blends *nt, nd, mp, nk* is difficult because the nasal phoneme is elusive in speech. The nasal feature of the consonant is assumed by the vowel, and the nasal consonant is articulated with the tongue in the same position as the consonant that follows it. The two consonants become part of a single speech gesture. Thus, young students (and those older students who progress slowly) commonly make errors such as these:

SIK/sink WET/went
BASEMET/basement
JUPPY/jumpy
SIPLE/simple

Instruction to address these errors is more successful if (1) the nasal phonemes have been directly taught, and (2) students are cued to hold their noses and feel the nasal feature associated with the presence of a nasal consonant.

Tongue flap for medial /t/. American English speakers habitually change /t/ to a medial tongue flap in multi-syllable words when it occurs between an accented and unaccented vowel. Words such as *water, better, writer, British*, and *little* may be spelled as WADR, BEDR, RIDR, BRIDISH and LIDL.

Affrication of /t/ and /d/ before /r/ and /y/. The stop consonants /t/ and /d/ are affricated before /r/ or /y/. That is, in anticipation of liquid /r/ or glide /y/, the lips pucker and the phonemes are produced like /č / and /ǰ/. Young students may use the letter *h* to spell /č / because *h* is the only letter name that contains /č/. Likewise, they may use either *j* or *g* to spell /ǰ/. Typical spellings are as follows:

CHRAN/train
JRS/dress
CHRICK/trick
JRAGIN/dragon
HRET/treat
GRAN/drain
NACHR/nature
EJUKATE/educate

Recognizing Phonetically Accurate Spelling of Young Children

Younger, novice spellers try to spell by sound. In addition, their experimental spellings may incorporate orthographic patterns commonly seen in print, including doubled letters, alternating vowels and consonants, and final e on the ends of words (Bourassa & Treiman, 2014; Treiman, 1993). In the early stages of learning, four and five year-olds typically rely on their knowledge of letter names to invent some spellings (Read, 1986; Tangel & Blachman, 1995; Treiman, 1993). Six and seven year-olds may persist with letter-name and surface phonetic spelling strategies until their print vocabulary expands and they achieve a more consolidated sense of how spelling works.

Inventive spelling attempts commonly seen in the writing of kindergarten and first grade children include the following:

1. Long vowels derived from a vowel letter's name.
   DA = day, KAM = came, FEL = feel

3. Short vowels derived from the letter name closest in articulation (tongue height, front-back placement in the vocal cavity).
   - a for short e, /ɛ/ BAD = bed, SAD = said
   - I for short o, /ɑ/ GIT = got, SIP = stop
   - e for short I, /I/ FES = fish, DEG = dig
   - o for /ʊ/ SOGH = sugar
   - i for short u /ŭ/ KIT=cut

4. Nasal consonants, /m/, /n/, /ŋ/ omitted before consonants (vowel is nasalized and nasal consonant is "lost" in articulation).
   JUP = jump AD = and ED = end

5. Consonants /m/ /n/ /l/ /r/ used to represent syllables, especially in word-final position.
   LIDL = little BIGR = bigger OPN = open

6. Inflections (ed, s, es) spelled phonetically.
   WALT = walked DAWGZ = dogs
   BEGIZ=beaches

7. Rounded vowels and diphthongs transcribed with phonetic detail.
   SOWN = soon GOWT = goat BOE = boy

8. Affrication of /t/ and /d/ before /r/ represented phonetically with "ch" and "j".
   CHRA = tray CHRIBLS = troubles
   JRAGN = dragon

9. Intervocalic flaps shown as D.
   LADR = letter WODR = water

10. Letter names Y used for /w/ and H used for /č/.
    YOH = watch YL = will HRH = church

A clinician assessing spelling should recognize these common representational strategies as logical attempts to write how words sound when only a limited repertoire of symbols is available to the student. All of the spellings can be viewed as phonetically accurate, in that they offer a logical set of symbols for speech. Spellers at these beginning levels are as yet uninformed about the English phoneme-grapheme correspondence system and have not yet learned either syllable spelling conventions or common morpheme spellings. It would be misleading to classify these spelling attempts as phonetically inaccurate even though some of them do not look at all like real words. In fact, when students in kindergarten and early first grade can spell phonetically, they are unlikely to need additional work on phoneme awareness and are usually ready to focus on learning how words are actually spelled. There is no advantage to promoting "invented spelling" for its own sake when students need to get on with the business of learning how orthography works and mastering the correct spellings for the highest frequency words in the language. Figure 1 below shows inventive spellings produced by a late kindergarten student with age-appropriate phonemic awareness and spelling development.

Figure 1. Inventive spellings in the writing sample of a typically developing five year-old child late in the kindergarten.

It is 60 dgres [degrees]. Im going to play at Woshintin DC. Im going to pack cklos [clothes]. I going to see the wit [white] hous. I wil see presindint booshe [President Bush].

Typical Errors of Students with Phonological Deficits

An important goal of diagnostic assessment is to determine which aspects of a student's language functioning should be the focus during instruction or remediation. Spelling errors provide valuable insight into phonological, orthographic, and morpho-syntactic language competencies. Phonological analysis of spelling errors estimates the degree to which a spelling matches the phonetic features of the entire spoken word (Moats, 1996, 2010). Not only are the identities of phonemes obscured in normal speech, because phonemes overlap in coarticulated words, but also individual phonemes are shaped by the phonemes before and after them. The diagnostician must be careful to evaluate the accuracy of phonetic transcription in relation to how words are actually spoken and in relation to a student's phase of spelling development (Ehri, 2014).

Phonetically inaccurate spellings usually indicate that the student has not established awareness of individual consonant and vowel phonemes and/or is having difficulty extracting them from the speech stream. Error analysis, in addition, must be informed by consideration of the syllable stress patterns in multisyllable words and by the salience or obscurity of phonemes in those stressed and unstressed syllables. All phonemes are not equally difficult to identify. Some stand out and are easy to hear, while others evade recognition. Students with

phonological processing weaknesses, such as are common in reading and spelling disabilities, tend to make dysphonetic errors – that is, spellings that fail to represent the sounds in the words – on the more elusive and difficult phonemes and phoneme sequences.

Phonetically inaccurate errors involving consonant phonemes tend to occur on these linguistic elements or within the phonological contexts shown below (Barr, Silliman, Berninger, & Dow, 2012; Cassar, Treiman, Moats, Pollo, & Kessler, 2005; Moats, 1996):

1. Deletion or confusion of consonants on the inside of consonant clusters or blends.
   SOPID/stupid SPITING/splitting
   PAIRIE/prairie

2. Confusion of consonants that share phonetic features but differ only in voicing.
   BEGIS/beaches THRIVT/thrift
   GRACH/garage SBIN/spin

3. Confusion of consonants with a similar manner of articulation (stops; nasals; fricatives).
   HANER/hanger AMNAL/animal
   FREE/three STASUN/station

4. Confusion of consonants with names that do not contain the sound the consonant represents.
   WESTERDAY/yesterday YIL/will

5. Omission of a nasal placed between a preceding vowel and a following consonant.
   TRASPLAT/transplant PAITING/painting
   UNBLEDED/unblended SIK/sink

6. Omission, substitution, or misplacement of a liquid /l/ or /r/.
   PSN/person DRTER/daughter
   CLOL/color FRIST/first
   PORTET/protect

Vowel omission and substitution errors are also common in the writing of students with dyslexia and related spelling difficulties. Several factors render vowel spellings more difficult: (1) the identity of vowels can be challenging because many are indistinctly pronounced, or spoken as schwas; (2) dialect differences cause variation in vowel pronunciation; (3) some vowel phonemes, especially the long vowels, are represented by several graphemes; and (4) only five letters are used, often in combination, for those graphemes. Nevertheless, when spelling attempts are dysphonetic (do not represent the phonemes of a word in a plausible way), vowel phonemes are omitted, misplaced in the phoneme sequence, spelled with letters never allowed for the target phoneme, or confused with vowel phonemes that are close in articulation.

Categories for dysphonetic vowel spellings include:

1. Confusion of vowels close in front-back tongue placement or tongue height:
   MERRED/married PEK/pick
   SPONK/spunk AGINDA/agenda

2. Omission of vowels, especially de-stressed or unaccented vowels (schwas):
   GAJ/garage CATN/connects
   CLOST/closet FUNCHR/furniture
   RELTIFH (relatives)

Figure 2 below shows the phonetically inaccurate spells of a student with unremediated dyslexia.

Figure 2. Phonetically inaccurate spellings in 9-year old student with unremediated dyslexia.

Inmis. Tow day goach.in door pooll wath a salad that you can go wall fate on. Daning room thet has a catn to the kenckin.

Translation:
Items. Two bay garage. Indoor pool with a slide that you can go real fast on. Dining room that has a connection to the kitchen.)

If vowel spellings indicate that the student's attempts are close to the target, then instruction should focus on the vowel contrasts of minimal pairs such as *bat* and *bet*, *when* and *win*, and *moss* and *muss*. If the student barely grasps the concept of a vowel, then instruction should emphasize awareness of vowels in widely contrasting word pairs, such as *beet* and *boat*. Listening for vowel identity in spoken words should precede blending, segmenting, reading, and writing those words in the course of a lesson.

Students with poor phonological awareness often make many errors in spelling and make slow progress in spelling achievement. Instruction must address the fundamental problem with speech sound awareness as

well as other aspects of language processing and must be very systematic and incremental in order for measurable improvement to occur.

Phonetically Plausible, Orthographically Incorrect Errors

Even if a student has attained a level of phonological awareness that can support phonetic spelling, and spellings are a reasonable transcription of speech, remembering the graphemes that are actually used to spell the word can be daunting. Many students with milder forms of dyslexia demonstrate poor memory for orthography – both for word recognition and for spelling. While the majority of students with dyslexia demonstrate measurable deficits in phonological and phonemic awareness, some researchers estimate that up to one-quarter do not (Dehaene, 2009). The reading and spelling disability of that minority selectively affects memory for orthography and understanding of the language systems represented by written symbols. In addition, if students experience excellent early intervention that remediates their deficits in phoneme awareness, spellings are more likely to be either accurate or close approximations of a correct spelling (Boyer & Ehri, 2011; Blachman, Schatschneider, Fletcher, Francis, Clonan, Shaywitz et al., 2004; Weiser & Mathes, 2011).

Orthographically inaccurate errors are prominent in the writing of students with dyslexia. Students are spelling by sound but using incorrect graphemes to do so. Individual graphemes may be correct in some positions (initial, medial, final) but are not correct as used in the target word and, often, not permissible in any English word. For example, an initial "ck" in "clothes" is not allowed in English orthography, nor is a single final "v" in "have" (any word in English ending in /v/ must be spelled with a –ve combination). Violations of suffix addition rules requiring a spelling change in the base word and homophone errors are also classified as orthographic errors.

Categories of common orthographic errors include the following:

1. Possible but inaccurate consonant grapheme (letter or letter combination) for a single consonant phoneme, often violating spelling generalizations or patterns in English (CKLOS/clothes; SICCORS/ scissors; PICHfork/pitchfork; GANETERS/janitors)
2. Possible consonant grapheme with letter order confused (WACTHING/watching)
3. Possible but inaccurate vowel grapheme for a single vowel phoneme (WUS/was; TUCK/took; SEKE/seek)
4. Failure to apply orthographic change rules for suffix addition, including the consonant doubling rule, the change y to I rule, and the drop silent e rule: (SPLATED/splatted; STUDYS/studies; LOVEING/loving)
5. Whole word substitution, including homophones (IN/and; OF/off; THEIR/there; THAN/then; BRAKE/break)

Instruction for students with poorly developed orthographic memory must aim to develop a sense of how the spelling correspondence system works along with specific word recall. Where memory fails, students can improve their spellings by reasoning about word patterns, word origin, and word meaning. The better the educated guess, the more likely that spell check can be used successfully. The orthographic system should be taught at the phoneme-grapheme, letter pattern, inflectional morpheme, and syllable juncture levels, with language history as a conceptual backdrop (Wolter & Squires, 2014). Once these basics are fairly secure, the student can progress to a focus on derivational morphology. Figure 3 shows the writing of a 10 year old who spells phonetically but whose memory for the graphemes used to spell real words is poor.

Figure 3. Predominance of orthographic errors in a 4th grader with phonetically accurate spelling.

Whn I was 4 I had lukemea. I had to sta in the hosbitl for 2 week's. I had to have srjre. To have sumthing put in. I had to get wath thay call a bonemarul and spinultap.

Translation:
When I was four, I had leukemia. I had to stay in the hospital for two weeks. I had to have surgery. To have something put in. I had to get what they call a bone marrow and spinal tap.)

Errors Indicating Underdeveloped Morphological Awareness

Morphological errors may begin to stand out as the student gains skill in foundational spelling concepts and patterns (Bahr, Silliman, Berninger, & Dow, 2012; Bourassa, Beaupre, & MacGregor, 2011). These errors also characterize the spellings of students with poorly developed vocabularies and students who have never been taught about word origin and word structure. Errors typically involve phonetic spelling of prefixes, roots, base words, and suffixes. Students who misspell common morphemes generally have not learned to recognize these meaningful parts in spoken or written words. Categories of morphological misspellings, with examples, are as follows:

1. Phonetic spelling (inaccurate) of a root, combining form, or base word:
   - DESISION/decision
   - EXPRETION/expression
   - EQUILISE/equalize
   - CONSONTRAT/concentrate

2. Phonetic spelling (inaccurate) of a common prefix or assimilated prefix:
   - INPROVE/improve
   - CORASPOND/correspond
   - COLECTED/collected

3. Omission, addition, or substitution of inflections and common suffixes:
   - FRIGHTING/frightening
   - OVERWELMLY/overwhelmingly
   - STARSES/stars

4. Phonetic spelling (inaccurate) of inflectional suffixes:
   - CRISBIST/crispest
   - CLASSIS/classes
   - STRAPT/strapped

5. Phonetic spelling (inaccurate) of derivational suffixes:
   - SHRINKEDGE/shrinkage
   - FAMES/famous
   - VAKASHUN/vacation

Figure 4 shows the writing of a 13-year old whose phonetic spelling is good, but whose spelling errors show both poor memory for the specific letters used in words and underdeveloped awareness of morphemes and their spellings.

Figure 4. Preponderance of orthographic and morphological errors, with good phonetic spelling, in composition of 13-year old.

I an Dyslexic, non of my famly has Dyslexia althow my dad might hav it. My family notist that we had to start doing something about it in the 6th grade. Then began my great adventcher. We heded to Bostin. Its amazing loking out a window in the city, the cars speeding by in a calerfol [colorful] bler [blur] of head lights and street lights all arownd, th sownds of horns and sirens from all derectchins [directions]. aparenty [apparently] I had to go threw like 8 awers [hours] of testing, some of it was fun thow. After I finisd testing we needed to go to egecashinol [educational] consultants at the XXXXX senter

This adolescent has made a few phonological errors including one notable vowel identification error (calerfol) and a fricative substitution (finisd). Although he has received excellent instruction to boost his phonological skills, his writing contains many graphemic and morphological spelling errors. His errors occur on vowel teams, vowel-r combinations, and some common words with irregular vowels such as *none*. At the level of morphology this student needs to review past tense and common Anglo-Saxon suffixes including –ily and –ly. He chooses to use Latin-based words even though he struggles to spell them correctly – a sign of a strong vocabulary. He would benefit from instruction focused on word-building with common roots, assimilated prefixes and derivational suffixes, beginning with the most common morphemes in English (Bowers, Kirby, & Deacon, 2010).

Are the Spelling Errors of Students With Dyslexia Unique?

If the spelling of students with dyslexia is compared to same-age, normally progressing students, errors are not only more prevalent, but can appear bizarre or qualitatively different in comparison to normally progressing students. An important question, then, is whether the spelling of students with dyslexia contains errors that are uncharacteristic of normally progressing students matched on spelling level rather than chronological age. If there are qualitative differences between students with dyslexia and spelling level-matched controls, then the two groups should differ on types of errors and frequency of errors. If, on the other hand, children with dyslexia are simply slower to learn,

but learn to spell in the same way, then their errors should be indistinguishable from younger, normally progressing students. The same linguistic structures will pose challenges for both groups.

Although a few studies (Friend & Olson, 2008; Kibel & Miles, 1994) have found that students with dyslexia demonstrate more problems with phonological representations than spelling-matched, younger students, the most detailed and systematic comparisons of the spelling of older students with dyslexia and younger, spelling-matched controls (Bourassa & Treiman, 2003; Cassar et al., 2005; Moats, 1983; Nelson, 1980) have yielded consistent findings to the contrary. The spelling errors of students with dyslexia do not differ from spelling-matched controls in either phonological or orthographic error types. All of the cited studies took into account the errors typical of younger, novice spellers, such as omission of nasals before final stop consonants (PAITING/painting) and affrication of /t/ and /d before /r/, as in CHRAN/train. Such errors were not categorized as phonologically inaccurate, but rather as reflecting normal judgments of phonetic word features. The spellings of students with dyslexia were influenced by those phonetic realities to the same extent as the controls. In addition, their spellings reflected comparable sensitivity to orthographic print conventions. Letter name spellings, omissions from consonant clusters, spellings of reduced vowel syllables, and memory for doublets, for example, were equally prevalent in both groups. At the morphological level of analysis, Bourassa and Treiman (2008), and Bourassa, Deacon, Bargen, and Delmonte (2011) found also that older students with dyslexia and younger, normally progressing students spelling at a mid-second grade level were indistinguishable. Each group made the same proportion and type of error on roots, inflections, and derived forms.

What if the spelling and writing of students with generally weak language skills, attending low-performing urban schools, are considered with reference to a similar analytic framework? Moats, Foorman and Taylor (2006) conducted such an analysis of third and fourth graders' spelling and grammar errors in written compositions. None of the students in the study were eligible for special education. In order to evaluate the impact of high quality and low quality writing instruction on the written compositions of these students, writing samples were scored in three ways: (1) according to a rating scale within a reliable scoring rubric, (2) according to countable surface features such as words correctly sequenced, and (3) according to the frequency of specific phonological, morphosyntactic, and orthographic errors. Quality of writing instruction did influence length and quality of students' compositions, but overall quality of student writing and writing instruction was low. More relevant to this article, ubiquitous and wide-ranging problems of language formulation, production and representation characterized the sample. Although these students were within the average range on standardized reading tests, neither spelling nor writing were developing at average levels. Error types and error patterns were very similar to those of students with diagnosed dyslexia, especially in the category of morpheme misspellings. Inflectional suffixes were often spelled phonetically, confused with one another, or omitted altogether. Again, those aspects of symbolic representation that challenge novice and/or poor spellers with diagnosed dyslexia are similarly challenging to students with more generalized language delays or deficits.

The struggle of students with dyslexia to improve their spelling accuracy, however, is a diagnostic touchstone. Students with dyslexia learn printed words far more slowly, remember less over time, need far more practice to learn and retain memories for graphemes, make many more errors in their writing, and find the whole enterprise extremely frustrating. Clinicians often observe that students with dyslexia misspell the same word in different ways in the same composition, and that words recently studied are often forgotten. Those qualitative differences of symbolic learning and the ensuing emotional consequences of anxiety and frustration are hallmarks of this disorder – not unique error types.

How to Approach Spelling Assessment

Frameworks and tools for assessing spelling are suggested by Larsen, Hammill, and Moats (2013) and Masterson and Apel (2014). Error analysis should be part of a more comprehensive assessment designed to inform instruction. Several helpful diagnostic activities, in addition to administration of a standardized spelling test yielding standard scores and percentiles, provide a broader context for error analysis.

Examine the student's written compositions. An individual's written spelling accuracy may vary according to situational factors such as choice of writing topic, amount of structure available in the writing task, level of motivation to produce a well-written product, or response mode (keyboarding, handwriting). Poor spellers may know rules, patterns, or generalizations under structured conditions but may not generalize their knowledge to spontaneous writing. Therefore, their spelling in several examples of classroom work should be compared to their spelling in lists. If spelling is not generalized to spontaneous use, additional practice under structured conditions will be necessary, as well as instruction in proofreading and self-correction.

Assess phoneme awareness with oral-verbal tasks. The ability to detect the number, identity, and sequence of speech sounds in words should be measured directly especially in those students who are in the early stages of literacy development. Later spelling development is less closely correlated with performance on phonological awareness measures as it depends more on orthographic memory, knowledge of word meanings, morphological awareness, and awareness of a word's role in a sentence. Nevertheless, the poorest spellers are highly likely to demonstrate poor phoneme awareness on direct measures of phoneme isolation, substitution, segmentation, and deletion.

Assess phonetic spelling ability at K-1. A child's skill at representing the speech sounds in words with letter-name or preconventional spelling strategies is a very good predictor of both spelling and reading achievement in young children. A useful scoring system was devised by Tangel and Blachman (1995) to quantify the developmental maturity of children's early phonetic spellings. These investigators devised a quality point system for determining developmental level of spelling in children in kindergarten and first grade, before they have learned to spell conventionally. The scoring system is reproduced in the manual of the *Test of Written Spelling*, *Fifth Edition* (Larsen, Hammill, & Moats, 2013).

Tangel and Blachman (1995) chose five words to give their kindergartners (*lap, sick, elephant, pretty, train*) and added five more for their first graders (*hunt, street, kissed, order, snowing*). These more advanced words deliberately included a preconsonantal nasal, a three-consonant cluster, an r-controlled vowel, and two inflections. Quality points were assigned according to the progressive improvements children were expected to make as they developed spelling skill. Tangel and Blachman demonstrated the high reliability for their scoring system and its ability to identify which students were at risk for reading and spelling difficulties.

Survey alphabet knowledge and developmental level of spelling achievement. Ask young students to write the lowercase cursive (or manuscript) letters from memory. When letters are "forgotten," determine if the student can write them from dictation or identify them in an array. Determine if the student can copy those letters that are not recalled at all. Record length of time required to write and copy.

Qualitative inventories of spelling development were first developed at the University of Virginia by Henderson (1990) and have been used extensively in research and practice over the past several decades (Bear, Invernizzi, Templeton, & Johnston, 2012). Qualitative inventories are convenient tools for classroom teachers who wish to group children by achievement level for spelling instruction. Qualitative inventories, however, do not usually measure a student's knowledge of high-frequency irregular words, homonyms, contractions, possessives, and plurals, all of which pose difficulty for persons with spelling disabilities.

The *Test of Written Spelling* (5th Edition) (Larsen, Hammill, & Moats, 2013), also includes a copy of Kottmeyer's *Diagnostic Spelling Test.* This informal assessment is a traditional, well-structured survey of specific orthographic elements that can be used to measure small increments in student improvement. Words are dictated and then a sentence read that contains each word, so that the meaning will be clear.

Summary and Implications

Children's spellings can provide important insights into their phonological, orthographic, and morphological competencies. Spelling development in English speakers is mediated, in the beginning stages, by children's growing awareness of the speech sounds in words and their growing awareness of our alphabetic writing system. While there is no consistent evidence that students with dyslexia demonstrate qualitative differences in the types or frequency of phonological, orthographic, or morphological errors, obviously there are great differences in the ease with which dyslexic

students acquire the linguistic competencies that underlie the ability to spell.

All students find that certain aspects of word analysis and word representation are more difficult than others. Simple syllables, without consonant clusters, for example, are easier to spell than words with consonant clusters. Vowels in accented or stressed syllables are more accessible than those in unstressed syllables. Stop consonants are easier to represent in initial position, where they are aspirated. Nasals and liquids, especially when they occur in medial position or after a vowel, are elusive and difficult to place in a phoneme sequence. Inflectional and derivational morphemes have consistent spellings that may be pronounced differently and must be learned by ignoring pronunciation. Consonants and vowels with overlapping features, that are similar in articulation, are difficult to distinguish one from another because of coarticulation. Students with dyslexia, not surprisingly, are far more likely than normally progressing students to experience persistent frustration with these spelling challenges.

These findings, supported by more than 35 years of research, suggest several important ideas that have yet to influence how spelling is taught in most American classrooms. Learning to spell is not a rote visual memory activity. Learning to spell can be facilitated by direct teaching of linguistic awareness, orthographic patterns and correspondences, and knowledge of word meaning and word origin. Error patterns suggest where the therapist or instructor should focus relatively more time and where, in a scope and sequence (see Appendix A), instruction should start. Error patterns can indicate whether the student's lessons should emphasize phonological awareness, phoneme-grapheme correspondences, orthographic patterns in single syllable or multi-syllable words, or morphology. Students with dyslexia will progress more slowly, require more practice and review, and need more compensatory supports (proofreaders, spell checkers, speech to spelling technology) to manage this very challenging aspect of literacy. ♦

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Appendix A

Scope and Sequence for Spelling Instruction: Phoneme-Grapheme Correspondence, Orthographic Patterns, and Morphology

Louisa C. Moats Ed.D.

Grade Level	1	2	3	4	5	6	7-8
Beginning single consonants	b, d, f, g, h, j, c, k, l, m, n, p, qu, r, s, t, v, w, y, z	ce, ci, cy = /s/ ge, gi, gy = /j/					
Ending consonants	b, d, g, l, m, n, p, r, t, x /z/ = s, z /v/ = -ve	ff, ll, ss, zz (Floss rule); -ge, -dge					
Digraphs	sh, th, ch, wh, ng, -ck	-ch, -tch	ph, gh = /f/	ch = /k/			
Beginning blends	consonant + /l/ or /r/; sk, st, sl, sm, sn, sp, sw	shr, thr scr, squ, spl, spr, str					
Ending blends	mp, st, nd, nk, ft, lt, lf	cks/x					
Silent letters		kn, gn, wr, lk	s(t), -bt, -mn	ps, rh			
Short vowels (closed syllables)	a, e, i, o, u			y = /ĭ/			

Grade Level	1	2	3	4	5	6	7-8
Vowel teams including diphthongs	ee, ea, oa, ai, ay	igh, au/aw, oi/oy, ou/ow, oo	eu, ew, ue, ui, eigh, ough, aigh				
Open syllables (single long vowels)	e, o y = /ī/	a, e, i, o, u, y = /ē/					
Vowel-Consonant-e	(introduce concept)	a_e, i_e, o_e, u_e, e_e	ore, are, ure, ire, ere				
Vowel-r	er, ar, or	oar, air, ear; war, wor	er = /ar/;				
Rime Chunks	-ing, ang, ung -ink, ank, unk -all						
Inflections and ending rules	/s/, /z/ = plural s -ing, -en	/t/,/d/, /ed/ = ed er, est (no base change); doubling rule, drop e rule	change y to I rule; doubling rule and drop-e rule, multi-syllable wds.	change y to I rule; doubling rule and drop-e rule, multi-syllable wds.			
Prefixes		un, re, mis	dis, in, ex, con, com, per	bi, tri, uni, circum, inter, super, mal, trans, intra	[various Latin and Greek prefixes]	auto, phono, hemi, mono, hyper, chron	Assimilated prefixes (com/con/col /cor)

Grade Level	1	2	3	4	5	6	7-8
Derivational suffixes	-y, -ish, -able	-less, -ness, -ful, -ly, -ment	-tion, -ive, -age, -ic, -ity, -ible	- ology, -sion, -ary, -or, -al	[various Latin and Greek suffixes]	graph, meter, sphere, scope	
Base words, roots	[compounds]	[contractions] [base words whose forms do not change when endings are added]	[multisyllabic Anglo-Saxon base words]	port, form, tract, script, rupt, spect, struct, ject, dict	flect/flex, ped/pod, mit/miss, tend/tens, ten/tain, pic/ply, fer, aud, vis	cred, duc/duct, pel, puls, fac/fic/fect, vert/vers, capit/capt, cept/cap/ceiv	pend/pens, pos/ pon/pose, sist/sta/stat/

Note: This scope and sequence was developed by the author over many years of surveying the commonalities in developmental spelling programs.

Dyslexia and ADHD: A Review of Frequently Co-Occurring Conditions

Andrew N. Colvin and Cheryl H. Colvin

Abstract

Dyslexia and Attention Deficit Hyperactivity Disorder (ADHD) are common neurodevelopmental disorders that frequently occur together. When dyslexia and ADHD are comorbid, there is a greater risk of an adverse outcome (Boada, Willcutt, & Pennington, 2012; Germano, Gagliano, & Curatolo, 2010). This article provides a brief review of each disorder separately, followed by a review of comorbid dyslexia and ADHD that discusses the theoretical approach to examining comorbidity in both single-deficit and multiple-deficit models. The implications for assessment and intervention are briefly discussed.

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Learning Objectives

1) State the deficits that distinguish between dyslexia and ADHD
2) Describe the theories that explain the relations between dyslexia and ADHD
3) State implications for assessment and intervention

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Clinicians who encounter children with dyslexia or Attention Deficit Hyperactivity Disorder (ADHD) frequently note the co-occurrence or comorbidity of these disorders. As neurodevelopmental disorders, dyslexia and ADHD each provide challenges to academic progress. Because of the deficits in phonological processing that underlie dyslexia, this disorder hampers the acquisition of word-level written language skills, such as word recognition and writing (Fletcher, Lyon, Fuchs, & Barnes, 2007). Children with dyslexia then frequently encounter problems with reading fluency, comprehension, and written expression (Fletcher et al. 2007; Pennington, Peterson, & McGrath, 2009). Children with ADHD are at risk for academic underachievement (DuPaul & Stoner, 2003; Spencer, Biederman, & Mick, 2007), as deficits in attention and executive functions often lead to poor academic performance (DuPaul & Stoner, 2003).

When dyslexia and ADHD are comorbid, this often magnifies the academic and functional difficulties experienced by these children (Boada, Willcutt, & Pennington, 2012; Germano, Gagliano, & Curatolo, 2010). Boada et al. (2012) state that clinicians must take these comorbidities into account when completing an assessment, as failing to do so may interfere with accurate interpretation of test results and lead to incomplete treatment planning. For example, untreated ADHD symptoms in a student with dyslexia may cause poor outcomes for the interventions that typically improve reading (Fletcher, Shaywitz, & Shaywitz, 1999). In addition to offering clinical implications, research into the comorbidities between dyslexia and ADHD has helped guide the development of theories that help to better understand the overlap in symptoms among developmental disorders (Pennington, 2006).

What are Dyslexia and ADHD?

Dyslexia, or word-level reading disability, is the most common form of learning disability (Fletcher et al., 2007) and is estimated to occur in up to 15% of school-age children (Fletcher et al., 1999; Pennington et al., 2006). The prevalence of dyslexia by gender has been found to be relatively equal (about 1.5 boys to 1 girl) in the general population, but the gender distribution in children who have been referred for behavioral health services is much more heavily weighted towards boys

(Willcutt & Pennington, 2000). One possible explanation for this discrepancy is that a greater number of externalizing behaviors, such as defiance or aggression, can lead to clinical referrals (Pennington, 2009). Peterson and Pennington (2012) reviewed research suggesting that while children with dyslexia frequently show deficits in more than one neurocognitive domain , a primary deficit in phonological processing has been repeatedly demonstrated. Rapid automatic naming of overlearned material such as letters and numbers is strongly associated with reading achievement and therefore frequently deficient in dyslexia (Fletcher et al., 2007; Schatschneider & Torgeson, 2005), but it is not clear whether this is another representation of phonological processing. For example, Waber, Wolff, Forbes, and Weiler, (2000) found evidence that poor performance in rapid automatic naming is not unique to dyslexia. Dyslexia also has been associated with deficits in verbal short-term memory, especially when the phonological processing load on memory is increased (Kibby, 2009).

In the *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (American Psychiatric Association, 2013) ADHD is defined by problematic levels of inattention, hyperactivity, or impulsive behaviors. The *DSM-V* (American Psychiatric Association, 2013) recognizes three subtypes of ADHD, the predominately hyperactive-impulsive type, the predominately inattentive type, and the combined type. The hyperactive-impulsive type primarily displays behaviors such as fidgeting, acting as if 'driven by a motor,' talking excessively or blurting out. The inattentive type primarily displays behaviors such as careless mistakes on tasks, not seeming to listen, or disorganization. Children with ADHD-combined type display symptoms from both the hyperactive-impulsive and the inattentive categories. For any of the subtypes, the symptoms must cause a marked level of impairment in functioning during activities of daily life (American Psychiatric Association, 2013). ADHD occurs frequently in children, with estimates of up to 5% of children meeting criteria for diagnosis (American Psychiatric Association, 2013). Children with ADHD are estimated to be 30% to 40% of behavioral health referrals (Barkley, 1990). Boys significantly outnumber girls in both the general population and in clinic-referred samples. The higher proportion of boys in the clinic-referred samples is possibly because of an increased number of comorbid psychosocial problems (DuPaul & Stoner, 2003).

Children with ADHD often display deficits in self-regulation that are hypothesized to underlie more widespread deficits in executive functions, such as working memory and planning (Barkley, 1997). Additionally, children with ADHD, especially those with the primarily inattentive subtype, often display processing speed deficits (Weiler, Bernstein, Bellinger, & Waber, 2000). However, research does not show any single neurocognitive deficit with a large enough effect to completely explain all ADHD symptoms (Boada et al., 2012).

Discovering the Comorbidity between Dyslexia and ADHD

In many of the earliest descriptions of developmental and behavioral disorders, there were few distinctions made between poor attentional control and learning problems (Fletcher et al., 1999). Even as researchers began looking at learning disorders and ADHD as separate clinical entities, a significant and consistent association was identified (Cantwell & Baker, 1991). Early estimates of comorbidities may have been influenced by the varying definitions that researchers have used to define learning disorders over the years (Semrud-Clikeman, Biederman, Sprich-Buckminster, Lehman, Faraone, & Norman, 1992). In addition, children with ADHD frequently display deficits in academic performance in the absence of deficiencies in academic skills (DuPaul & Stoner, 2003). In other words, the classroom performance of many children with ADHD falls below expectations despite relatively intact abilities in foundational skills, such as phonological awareness. As models of learning disorders such as dyslexia have become more refined, with better evidence for deficient foundational skills, it has become easier to separate skill deficits from performance deficits in children with ADHD (DuPaul & Stoner, 2003).

As researchers have begun to use more careful definitions of dyslexia and ADHD, studies have consistently reported that the comorbidity between dyslexia and ADHD falls into a range between 18% and 45% (Germano et al., 2010). This relationship is significantly greater than would be expected from chance associations (Willcutt et al., 2010). Moreover, the strong association between dyslexia and ADHD is unlikely to arise from measurement artifact, as different

methods typically are used for identification (Boada et al., 2012). Dyslexia typically is identified using measurements of academic skills, whereas ADHD is identified, at least for research purposes, using behavioral checklists completed by parents and teachers.

Theoretical mechanisms for the Comorbidity between Dyslexia and ADHD

Phenocopy Hypothesis: Behavioral Problems Caused by Learning Disorders

There have been several theories about the underlying relationship between ADHD and dyslexia (DuPaul & Stoner, 2003). McGee and Share (1988) conceptualized ADHD in children with learning problems as a conduct problem that resulted from an inability to understand academic material. In support of this, these authors suggested that the existing data did not show consistent neurocognitive deficits that distinguished learning disabilities from ADHD. Moreover, they interpreted existing longitudinal data as pointing in the direction of learning deficits causing attention problems in the classroom, with little evidence of ADHD existing in the preschool years. This interpretation is known as the phenocopy hypothesis, which states that a primary disorder is entirely responsible for secondary symptoms (Willcutt et al, 2001).

Distinct Neurocognitive Deficits

The relationship between dyslexia and ADHD is complex, and there do appear to be some overlapping cognitive deficits (that will be discussed below) (Shanahan et al., 2006: Willcutt et al., 2010). Nevertheless, in contrast to the predictions of the phenocopy hypothesis, the overall evidence to date strongly suggests that ADHD and dyslexia are separable disorders, and that the comorbid condition is a combination of the two, rather than a third, entirely separable disorder (Fletcher et al., 1999; Pennington, 2006). Pennington, Groisser, and Welsh (1993), found a different primary deficit for each disorder, with children in a reading disorder only group showing a deficit in phonological processing and children with ADHD showing a deficit in executive functions. Willcutt et al. (2001) provided further evidence against the phenocopy hypothesis. These authors found that children with reading disorder displayed deficits in phonological processing and verbal working memory, whereas children with ADHD displayed executive deficits. Furthermore, these authors found that a comorbid group demonstrated the greatest deficits on measures of both phonological awareness and executive functions, suggesting that meeting criteria for both disorders placed this group at greater risks for functional deficits. Willcutt et al. (2010) found that children with dyslexia displayed deficits in verbal reasoning, naming speed, and working memory, with deficient phonological awareness as the strongest influence. Compared to children with dyslexia, analyses indicated that children with ADHD had a unique deficit in response inhibition.

Shared Genetic Influences

While dyslexia and ADHD have shown distinct sets of neurocognitive deficits, ongoing investigations have shown linkages between the two disorders that help explain why there is a greater than chance level of co-occurrence. Both dyslexia and ADHD are strongly heritable (Germano et al., 2010; Gillis, Gilger, Pennington, & De Fries, 1992), and studies in monozygotic twins have shown evidence of a genetic overlap between the disorders (Light, Pennington, Gilger, & DeFries, 1995; Willcutt, Pennington, Olson, & DeFries, 2007). Willcutt, et al. (2010) noted that the hypothesis of shared genetic influences between dyslexia and ADHD was supported by findings of a significant relationship between the estimated common genetic contributions and shared deficits on measures of both rapid automatic naming and generalized information-processing speed.

Investigations into Shared Neurocognitive Deficits

Because twin studies indicated that ADHD and dyslexia shared genetic influences, but neuropsychological measures suggested deficits that clearly dissociated the two disorders, research into common neurocognitive vulnerabilities has begun (Shanahan et al., 2006; Willcutt et al., 2010). Kibby and Cohen (2007) found that both children with dyslexia and children with ADHD have problems with short-term memory, although these authors also found a difference in the deficit type. That is, children with dyslexia showed a greater problem with verbal short-term and working memories, whereas children with ADHD showed a weakness in visual memory. For children with ADHD, problems with verbal and visual working memory have been shown to be associated with slowed processing speed, and with reduced reading fluency (Jacobson et al., 2011). Dyslexia and ADHD also are both associated with deficits in rapid automatic naming (Pennington, 2009),

although this association has not been found in all studies (Semrud-Clikeman, Guy, Griffin, & Hynd, 2000).

Outside of the rapid naming paradigm, Weiler, Bernstein, Bellinger, & Waber (2002) found that the inattentive subtype of ADHD and dyslexia were both associated with a deficit in speed of information processing. These authors found that both groups performed worse than controls on visual and auditory processing speed tasks, with relatively worse performance by the ADHD group on the visual task and by the dyslexia group on the auditory task.

Using a twin study, Shananhan et al. (2006) found that deficient processing speed on both linguistic and non-linguistic tasks was a shared risk factor in both dyslexia and ADHD. The authors described processing speed as a shared deficit, rather than an additive deficit, because the processing speed deficit was less in a comorbid group than it would have been if the deficits from the dyslexia-only and ADHD-only groups were added together. As a shared deficit, slowed processing speed might then contribute to the development of both ADHD and dyslexia (Shanahan, 2006).

Multiple-Deficit Models

Pennington (2006) began developing models of neurodevelopmental disorders that moved beyond single-cause conceptualizations (e.g. phonological awareness alone contributing to dyslexia). The development of multiple-deficit models has been needed because single-deficit models do not adequately explain dyslexia and ADHD either alone or in the comorbid condition (Peterson & Pennington, 2012), as there are strong indications that there are heritable, shared deficits in neurodevelopmental disorders (Willcutt et al., 2010). The development of a multiple-deficit model takes into account the interaction of shared genetic risk factors that interact with neurodevelopment to produce distinct or comorbid disorders (Willcutt et al., 2010).

As multiple-deficit models develop more fully, there should be better explanations of the causes of neurodevelopmental disorders (Pennington, 2006). For example, use of the multiple-deficit model should help to guide investigations into the genetic and neurobiological interactions that underpin these disorders (Germano et al., 2010). Identification of additional shared risk factors will help researchers and clinicians identify how risk factors interact. Currently, a relationship between working memory and processing speed has been identified, but the exact nature of this relationship is unclear (Boada et al., 2012). Additionally, more information is needed as to the causal direction of the risk factors (Shanahan et al., 2006). Finally, more information is needed about how each risk factor contributes to the development of dyslexia or ADHD (Boada et al., 2012).

Table 1. Shared and Non-Shared Neurocognitive Deficits

Dyslexia: Unique Deficits	ADHD: Unique Deficits	Dyslexia + ADHD: Shared Deficits
Phonological Awareness Verbal Reasoning Verbal Working Memory	Self-Regulation/Response Control Executive Functions: Planning Problem-Solving Flexibility Visual Working memory	Rapid Automatic Naming General Information-Processing Speed

Implications for Assessment and Treatment

Identification of the comorbid dyslexia and ADHD condition requires a diagnostic assessment of the core deficiencies of both disorders (DuPaul & Stoner, 2003), as well as consideration of shared risk factors, such as processing speed. Any assessment has implications for treatment approaches. Effective treatment for dyslexia relies on well-established treatment approaches that use explicit methods for systematic phonics instruction (Fletcher et al., 2007; Peterson & Pennington, 2012). This instruction usually is best delivered in individualized or small-group settings (Peterson & Pennington, 2012). For ADHD, effective, research-based treatment includes medication options and behavioral therapy (Barkley, 2006; Germano et al., 2010). Untreated attention problems in a child with comorbid dyslexia and ADHD frequently interfere with any improvement in the child's reading, prolonging the time needed for intensive interventions (Fletcher et al., 1999). This becomes especially important when considering long-term outcomes, especially as effective early interventions often produce better results (Fletcher et al., 1999). If the comorbid condition is identified, there is evidence that medication treatment improves not only the symptoms of ADHD, but also reading skills (Keulers et al., 2007; Shaywitz, Williams, Fox, & Wietacha, 2014). Shaywitz, et al. (2014) noted

that better scores on reading measures were not fully explained by decreases in ADHD symptoms. Similarly, Keulers, et al. (2007) suggested that the medication had an indirect effect on improved reading scores, as only children with the combined conditions showed better reading skills. Thus, these authors proposed that the medications likely increased receptivity to interventions such as specialized tutoring. With this in mind, a thorough assessment of the core deficiencies for dyslexia and ADHD will provide parents, physicians, and other treating professionals with a broader perspective as they consider possible treatment options. ♦

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Dyslexia and Language-based Learning Disabilities: Implications for Speech-Language Services for School-Age Students

Monica Gordon-Pershey

Abstract

This article explains the relationships between dyslexia and language-based reading difficulties, with a primary focus on the reading deficits encountered by learners who have disturbances in both the oral and written language modalities. These students struggle to gain the vocabulary, background knowledge, and reading experiences needed to support reading comprehension and, in turn, the further learning that is acquired by reading regularly and widely. Next, this article outlines the beneficial elements of speech-language and literacy services for children and adolescents with language-based learning disabilities. Finally, concluding case reports describe learners' underlying linguistic concerns in detail and offer examples of interventions that can foster school success.

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Learning Objectives

1) State the secondary characteristics of dyslexia as described by the International Dyslexia Association
2) Explain how language deficits contribute to the origins of the secondary consequences of dyslexia
3) Describe strategies for improving language skills in children who have secondary consequences of dyslexia

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The International Dyslexia Association (IDA, 2013) defines dyslexia by using the following terminology:

> *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 the growth of vocabulary and background knowledge.* (p. 3)

IDA subsumes dyslexia under the overarching term *specific learning disability*. The Individuals with Disabilities Education Act (IDEA, 2004) defines specific learning disability as "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. … Such term includes such conditions as … dyslexia." Both IDA and IDEA are in accord that dyslexia is a form of specific learning disability.

Beyond that fundamental agreement, there is a variety of discrepant and sometimes confusing information about the relationship of dyslexia to deficits in the language systems of phonology, morphology, semantics, syntax, and pragmatics. Service providers may employ varying usage of the terms *specific learning disability, dyslexia, language-based learning disability, reading disability,* and *language disorder*. Members of an educational team, including parents, may not share a full understanding of what these labels mean or how the labels are being used to describe an individual learner.

The American Speech-Language-Hearing Association (ASHA, n.d.) reports that "80% of students identified as having a learning disability have a language disorder." Language abilities and skills contribute to the ability to learn and perform academic tasks; deficits in language can hamper these aims (Abbott, Berninger, & Fayol, 2010; Berninger & Abbott, 2010; Siegel, 2006). A summary prepared by ASHA (n.d.) contextualizes dyslexia as one manifestation of a language-based learning disability and, therefore, as a specific learning disability in using language in written form. The ASHA summary states that a child with dyslexia has trouble almost exclusively with the written (or printed) word. A child who has dyslexia as part of a larger language learning disability has trouble with both the spoken and the written word. These problems may include difficulty with the following:

- Expressing ideas clearly, as if the words needed are on the tip of the tongue but won't come out. What the child says can be vague and difficult to understand (e.g., using unspecific vocabulary, such as "thing" or "stuff" to replace words that cannot be remembered). Filler words like "um" may be used to take up time while the child tries to remember a word.
- Learning new vocabulary that the child hears (e.g., taught in lectures/lessons) and/or sees (e.g., in books)
- Understanding questions and following directions that are heard and/or read
- Recalling numbers in sequence (e.g., telephone numbers and addresses)
- Understanding and retaining the details of a story's plot or a classroom lecture
- Reading and comprehending material
- Learning words to songs and rhymes
- Telling left from right, making it hard to read and write since both skills require this directionality
- Letters and numbers
- Learning the alphabet
- Identifying the sounds that correspond to letters, making learning to read difficult
- Mixing up the order of letters in words while writing
- Mixing up the order of numbers that are a part of math calculations
- Spelling
- Memorizing the times tables
- Telling time

ASHA's list implicates problems with a learner's use of words, sentences, and general linguistic meaning. Disturbances of morphology, semantics, syntax, and pragmatics may co-occur with the problems with phonology and reading that have been diagnosed as dyslexia.

Gauger and Lombardino (2015) summarize current research that further defines the characteristics of dyslexia. Their report differentiates the critical features between two main types of reading disabilities: mixed spoken/written language-learning disabilities and dyslexia.

In dyslexia and language-based reading difficulties, poor decoding can lead to poor comprehension. Quite simply, reading comprehension difficulties in children with dyslexia can occur as a consequence of inaccurate decoding. A text that is not read accurately may not be readily comprehended. Relatedly, a second consequence, i.e., having a lack of reading experience, can impede the growth of vocabulary (an aspect of the semantic domain of language) and growth of general knowledge. Any vocabulary deficiency would be the consequence of a lack of exposure to words and their meanings, not a lack of language ability. This would hold true as well for why persons with dyslexia would lack "background knowledge." Reading builds a storehouse of general knowledge, usually referred to as prior knowledge (Anderson & Pearson, 1984) that makes subsequent reading more comprehensible. The lesser amount of prior knowledge that poor decoders (who are potentially also poor comprehenders) have limits the background and familiarity that they can bring when they approach decoding and comprehending unfamiliar text. The problem is compounded into a vicious cycle: readers with dyslexia do not have proficient decoding ability, which prevents them from gaining the varied vocabulary and background knowledge that experiences with wide and frequent reading can bring, so each act of reading can seem new and challenging. Readers with dyslexia may continue to perceive themselves as inexperienced and challenged, despite their best efforts to gain experience and skills.

The main purpose of this article is to discuss the broader diagnosis of language-based learning disabilities in detail, in order to provide insight into the reading difficulties encountered by learners who have deficits in any of the language systems in both the oral

and written language modalities. Next, this article outlines some elements of speech-language and literacy services that are beneficial for children and adolescents with language-based learning disabilities. Lastly, this article concludes with case reports of children and adolescents with language-based learning disabilities. These student examples provide information on how speech-language pathologists and other interventionists can describe the learners' underlying linguistic problems and intervene to foster school success.

Reading Difficulties in Learners with Language-based Learning Disabilities

Students with language-based learning disabilities and the reading difficulties associated with them may have deficits in any of the language systems in both the oral and written language modalities. Morphology, semantics, syntax, and/or pragmatics are inherently affected in learners who manifest language-based learning disabilities. For these learners, their literacy deficits are part of a complex interplay of weaknesses across the language systems in the oral and written language modalities. Weaknesses of the language systems are the antecedents to learners having reduced reading comprehension and lesser participation in reading experiences. Their lack of phonological access may be similar to learners with dyslexia, but, beyond that, these learners may struggle to comprehend words, sentences, and the pragmatic purposes or intents of texts. Improving phonological access is important to aid decoding, phonic skills, reading fluency, spelling, and writing, but does little to address the needs in morphology, semantics, syntax, and pragmatics that prevent full reading participation, access to text, and comprehension of text.

Of particular interest is how learners with language-based learning disabilities approach reading for meaning. School-age children and adolescents who have difficulties with understanding the meaning of what they have read often have antecedent deficits in the aspects of language and learning that influence how they comprehend text (Culatta, Horn, & Merritt, 1998; Cunningham, 2006). Oral language capabilities, especially sufficient vocabulary knowledge, coupled with learning experiences that build background knowledge and with familiarity with a variety of texts, all work together to influence successful reading comprehension.

The Interplay of Vocabulary, Background Knowledge, and Reading Experiences

The authors of a recent IDA (2013) manuscript underscore the long-held belief that continual and cumulative reading experiences build vocabulary and background knowledge (Cunningham & Stanovich, 1998; Jimson, 1982; Nagy, 1988; Sedita, 2005; Shanahan, 2006; West & Stanovich, 1991). School age children and adolescents with language-based learning disabilities may not experience sufficient opportunities for engagement with text and may not have the metacognitive strategies needed to derive meaning from text. Not only may individuals with language-based learning disabilities read a lesser quantity of texts; the quality of the texts they read may be simpler in linguistic style, have less rich vocabulary, and present more simplistic ideas. The simpler quality of texts is perhaps related to the need to read texts that are more readily decodable and at a readability level commensurate with their decoding skills. Controlled and decodable texts use basic sentence structures, shorter words and briefer passages (Lesesne, 2003). School age children and adolescents with language-based learning disabilities may not have had the opportunities to encounter a diversity of reading materials that foster engagement and understanding.

Throughout the latter half of the twentieth century and into the current century, reading theorists and researchers have explored how text engagement and understanding occur and are facilitated. Schema theory (Anderson & Pearson, 1984) suggests that in order to be motivated to read and to read with adequate comprehension, readers should have some prior knowledge of the topic of the text they will be reading (Pressley, Wood, Woloshyn, Martin, King, & Menke, 1992). Achieving adequate reading comprehension is dependent upon how well readers create mental representations of the ideas mentioned in the text (Horowitz & Samuels, 1985) and whether readers relate text ideas to their prior knowledge (Chan, Burtis, Scardamalia, & Bereiter, 1992; Culatta, Horn, & Merritt, 1998; Pardo, 2004). Readers must anticipate that what they are about to read will make sense, and they must be able to monitor themselves while they are reading to recheck that the text continues to make sense (Almasi & Fullerton, 2012; Cunningham, 2006; Hidi, 1990; Massey, 2003). Ostensibly, then, with the experience of reading, children's background knowledge and vocabulary will grow. For many children and adolescents with

language-based learning disabilities, enhanced opportunities to read or to hear text read aloud will be sufficient. For others, there are underlying language problems, working memory deficits, and executive functioning issues that reading experiences alone cannot remedy.

Language, thinking, reasoning, and memory capabilities influence successful reading. As schema theory (Anderson & Pearson, 1984) suggests, readers begin the act of reading with some degree of relevant background knowledge and vocabulary that they bring with them when they approach a text. Background knowledge and vocabulary allow readers to build an understanding of the content and concepts described in a text. Importantly, then, children and adolescents with language-based learning disabilities may have to confront complex deficits even before the act of reading begins. For example, some students may have difficulty initially acquiring the background knowledge to bring to the reading experience. Others have limited vocabulary development; thus, they bring a lesser knowledge of words to the act of reading. When underlying background knowledge and vocabulary are lacking, a vicious cycle may develop. In the beginning, reduced background knowledge and vocabulary inhibit access to text meaning and often result in low motivation to read. This, in turn, may lead to fewer reading experiences, resulting in even fewer gains in knowledge and vocabulary. Ultimately, this chain of events leads to an ever-growing knowledge deficit that causes significant struggles for the growing reader.

It is important to identify the entry point to breaking this cycle. It would appear that initial deficiencies in background knowledge and vocabulary development are the actual precursors to poor experiences with reading comprehension. Background knowledge and vocabulary allow readers to have an understanding of the content and concepts described in a text. Readers apply the information and the vocabulary words that they have acquired during their life experiences in order to comprehend text (Hirsch, 2003; Stahl, 2003). Without adequate initial background knowledge and vocabulary, text comprehension may be reduced (Mele-McCarthy, 2006). Children may learn to read, but text will not be as meaningful if it is not connected to children's prior knowledge and oral vocabularies (Duffy, 2003; Parker, Hasbrouck, & Denton, 2002; Sternberg, 1987).

The Linguistic Mediation of Background Knowledge

Background knowledge is gained through everyday experiences and academic learning (Hirsch, 2003; Stahl, 2003). Much of this information is presented through language. Even when learning involves visual stimuli, motor and tactile experiences, and non-language auditory stimuli, language accompanies these inputs. Learners pair experiences with words; then they think about their experiences as linguistic concepts; and finally they store this linguistically mediated experience in memory (Adams & Gathercole, 2000; Cain, Oakhill, & Lemmon, 2004). Therefore, background knowledge is acquired by using language-mediated cognitive skills (Hirsch, 2003; Stahl, 2003). Much of the time, this learning cycle is instantaneous, unconscious, and covert. Other times, the act of remembering requires self-talk. In other words, it is necessary to rehearse information verbally in order to store it in memory. Simply put, this means that learners use language to talk to themselves about what they are learning. Once new information is stored, it can be retrieved through conscious, directed recall of the stored verbal information (Adams & Gathercole, 2000; Duffy, Roehler, & Herrmann, 1988; Duffy et al., 1987; Stahl, 2003).

Language-based learning disabilities can impair language-mediated cognitive skills (Stackhouse, 2001). In some cases, this occurs because the language systems themselves are impaired, especially the semantic system that allows for growth in vocabulary (Gillon, Moran, & Page, 2007). However, language-based learning disabilities may affect other aspects of language in addition to vocabulary or independent of vocabulary. Children and adolescents with language-based learning disabilities may struggle with one or any combination of the domains of language – semantics, morphology, syntax, and/or pragmatics (Bishop & Snowling, 2004; Culatta, Horn, & Merritt, 1998; Scott, 2009). In cases where language development itself is an area of weakness, improvement of language skills may lead to improvements in learning. Better language – such as stronger vocabulary or more elaborate syntax – could support better learning (Catts, Adolf, & Weismer, 2006; Gillon, Moran, & Page, 2007; Scott, 2009). In other cases, *language itself is not impaired, but language is not being used to successfully mediate cognition and learning* (Bishop & Snowling, 2004; Pressley, Jimson, Symons, McGoldrick, & Kurita, 1989; Silliman & Berninger, 2011; Stackhouse, 2001; Swanson, 1986; Walker, & Poteet, 1989). In the latter case,

children and adolescents will likely need help developing the process of using language to learn concepts and information. Both cases are manifestations of language-based learning disabilities (Catts, Bridges, Little, & Tomblin, 2008; Gillon, Moran, & Page, 2007; Scarborough, 1990; Silliman & Berninger, 2011).

Readers with language-based learning disabilities face multiple challenges that may coexist in a myriad of combinations and may have a marked impact on academic success (Yale Center for Dyslexia & Creativity, 2015). Members of a school or district educational team who must identify, diagnose, and provide appropriate educational interventions to students with disabilities, may be puzzled by the complexity and intricacy of the problems that appear in students with language-based learning disabilities. Teachers and parents may well understand that students with language-based learning disabilities often need several years of instruction to acquire overtly fluent reading and writing skills. These students' oral reading may be slow and hesitant; they may guess at unfamiliar words rather than apply decoding strategies; and their spelling and handwriting may be below grade level expectations (Shaywitz, 2003; Yale Center for Dyslexia & Creativity, 2015). These issues are common to students with language-based learning disabilities as well as those with dyslexia. However, teachers and parents may be baffled by how the demands for linguistic mediation of learning experiences exceed children's capacities (Bishop & Snowling, 2004; Nelson, 2013; Scarborough, 1990; Silliman & Berninger, 2011). It is difficult to know how learners pair experiences with words, how they process their experiences as linguistic concepts, and how they store this linguistically mediated experience in memory. The uniqueness of each child's diagnostic profile can be perplexing. The linguistic difficulties that affect the competent use of the domains of language or that cause children to struggle to use language to learn concepts and information reveal themselves in behaviors that in and of themselves seem bewildering. Adults might ask questions to try to find the reasons behind the child's language behaviors: Why does this child search for words? Why does this child seem to forget the names of things, and says "stuff' or 'thing" instead? Why does this child pause or say "ummm" often when speaking? Why does this child mispronounce words, or confuse words that sound similar? Why does this child take so long to answer questions? Why does this child forget directions and forget what to do? Why can't this child keep materials neatly order? Why can't this child learn names and dates in history class? Why are math story problems so challenging? Why is foreign language class so difficult (Shaywitz, 2003; Yale Center for Dyslexia & Creativity, 2015)?

Often the SLP is the member of the educational team who others turn to for answers to these questions. The SLP is charged with sorting through this cluster of issues, determining their origins, and devising how to remediate them. Students with dyslexia demonstrate a specific learning disability wherein the language system of phonology affects the language modalities of reading and/or written language. Language-based learning disabilities differ from dyslexia in the sense that any or all of the language systems of phonology, morphology, semantics, syntax, and pragmatics may be affected (as described by Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Bishop & Snowling, 2004; Catts & Kahmi, 2005). In many cases, the team can arrive at a diagnosis of a language-based learning disability when the SLP has identified difficulties in semantics, morphology, syntax, and/or pragmatics. Other times, the SLP may determine that a child's language itself is not impaired, but the child not using language effectively to successfully mediate the cognitive skills that aid learning. Better use of language would be needed to facilitate reading comprehension and alleviate the secondary characteristics of dyslexia. For example, better use of language to mediate and rehearse learning would improve memory skills for storing information or would bring about the reasoning skills that allow for better thinking and learning. Better use of language-mediated reasoning would allow the student to organize concepts and aid in academic problem solving. With better thinking skills, new knowledge and vocabulary would be acquired (Collins, 1991).

Diagnostic Considerations

Deficits across the domains of language, coupled with difficulties using language to mediate learning, characterize language-based learning disabilities.

Language-related deficiencies may appear as clusters of weaknesses in the following areas:

- phonological awareness
- morphology and morphological awareness
- vocabulary

- word retrieval
- syntax
- using language to guide attention, focus, and self-regulation
- auditory comprehension
- language processing
- verbal reasoning
- working memory
- self-organization skills

These difficulties may inhibit children's and adolescents' ability to develop the language skills necessary to become skilled readers. Any of these diagnostic considerations can serve to alert parents and practitioners to the need for comprehensive assessment and interventions by an educational team, in order to attempt to prevent or lessen the consequences of dyslexia and language-based learning disabilities.

SLPs may observe these deficits in learners with dyslexia. The problems may be at the root of dyslexia, or they may arise as the consequences of difficulty with engaging with print and reading readily.

Case Examples

The intricacy, complexity, and individual variability that characterize language-based learning disabilities are the focus of the remainder of this article. The following reports of cases are based on children and adolescents with language-based learning disabilities, one of whom was diagnosed with dyslexia, and two who had not yet been diagnosed with dyslexia but whose oral and written language needs were paramount. The cases illustrate that although students may not be labeled as having dyslexia, their clinical presentation may include the characteristics mentioned in the descriptions of dyslexia and language-based learning disabilities given in this article. These cases provide some information on how to describe underlying linguistic problems, diagnose their presence, and intervene to foster school success (Josephson & Gordon Pershey, 2007).

Case 1: Jim

Jim's case is being related from the vantage point of the end of his third grade school year, when he was diagnosed with dyslexia. Looking back on Jim's involvement with intervention services since first grade, it is apparent that his underlying, fairly subtle language deficits contributed to the origin of his difficulties with accurate and fluent word recognition and decoding, spelling, and written expression. Jim's dyslexia was complicated by his having low motivation to read, being overwhelmed by the content of the passages that he read, and struggling to keep up with the amount of growth in knowledge and vocabulary that was expected in academic subjects.

In first grade, Jim demonstrated a few speech-language difficulties. Although his conversational speech and language appeared average, he scored poorly on phoneme discrimination testing. Sometimes his speech was not fully intelligible, especially when he tried to incorporate new words, including new proper names. Jim used many nicknames for people that he knew. He had a few developmental articulation errors, such as f/th (voiceless) and errors in production of phonemes in multisyllable words ("magnifying glass" was spoken as "manifying glass"). Other children in his family had speech production that was less intelligible than Jim's, which caused his parents to forego any speech-language testing,

Visual motor planning was difficult for Jim, too. Consistent with deficits common to dyslexia, his handwriting developed very slowly. He demonstrated motor planning difficulties for some fine motor tasks, but overall he was an appropriately active child with good play skills. His parents may not have recognized that these early shortcomings, taken together, could lead to problems in the development of Jim's vocabulary and background knowledge, and would later have an impact on his reading achievement.

The first grade reading curriculum required Jim to develop sound-symbol relationships. He was inconsistent in developing this skill, being better at going from symbol to sound than from sound to symbol. Accurate performance of the latter skill depended upon whether he discriminated a sound correctly. He had difficulty spelling real words and nonsense words, and did not decode nonsense words well. It seemed that Jim was using his knowledge of the meaning of words to help him master decoding and encoding, and when he could not rely on meaning, he did not have full use of the sound-symbol system. These weaknesses in Jim's phonological awareness skills, development of sound-symbol relationships, and word-attack strategies led to his diagnosis of dyslexia.

Phonetic spelling was compromised by his misarticulations; for example, he spelled "with" as "wif." He did not discriminate well enough to understand accurate vs. inaccurate paired comparisons presented by adults, so there remained few strategies to help him correct errors and his spelling progress was slow. Words loaded with similar sounds, like "twists," were particularly hard for him to spell. He also struggled to develop a bank of non-phonetic sight words. Jim's phonological memory and orthographic memory were weak, further supporting the diagnosis of dyslexia.

As Jim progressed through first and second grade and began working with interventionists, it became apparent that word meaning was not a reliable fallback for him, either. His omitted word suffixes and function words in both his reading and his writing, and he persisted in mispronunciation of multisyllabic words. His oral vocabulary was not consistently supporting growth of his reading vocabulary. He developed an impulsive work style of reading many words per minute. He made frequent errors that he did not stop to self-correct. Multisensory, structured literacy interventions for phonology and morphology (IDA, 2013) focused on developing syllabication skills to help him notice all phonemes and morphemes in words, to read words slowly and deliberately, and to pronounce multisyllabic words. His interventionists linked his word meaning skills to improving his decoding and encoding by having him blend and segment words of up to six sounds and then discuss their meanings. His error patterns during these tasks were occasional sound omissions or substitutions.

In third grade, Jim was able to state the rules of syllabication, identify five syllable types, and identify and tell the meaning of basic suffixes and prefixes. He had a functional bank of sight words. Even so, he had difficulty integrating skills. His focus on decoding compromised his comprehension, and his retelling test scores were at about 77% accuracy. He tended to omit proper names used in texts when retelling. His teachers and interventionist had the impression that he was not gaining a lot from reading. That is, he was approaching reading as a decoding task rather like solving a puzzle, not as an opportunity to learn from text. Text remained a rather foreign medium of communication for him. Oral syntax errors became evident when he was discussing texts. For example, he produced the following sentence: "They went to the bank for they could get money tooken out." Written language showed syntax errors like, "he is all the time lately" instead of "he is late all of the time." It became apparent that Jim was not making the language of text his own, which revealed that he was not carefully using language to mediate his own learning and to process new information. Adult modeling helped him become a bit better able to transform the language of text into his own words, within the constraints of his phonological and morphological memory. Writing about his personal experiences was effective for helping him to see his own spoken language as text. This provided him with text that was accessible and interesting. He enjoyed co-creating text with his peers and interventionists.

To help Jim gain more meaning from text, his teachers and interventionists focused on the meaning of words found in texts. They introduced derived words with more than one suffix, such as "carelessly" and "destructiveness." Jim sometimes misused new words in sentences, as in the following example: "He destructiveness knocked the building over." Word study for homophones, multiple meaning words, and idioms was also a focus of his interventions.

Jim appeared to be linguistically overwhelmed by the content of the passages that he read. He was challenged to keep pace with the concept development and vocabulary learning that were expected in academic subjects. He did not self-select books or enjoy discussing books. Jim appeared to be a child with dyslexia who also had a language-based learning disability in the morphological, syntactic, and semantics components of language, despite his adequate cognitive abilities and the provision of instruction. He had a primary difficulty with fluent reading. This further reduced his reading experiences and likely had a negative impact on his later reading comprehension skills. He was reading the minimal amount that he could to get his assignments done. Potentially, in time, his low engagement with text could impede his development of the amount of vocabulary and background knowledge that his more engaged peers would acquire. In sum, these results are often referred to as the secondary consequences of dyslexia.

It might be possible to engage Jim by introducing him to texts that are easily accessible and that feature topics of interest to him. For example, Lesesne (2003) describes strategies for "matching" readers to texts. Texts with

engaging topics and formats that are suitable for children's age levels may coincide with the prior knowledge that readers bring to the texts. Texts should provide readers with enough complexity to be interesting but not so much complexity that the text is inaccessible. The text should not be so complex that readers cannot self-monitor whether they are achieving comprehension (Massey, 2003).

Case 2: Doug

Doug was referred to the special education team at his school because he was experiencing academic difficulties toward the end of his first grade year. The psychologist on his educational testing team identified Doug's basic problem as "over-focusing." Doug was slow to follow directions, was limited in his attention span, did not organize himself well during transitions, was reported to "lose track of time," and had mild anxiety about school. Neurological testing was conducted to affirm or rule out attention deficit disorder. Doug was diagnosed with an attention deficit disorder characterized primarily by inattention as well as a mild affective disorder.

Doug's teachers noted that he often seemed to be guessing when participating in class, and his intonation was that of a question, not a statement. Adults characterized him as "unsure" but "willing" and "a little scattered but bright enough."

Language testing included exploring Doug's phonological, morphological, and syntactic skills, but also important were the results of the SLP's observations of Doug's functional language performance in school and daily living. Doug had not fully memorized word sequences that are typically mastered by grade 1, including the days of the week, the months of the year, and the seasons of the year. He struggled to memorize his address and phone number. He erred when discussing conceptual groupings, such as confusing one holiday with another. An SLP tested Doug using the *Comprehensive Receptive and Expressive Vocabulary Test-2* (CREVT-2, Wallace & Hammill, 2002). Receptive vocabulary testing placed him in the 37th percentile, and expressive vocabulary was in the 19th percentile. Doug's language testing errors were of the type that do not allow for a correct score but which show some level of knowledge. When defining "oven," he said, "it's hot." When defining "lemon," he said, "put it in drinks." When naming the parts of a car, he said, "motor, door, air thing, driver's plate." Finally, when prompted to provide an analogy for "baseball is a sport; cake is a _____," he replied, "eat."

Doug's handwriting was immature, with letterforms being somewhat legible approximations of targets, and his writing speed was slow. On the other hand, he was developing phonological awareness and phonics skills, as evidenced by his classroom performance on phonological awareness and phonics tasks and exercises. Interestingly, however, Doug was not applying these sound-symbol skills to decoding and spelling. He had not developed good recognition of sight words, and was not reading grade level text fluently. The school team believed that it would have been premature to label his developmental learning behaviors and his need to become familiar with the print-based skills as dyslexia.

Doug's attention deficit disorder may have contributed to his having lesser vocabulary and background knowledge to bring to the act of reading. He needed to develop his attentional and motor skills along with his language skills. In second grade, when Doug's special education services began, the instructional format that was adopted for his lessons focused on moving from a structured response situation to a spontaneous response situation. This paradigm was used to minimize his guessing and insecurity. First, Doug's teachers gave him a structured response opportunity, For instance, they might use a vocabulary web to teach a word, its definition, its synonym, its antonym, its part of speech, and to give examples of the word in context. After completing the web, he would be asked to use the word spontaneously in his oral and written output in class. Doug was held accountable for his structured learning experiences during interventions, but he was not judged on his incidental or unstructured use of vocabulary in class. He was monitored for carry over but not evaluated. Doug's teachers taught vocabulary explicitly in every academic subject, tried to anticipate his questions and needs, and never assumed that he knew a word or a concept that he did not demonstrate. Repetition and review of words and concepts were used, including asking Doug to repeat words and sentences verbatim to solidify learning. His teachers were careful to make repetition and review meaningful and not to rely on rote copying, which would not challenge Doug to truly learn word meanings. In time, Doug was held accountable for deriving vocabulary and

knowledge from his reading, but first he had to work very hard to learn vocabulary and background knowledge through the variety of strategies that his teachers and interventionists provided.

Case 3: Kasey

The language basis for Kasey's literacy struggles did not become apparent until she was in sixth grade. Until that time, her teachers had regarded her as a plodding but average reader and writer. Her progress in grade six had plateaued. Kasey's reading scores on curriculum-based achievement measures presented in class revealed that her comprehension was at the 5th grade level. Her teachers and parents referred her for an educational assessment. Kasey told her examiner that she was not interested in reading. Furthermore, the examiner found it difficult to engage Kasey in a discussion about the imagery evoked by the passages they read.

Kasey performed about six months below age expectations on the *Test of Language Development-Intermediate, 2nd edition* (TOLD-I:2, Hammill & Newcomer, 1997), with vocabulary being her weakest skill. She showed word retrieval deficits when using more advanced or unfamiliar vocabulary. Her written work, as evidenced by the *Test of Written Language* (TOWL-3, Hammill & Larsen, 1996) showed a similar stagnation, with scores at grade 4, 4 months. Her writing was wordy, repetitive, and low in content. She used many basic verbs, like "getting," "being," and "having," instead of more descriptive verbs. Her writing was more like "talk written down" rather than written composition. She appeared to have few written language models internalized for use when writing. Assessment for dysgraphia was inconclusive, and this label was "put on hold" pending whether the educational team could acquire additional evidence to support this diagnosis.

Kasey wrote this paragraph to describe the book her class was reading, *The Giver* (Lowry, 1993):

> *In chapter 6 there is a ceremony and everyone turns a year older at the same time. When they turn a year older they get a gift. Lily is turning 9 and is getting a bicycle. Jonas is turning 12 and is getting to get a job.*

This is a correct response, but it is basic. Kasey would need to develop better elaboration skills in order to earn higher grades.

Kasey's lesser degree of language achievement and background knowledge were likely leading to low reading engagement. The problem appeared to be that if she did not read readily, then she would have fewer opportunities to use reading to develop more advanced vocabulary and additional background knowledge. Interventions for Kasey involved many approaches. Kasey learned to use language to help her rehearse her learning and to convey her ideas in writing. Similar to the approach taken when working with Doug, Kasey practiced giving a structured response before she was asked to produce a spontaneous response. She was asked to answer direct, convergent questions to show her knowledge of word meanings and academic concepts and to demonstrate academic procedures, such as how to use a table of contents. Her educators were careful never to assume that she knew something that they did not ask her directly. She met with her interventionist to review her class notes, worksheets, and assignments, and her interventionist helped her learn the words and concepts that she may have not understood. Her teachers assisted her in writing out any questions that she had for them regarding the class lessons or about texts she was reading. Kasey was also given help transforming class content into flashcards and memorization games. Regularly, her interventionists asked her to draft a response to a reading passage, similar to her response to *The Giver*, and then rewrite it two or three more times, using different wording or different sentence forms. Kasey was given sentence form templates to use – simple sentences, complex sentences, and compound sentences. She was also given starter lists of descriptive words, and added new words as she learned them. She was asked to edit her own work and strike out unneeded or repetitive words, and then was invited to show her drafts to friends for their comments. On some occasions in class, Kasey was tested orally instead of through writing, or was allowed to have simplified test formats. The purpose of these accommodations was to directly test her knowledge gained from reading, rather than confound her with too many language demands. Kasey was not formally diagnosed with dyslexia or dysgraphia, but her performance was very much like the performance of young adolescents with these diagnoses.

Table 1. Interventions to Improve the Language Basis that Contributes to Reading Difficulties

Semantics & Vocabulary	• Provide Gestural Cues to Guide Word Meaning
	• Provide Lists of Adjectives (A Menu)
	• Provide Lists of Starter Words for Adverb Phrases (A Menu)
	• Teach Phonological Neighbors and their Meanings ("budge" and "budget")
	• Teach Semantic Neighbors – Precision of Usage (e.g., small, tiny, minute)
	• Teach Vocabulary Meaning Directly in All Subject Areas (Alternate Meanings, Specialized Vocabulary)
	• Prompt Students to Use New Vocabulary Words in Orally Generated Sentences
	• Use Word Webs to Teach a Word and its Associated Meanings:
	  ○ Word Definition
	  ○ Examples of Usage
	  ○ Antonyms/Synonyms
	  ○ Multiple Meanings
	  ○ Part of Speech

Morphology & Syllabication	• Teach Rules for Syllabication (Use a Dictionary or Strategies from Structured Literacy Approaches such as Orton-Gillingham, Wilson Reading Method, etc.) • Identify Word Roots and their Meanings • Identify Morphological Affixes and their Meanings • Investigate Word Derivatives

Syntax	• Teach 3 Sentence Types: Simple Sentences - Complex Sentences - Compound Sentences
	• Use Templates to Practice Correct Word Order, with Gradual Elimination of the Templates
	• Teach Parts of Speech (Word Functions)
	• Target Common Errors:
	  ○ Omission of Suffix Endings
	  ○ Confusion of Suffix Endings
	  ○ Omission of Function Words
	  ○ Subject-Verb Agreement
	  ○ Confusion of Subject-Object Pronouns: Provide Lists of Subject/Object
	  ○ Pronouns
	  ○ Participles
	  ○ Irregular Past Tense Verbs
	  ○ Pluralization
	  ○ Comparative/Superlative Adjectives
	• Provide Lists of Verb Conjugations
	• Create Flash Cards - Matching Suffix to Word Function
	• Directly Teach Sentence Combining:
	  ○ Use of 'And'- Compound Subject, Predicate
	  ○ Use of 'And' 'But' 'So' - Compound Sentences
	  ○ Use of Correlative Conjunctions: 'Neither/Nor'; 'Not Only/But Also'; 'Either/Or'; 'Whether/Or'
	  ○ Use of Connectives (Transition Words/ Phrases)
	  ○ Adjective Placement Prior to Noun
	  ○ Break Apart Combined Sentences into their Component Parts

Table 1. Continued

Text Comprehension	• Teach Strategies such as, "Don't Know a Word? Look IN the Word and AROUND the Word"
	• Encourage attempts at understanding: "That's very close because…" (Validation Engages Thinking)
	• Practice Reading Fluency Drills to Encourage Re-reading of Passages
	• Explain Literary Terms:
	  ○ Hyperbole
	  ○ Idiom
	  ○ Metaphor
	  ○ Onomatopoeia
	  ○ Personification
	  ○ Simile
	  ○ Slang
	  ○ Proverb
	  ○ Dialect
	  ○ Figures Of Speech
	  ○ Allegory
	  ○ Irony
	  ○ Euphemism
	• Practice Comprehension Strategies using Text in any Content Area
	• Practice Comprehension of Discourse Formats that are Subject Specific
	• Discuss the Differences in Strategies Used for Reading to Learn vs. Reading for Pleasure
	• Teach Inferential Language (Understanding the Implicit Meaning) as well as Explicit Meaning in Literature and in Content Area Reading
	• Clarify the Use of Humor
	• Clarify Understanding of Hidden Motivations of Characters in Literature
	• Provide Opportunities for Applying Math Instruction in Everyday Life
	• Consistently Review (using Flash Cards, Game Formats)
	• Avoid Assignments Involving Predominantly Copying – Require More Active Learning
	• Provide Opportunities to Practice Answering Comprehension Questions before a Test

Written Language	• Move from Support to Independence: Structured Spoken Response, Spontaneous Spoken Response, Structured Written Response, Spontaneous Written Response
	• Provide Practice With Oral Sentences to Produce Written Sentences: Move from Speaking to Writing
	• Practice in Maintenance of Discourse on Topic - Use of Discourse Connectors, Transitions, Terminators
	• Practice in Oral Summarizing - Identification of Main Idea and Supporting Details, Use of Discourse Connectors (Use of Template); Move to Written Summary
	• Practice Providing Descriptive Information (Use of Template)
	• Ask Clarification Questions: "Do You Mean ____ Or ____?" or
	  ○ "If I Understand Correctly, You Said ___"
	  ○ Paraphrase the Response: "So You're Saying…"
	  ○ "I'm Having Trouble Understanding"
	• Ask Another Student to Reverbalize What the Student Wrote

Table 1 shows additional interventions that are useful for children like Jim, Doug, and Kasey (Josephson & Gordon Pershey, 2007). These suggestions address semantics and vocabulary, morphology and syllabication, syntax, text comprehension, and written language.

Conclusion

There is a variety of discrepant and sometimes confusing information about the relationship of dyslexia to deficits in the language systems of phonology, morphology, semantics, syntax, and pragmatics. The children who are diagnosed with *specific learning disability, dyslexia, language-based learning disability, reading disability,* and *language disorder* share many commonalities, but they also have particular characteristics, strengths, and needs that are more typical of their unique diagnostic labels. The descriptions presented in this article have attempted to show the relationships between reading deficits and language deficits, as have the cases of three students – one who has dyslexia, one who does not but who has co-occurring attentional concerns, and one who might or might not have dyslexia but who struggles with mastering literacy beyond a basic level. A team of service providers, including the SLP, has the responsibility for determining which of these etiologies are present, in order to make appropriate recommendations for intervention that will improve school performance and quality of life for these learners. ♦

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Helping Students with Dyslexia Learn *How to Learn* from Written Texts

Lauren A. Katz, Karen A. Fallon & Joanne M. Pierson

Abstract

While students with dyslexia typically demonstrate average to above average language comprehension skills, they often struggle with reading comprehension and more broadly, with learning from written texts. The most obvious reason for this is due to their weaknesses in decoding/word recognition – if you cannot read words accurately and efficiently, comprehension and learning will be affected. Less obvious reasons for difficulties with learning from texts can include subtle deficits in higher-level language comprehension skills as well as deficits in attention, working memory, and understanding and use of metacognitive reading strategies. Without question, students with dyslexia need to receive research-based intervention to target improvement in their word reading skills, but they also need skills and strategies for comprehending and learning from their grade-level texts in order to compete in post-secondary and professional contexts with their same-aged peers. Assistive technologies offer one way in which students can access their curricular content, but as students move into middle and high school (and even into college) students need to be strategic about what, how much, and for what purpose they are reading. These students need to be armed with skills and strategies for managing their reading demands while also learning the curricular content. This article will focus on six metacognitive reading comprehension strategies – the 6 Ps – that can help students with dyslexia manage large volumes of text, increase their engagement with texts, and learn deeply from texts.

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Learning Objectives

1) State how theoretical models of reading comprehension should be applied to assessment of reading comprehension.
2) Explain the 5S's of Intervention
3) List metacognitive reading strategies described in the 6P's

Dyslexia Defined

Both the International Dyslexia Association (IDA) and the National Institute of Child Health and Human Development (NICHD; 2014) are currently using the following to define dyslexia:

> ***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.***

For clarity, this current definition will serve as the framework for this paper. However, while this article addresses how students with dyslexia can be taught how to learn from written texts, there is empirical and

theoretical evidence that the methods reported herein can be applied to students with generalized reading disorders, language-based learning disabilities, and/or attention deficit hyperactivity disorder.

Reading Comprehension: Essential but not Sufficient

The act of making meaning out of written text is a complicated process; it involves the integration and management of a variety of skills – cognitive, linguistic, and metacognitive (see Adams, 1990; Cromley & Azevedo, 2007; Cutting & Scarborough, 2006; Gough & Tunmer, 1986; Kintsch, 1994; Perfetti, 1985).

In their simple view of reading, Gough and Tunmer (1986) proposed that reading comprehension is the product of two distinct skills: decoding and linguistic comprehension. They further argued that when an individual demonstrates good linguistic comprehension, but poor decoding, the result is a profile consistent with the diagnosis of dyslexia. In other words, the breakdown in reading comprehension is thought to be due to difficulty with deciphering the words on the page; it is not due to a generalized difficulty with oral language comprehension. That said, the simple view of reading is simple; it captures only two skill areas that are important for good reading comprehension. For example, the simple view does not account for the breadth and depth of prior knowledge that the reader brings to the task of reading; cognitive processes such as attention and working memory; and metacognitive and metalinguistic processes, such a comprehension monitoring, purposeful reading, and meaningful reflection.

We have known for decades that children classified as learning disabled (LD) and/or as poor comprehenders have also demonstrated limitations in their metacognitive skills during reading compared to same-age skilled readers (Brown, 1980; Garner & Kraus, 1981-82; Palincsar & Brown, 1987; Stone & Conca, 1993). Palincsar and Brown (1987) noted that compared to good readers, poor readers do not see reading as a search for meaning, there is a greater emphasis on decoding; they do not monitor; they do not engage in strategies when there is a breakdown in comprehension; and they do not modify their choice of strategy to meet the task demands (p. 69). Stone and Conca (1993) stated, "…as a group, children with LD recruit fewer strategies spontaneously and use strategies less often than same-age nondisabled peers." (p. 24). Perfetti and Hogaboam (1975) suggested that limited strategy use in poor decoders was secondary to their lack of automaticity in basic reading, thus preventing them from devoting their attention to higher-level processes. In fact, individuals with dyslexia have been found to exhibit much more brain activity

The importance of these cognitive and metacognitive skills was taken into account in a model of adolescent reading comprehension developed by Deshler and Hock (2007). This model goes beyond the simple view by illustrating how certain reading skills (i.e., phonological awareness, decoding, sight word reading, and fluency), language comprehension (i.e., background knowledge, syntax, vocabulary, and text structures), and executive processing skills (i.e., cognitive and metacognitive strategies) work together to bring about successful reading comprehension. While this model was developed with adolescents in mind, we know that use of metacognitive reading strategies by children with dyslexia and/or LD is beneficial to their reading comprehension skills (see Camahalan, 2006; Chan & Cole, 1986; Graves, 1986; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989; Schunk & Rice, 1992).

Still, while reading comprehension is of critical importance as students' progress through their school-age years and beyond, it is not enough. Students must be *learning* from the texts that they read (see Kintsch, 1994, 1998, 2005). The knowledge that students accumulate over time must be retained and then integrated with new knowledge that they come to acquire through both spoken and written modalities. Therefore, students must acquire the skills and strategies needed to learn from their texts, and for students with dyslexia, who struggle with word reading efficiency, these skills need to be directly and explicitly taught and practiced.

Developing an Intervention Plan

The first step in developing a treatment plan is the assessment. Whether assessing a student who is dyslexic or not, speech-language pathologists (SLPs) must conduct careful and comprehensive assessments when trying to identify the factors contributing to a student's difficulties with reading comprehension. Assessment should drive treatment, and SLPs have a responsibility to seek the answers to *why* their students are struggling with reading comprehension (Katz & Fallon, 2015). A weak score on a reading

comprehension measure does not tell us *why* the student is struggling – we need to examine word reading, spoken language comprehension, and use of metacognitive reading strategies. Katz and Fallon provide a detailed discussion on how best to assess students who are struggling with reading comprehension – from the skill areas to examine, the measures to use, and the qualitative information and data to take into account.

Once you have your data and an understanding of *why* it is that the student is struggling with reading comprehension, and learning more broadly, a plan of intervention should be developed. Katz and Fallon (2015) and Fallon, Katz, and Carlberg (in press), present a framework, and an expanded framework, of balanced intervention, respectively. In the most recent model, the 5S's of Intervention, five essential components of intervention should be considered in developing an intervention plan: *skills*, *strategies*, *school*, *student buy-in*, and *stakeholders* (see Figure 1).

Figure 1. Planning Balanced Intervention: The 5S Framework.

Skills	○ Foundational language & literacy skills
Strategies	○ Application of skills to content learning & academic assignments ○ Work in in partnership with the school
School	○ Intentional use of metalinguistic & metacognitive skills
Student Buy-in	○ Motivation & engagement
Stakeholders	○ Parents/guardians, spouses, siblings, friends, tutors, counselor, teachers, etc.

Katz & Fallon (2015), Fallon & Katz (in press)

For the *skills* component, explicit, systematic, and direct instruction in identified areas of weakness (e.g., phonological awareness, decoding, higher-level language comprehension) is paramount. Students, however, also need to be equipped with *strategies* so that they can learn how to learn and therefore become independent learners. Despite continued difficulty with efficient decoding or word recognition in their grade-level texts, students with dyslexia still need to access the content of these tests. In addition, as these students advance through their school career, they will need to be able to do so with greater efficiency as the amount and the complexity of the text continue to increase.

These skills and strategies need to be taught in the context of where students spend the bulk of their time engaged in literacy tasks: *school*. As much as is possible, therapeutic materials and methods should be relevant to the student's academic content and requirements, and whenever possible, cooperative and collaborative relationships between the clinician and key school personnel should be developed. Particularly as students become older, but even in the younger years, taking care to establish a good rapport and develop *student buy-in* can be an important contributor to a student's success with language therapy (Dickson et al., 1998). Finally, students are not yet independent beings, and particularly for those with LD, they often need and rely on support from key *stakeholders* (i.e., parents, siblings, and tutors).

Depending upon the particular student with whom the clinician is working, there may be more emphasis on one or some 5S's than on others. For example, consider a student with dyslexia whose decoding and word recognition skills are average but inefficient. While he can read the words in his grade-level texts, it takes him too long to get through all of his class assignments and readings, and he is struggling to comprehend and learn from his texts. While he has tried to use text-to-speech software to access the curricular content, there is not enough time to get through even half of what he is supposed to read. He is only in 6th grade, and he still has the remainder of middle school and high school to go. Moreover, he is bright; he wants to go to college and eventually, he would like to pursue a career in medicine.

Focus on Metacognitive Strategy Instruction

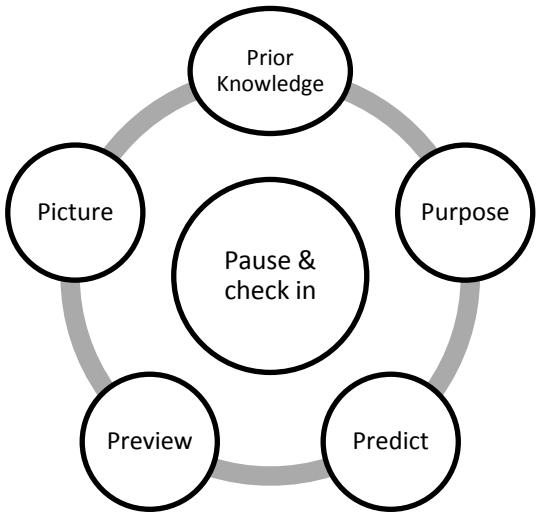
In the example above, while this student may continue to benefit from intervention targeting his word reading skills, to thereby improve his reading efficiency, it seems that he might also benefit from some strategies to help increase his comprehension of and learning from written texts. Like many adults with dyslexia, this student may never become an efficient word reader (Shaywitz, 2003), but he has the potential to become a more efficient and, even highly proficient in comprehension for learning.

Reading comprehension strategies have been categorized in a variety of ways. Strategies have been grouped according to *when* they occur in the reading process (see Klingner, Vaughn, & Boardman, 2007). For example, reading comprehension strategies can occur *before* reading the text even begins and might include setting a purpose for reading; previewing the title, headings, subheadings, bold words; and activating one's prior knowledge about the topic. *During*-reading strategies might include keeping a purpose in mind, making predictions about what might come next, self-generated questioning, and stopping to summarize. Finally, *after*-reading strategies are carried out once the reading is complete, and they might include summarizing, reflecting on what was learned, and answering questions.

Strategies have also been organized by type or function (see Carlisle & Rice, 2002; Mokhtari & Reichard, 2002). Carlisle and Rice classified reading comprehension strategies into four groups: *preparatory*, *organizational*, *elaborative*, and *executive*. Preparatory strategies are akin to pre-reading or before-reading strategies; organizational strategies include finding the main ideas, summarizing text, and identifying the text structure; elaborative strategies involve deriving meaning from the text that goes beyond the words on the page (e.g., making inferences, connecting the content with prior knowledge); and executive strategies are those that require monitoring of one's own comprehension and deciding how the task should be approached and completed. Mokhtari and Reichard (2002) developed the Metacognitive Awareness of Reading Strategies Inventory (MARSI), which categorizes 30 reading comprehension strategies into three categories: a) *global strategies*, b) *problem-solving strategies*, and c) *support strategies*. Global reading strategies are used for grasping the big picture (e.g., the author's purpose, main idea, and overall theme(s)). Problem-solving strategies are used when the text becomes challenging to read and comprehend. Foremost, students must be able to identify a breakdown in their comprehension and then, to fix the breakdown, they must know which strategies to use and how to use them (e.g., adjusting reading rate, reading out loud, rereading if necessary). Finally, support reading strategies that require resources outside of the text itself (e.g., taking notes while reading, underlining, paraphrasing, using outside reference materials, and discussing the readings with others) may be perceived as unnecessary extra work by students.

In our research and clinical work with school-age and college students, we have identified a set of six effective reading comprehension strategies that are particularly useful for increasing efficiency, enhancing engagement, identifying the central meaning(s) and message(s) found in a text, boosting understanding and connections with prior knowledge and knowledge that is yet to come, and improving learning more broadly, not just comprehension. The 6 Ps are as follows: *prior knowledge*, *purpose*, *predict*, *preview*, *picture*, and *pause to check in* (see Figure 2). While prior knowledge is often a good place to begin, these six strategies are not meant to be used in a set sequence; rather, they are meant to be used recursively throughout the reading process. In the sections that follow, we will describe each strategy in detail.

Figure 2. The 6 Ps.



Prior Knowledge

The activation of one's prior knowledge involves thinking about what one already knows about the subject matter of the text that is about to be read. This strategy need not take a large amount of time, yet this largely depends on the amount of prior knowledge a student brings to the task. When students face a topic they know nothing about, conducting a quick search on-line can give them just enough information to help them engage with the text in a more meaningful way (see Pressley & Gaskins, 2006). Making this very small investment of time up-front can pay-off tremendously. Students with dyslexia and other LDs often resist doing

anything that requires extra time or effort that is not obviously counting towards completion of the task (e.g., reading the chapter). Convincing your students that this initial investment is worth the time and effort can take time, but when they see for themselves that they are more engaged and focused, and ultimately comprehending with greater ease, they will come to appreciate the value. Therefore, before actually reading any paragraphs or turning any pages, students should begin the reading by thinking about what they already know about the topic. They can use the title, a picture on the cover page, or the teacher's earlier coverage of the subject matter to help stimulate some thoughts about the subject matter. They can ask themselves the following questions: What do I know about this topic? If I don't know much/anything, where can I find some information? How is what I know possibly related to what this text is going to be about?

Purpose

Students should always approach reading with a purpose in mind. Determining the purpose will help students to read texts in a more meaningful way, which in turn, will provide greater focus and efficiency. When we read for pleasure, generally, our purpose is not to remember every detail; we may just want to understand the plot and be entertained. With school (or work-related) readings, our purposes vary. During the school-age and college years, teachers and professors are generally the individuals who determine the purpose for each given reading. Students need to be aware that one of their jobs as students is to determine what the teacher intends for them to gain from the assigned reading. Sometimes, the teacher is explicit about this – "I want you to focus on the reasons why the war began." Sometimes the teacher is explicit, but in a different way – "After you read the chapter, you will need to answer the summary questions on the last page." Sometimes the teacher is not explicit, but does have a purpose that can be identified. This usually involves some detective work (e.g., making note of the kinds of discussion points raised in class, consulting study guides, noting the kinds of questions asked on quizzes and tests). Students should come to understand that different teachers have different views and beliefs about what is important. Depending on the teacher and the subject matter, a student may need to attend to specific dates of events, names of people and places, vocabulary terms, main ideas/themes, connections to their own experiences, or lessons learned. Teachers and professors are not always the purpose-setters – when students are engaging in research-like activities, their purposes may come from their own research questions or topics. For example, if a student is writing a report about the kinds of foods that are eaten in Mexico, they would not want to allocate careful (or any) attention to paragraphs of text about currency, crime, language, or climate – they would stay connected to their purpose before and throughout the reading process.

A reader's purpose should also be driven by his/her awareness of and familiarity with different text structures. For example, narrative texts are structured very differently than expository texts. When one prepares to read a narrative, he/she should anticipate a narrative or story structure: a setting, characters, a problem, some events/actions that occur in an effort to solve the problem, a climax, and some sort of resolution. In contrast, expository texts do not include these components, and there are also many different expository structures (e.g., descriptive, procedural, informational, persuasive, compare/contrast, etc.). For example, in a descriptive structure, the reader should expect to learn about how something, someone, or some place looks, sounds, feels, smells, and/or tastes. In a procedural text, the reader should expect to learn how to do something; key information might include the materials/equipment/people needed, the steps or processes involved, the sequence of steps to follow, the time involved to complete the procedure, and the expected result.

The following questions can help guide students to determine their purpose (or purposes) before and throughout the reading process: What kind of text is this (narrative, procedural, descriptive, etc.)? What does your teacher want you to know? Why is your teacher asking you to read this? What am I going to need to do after I read this (class discussion, paper, quiz, etc.)?

Predict

Making predictions before and throughout the reading process is another valuable strategy for increasing one's attention and engagement while reading. Readers who make predictions as they read are *active* rather than *passive* participants in the reading process. Regardless of whether or not our predictions are right, as curious (and competitive) beings, we will seek to know whether our predictions are right or wrong, and this keeps us

focused and engaged. While making predictions may lend itself more naturally to narrative texts (e.g., predicting what a character will do or what will happen to a character), it can also work with expository texts (e.g., Photosynthesis probably has something to do with light..). When students are reticent to make predictions or when they believe they don't have any predictions to make, it can be helpful to have them make "I wonder" statements (e.g., I wonder what will happen next.. I wonder what photosynthesis is.).

The following questions can help guide students in making predictions throughout the reading process: What does the title suggest this is going to be about? If this is a narrative, what do I think is going to happen next? If this is an expository text, what do the headings and subheadings suggest? Am I making "I wonder what…" statements?

Preview

Because reading can be such an effortful and time-consuming activity for students with dyslexia, and because reading demands only continue to rise as students' progress through and beyond their school-age years, they need to begin to learn how to succeed without reading every paragraph they're assigned. This is something that many skilled readers learn how to do without being explicitly taught how to do so (Pressley & Afflerback, 1995), and students with dyslexia actually need to have this skill to manage the volume of reading they will face in high school and college. We've referred to this skill as 'reading without reading' – the idea being that you don't need to read everything on the page or in the chapter to learn and understand the content. In addition to improving efficiency, previewing text does something quite significant for these students: it helps them see the big picture rather than a never-ending list of isolated details, which is something with which these students tend to struggle (Carlisle, 1999; Hansen, 1978). By initially skipping over the details and getting the overall picture, these students can start to make connections not only with information contained in one piece of text, but information contained across several different pieces of text. For example, instead of trying to remember something about slavery, something about the Battle of Gettysburg, something about Abraham Lincoln, something about the 13th Amendment, and something about Robert E. Lee, they can start to see that all of these things were related in time and place and in the context of the Civil War.

So, how can students be taught to preview or 'read without reading?' With narrative texts, previewing might include reading the back cover of the book, reading reviews or a summary of the book, reviewing the table of contents, or briefly examining other works by the author. With expository texts, while incorporating some of the previously discussed Ps (i.e., activation of prior knowledge, keeping a purpose in mind, making predictions throughout the reading process), students should be taught to read and think meaningfully about the title, headings, subheadings, figures, tables, pictures, maps, and bolded words. They should start the chapter or article by asking themselves, "What does the title mean? How does the title relate to what I've learned in class? How does the title relate to my own knowledge/experiences?" From there, they should ask themselves, "What do the headings mean? How do the headings relate to the title? How do the headings relate to what I've learned in class? How do the headings relate to my own knowledge/experiences? What do the bold/italicized words mean? How do the bold/italicized words relate to the heading? How do the bold/italicized words relate to the title? How do the bold/italicized words relate to what I've learned in class? How do the bold/italicized words relate to my own knowledge/experiences?" Once they've previewed the text, they should return to their purpose to identify which sections may need to be more carefully read. While there will be times that they'll need to go back and read more of the text, sometimes previewing will give them enough information to get a general sense of the material and participate in an in-class discussion the next day.

Picture

While research has been mixed regarding the effectiveness of picturing or visualization strategies during reading, there may be some value in using imagery strategies to increase students' engagement during reading (Long, Winograd, & Bridge, 1989) as well as their retention of information in long-term memory (Baddeley, Grant, Wight, Thomson, 1975; Oakhill & Patel, 1991; Sadoski, Goetz, & Fritz, 1993). Research has shown, however, that converting meaning derived from written text into visual images in one's mind can be particularly useful with concrete information and with narrative structures (Sadoski et al.; Weisberg, 1988). With expository structures and content-area readings, students should be encouraged to use

picturing strategies in a different way – connecting information in the text to personal experiences that are picturable. For example, in the context of a chapter on the Civil War, recalling images of a family visit to the Lincoln Memorial in Washington, D.C. during which a tour guide remarked about the size of the sculpture relative to how important Lincoln was in the abolishment of slavery when the country was so divided.

For narrative texts, questions or prompts that students can use to guide them in the picturing process might include the following: What do I see? What do I hear? What do I feel (heart and hand)? Are there any smells, tastes that are important to capture? For concepts, places, people, and events in expository texts, students might ask themselves: What experiences can I picture that will help me understand or remember this piece of information? Clinicians can also teach students to utilize self-drawn diagrams and graphic organizers to help themselves visualize, understand, and remember relationships between concepts or people, or sequences found within the both narrative and expository texts.

Pause to Check In

While skilled readers monitor their comprehension throughout the reading process, students with dyslexia and other LDs are less inclined to do so (Baker, 1984). Skilled readers not only stop periodically to monitor whether they are comprehending what they are reading, but they then act when necessary to ensure comprehension (Wilhel, 2008). For example, if they find themselves not attending to the text, they may reread the section wherein they were distracted, or they may stop to take a break and then return to reading when they are more alert. If we don't pause to check in on our comprehension of information than we are liable to miss important information.

Students can use the following prompts to serve as reminders to pause and check in during reading:

- Remind yourself of your purpose.
- Make frequent predictions and reflect on your accuracy.
- Ask yourself what the sentence, paragraph, page, passage was about, and actually answer!
- Ask yourself what you are learning, and actually answer (by paraphrasing)!
- Ask yourself if the text is making sense. If not, do something about it.
- Find main ideas and summarize frequently.
- Ask yourself if you are paying attention. If not, do something about it.

Two Case Descriptions

The following two case descriptions are based on several real clinical cases seen by the first author. The names and details have been changed, but the goals, methods, and outcomes are genuine. For coherence, the cases have been written in first person.

Dylan

Dylan was a 12-year old female with a diagnosis of dyslexia. She had a classic profile – above-average language comprehension skills and relatively weak word reading skills. While her word reading accuracy was solid, she was not an efficient reader, and this inefficiency impacted her reading comprehension, her learning, and her academic performance across most content areas, but particularly language arts. Coupled with her dyslexia diagnosis was a diagnosis of ADHD, which reportedly impacted her ability to stay focused when completing lengthy reading assignments, and primarily when reading fictional books that she found to be uninteresting. Otherwise, Dylan was a successful student – she had a lot of friends and was a gifted athlete.

Using the 5S Framework for Balanced Intervention, together, we developed goals and objectives around improving her reading comprehension skills and academic performance in language arts. Our plan was to work 1 hour per week for a month to see if Dylan might begin to experience some improvement. For Skills, the focus was on increasing her familiarity with narrative structures. For Strategies, where the bulk of our attention was placed, the focus was on improving Dylan's understanding and use of the following reading comprehension strategies: activating prior knowledge, predicting, reading with a purpose, picturing, and pausing to check in. Of note, the only P strategy that was not being taught was previewing, and this was because fictional novels do not lend themselves to previewing in the way that textbook chapters do. For School and Student Buy-In, her language-arts' novel served as the intervention materials; this meant that therapy was going to be academically relevant, and she was more than happy to engage if we were going to be

reading something that she had to read anyway. Finally, her mother watched the sessions from behind a one-way mirror so that she could reinforce the taught strategies at home. As an aside, when parent observation is not feasible, connecting via email or phone to report on what has been taught and offer suggestions for how parents (or tutors) can follow-up at home can be effective as well.

For the first session time was spent talking about narrative structures. While much of what was discussed was familiar to Dylan (i.e., setting, characters, resolution), the components weren't something that she thought about when she approached or read a narrative text. To help make these components more salient, we worked with a stack of pre-school books that were fast-reads and that had very salient narrative structures. We basically spent the hour reading these books and identifying the settings, characters, problems, events/actions that occur as an effort to solve the problems, climaxes, and resolutions. By the end of the hour, Dylan could independently identify these components in the pre-school books, but could also reflect back to the last two fictional novels she had read for school and identify these components in those texts.

For the second session, Dylan brought the novel she was required to read for her language arts class: *Watership Down* by Richard Adams. She had started reading the novel, but was finding it painfully boring and was reportedly unable to engage at all with the story. I prepared for the session by reading the *SparkNotes* (http://www.sparknotes.com/) summaries for the book and by reading the prologue and first two chapters of the book. I gathered some baseline data by asking Dylan to provide a summary about what she had read in the first two chapters. Dylan was only able to say that it was a book about rabbits who talked. This is true; it is an anthropomorphic story wherein the main characters are rabbits who can speak and think like humans but were otherwise just ordinary rabbits.

I took a few minutes to talk with Dylan about trying something new – investing a little bit of time before actually starting to read her book, so that she read with more focus, engagement, and even enjoyment. Dylan agreed, and I laid out what I had done to help increase my own engagement with the story. First, I told Dylan that I had read the summary of the book on SparkNotes to gain a big picture of the storyline. Second, I explained that I read the prologue, which included information about the author and how he came to write this story – it was based on oral off-the-cuff stories that he told his daughters in the car, and they insisted that he put them into writing. I told Dylan this made me more curious about the story as the authors' young children found it fascinating enough to encourage their father to write it down. I told her that I also learned that the author based much of the story in a place where he grew up and on his own experiences fighting in battles during World War II. And, I told her that this also piqued my interest – I wanted to know more and try to see if I could relate the story to how a real battle experience might have unfolded. Third, I talked with Dylan about activating her prior knowledge, and in the process, Dylan asked if Watership Down was a real place. We decided to run a quick search online and found that it was a hill (or a down) with a steep slope in England. Dylan talked about a childhood memory of a vacation during which she and her siblings played hide and seek on a green, hilly meadow. We also talked for a minute about World War II and what the experience of a war might be like generally. All of these discussions while seemingly irrelevant were actually activations of prior knowledge, which were beneficial in the long run. Finally, after just about 10 minutes of chatting, we were about ready to start reading.

I explained that I would take the lead and just wanted Dylan to listen and chime in if she wanted to. I had prepared to use a think-aloud approach to model my use of the 5 Ps. I started by reminding myself of our **purpose** (or Dylan's teacher's purpose): "So, I should first start by thinking about my purpose or what we need to be focusing on as we read. You have questions that we have to answer about the setting and characters, and we know this is a narrative, so we should expect that we'll also maybe learn about a problem…we'll be on the look-out for those things." Next, I read the first chapter's title ("The Notice Board") and made a **prediction**, "Hmmm…, I wonder if the board is an actual bulletin board or chalk board that contained a message of some sort. Maybe it's a message for the rabbits, or maybe a message that the rabbits will leave. Maybe it's going to tell us something about the problem. We'll see (with dramatic prosody)." Then, after a paragraph or so, I paused to reflect on the **picture** of the setting that I imagined in my mind. I also stopped to describe what I thought the two main rabbit

characters looked like: "I remember from the prologue – my **prior knowledge** – that Hazel had the qualities of an officer, so I think she's big and strong. I think Fiver is a little scrawny rabbit. I don't know why, but I think he is kind of small and nervous." I **paused** at one point because I was confused and needed to check my understanding of what I had just read: "Wait… I'm so confused. Why is Fiver freaking out and talking about a field full of blood? Oh! I remember (**prior knowledge**) – Fiver is supposedly cursed with always telling the truth but never being believed. Maybe Fiver can predict (**prediction**) what the truth will be. He says, 'There isn't any danger here, at this moment. But it's coming…' (Adams, 1972, p. 6)." Dylan and I continued reading the first chapter together in this way, and by the end, Dylan was actually excited to continue reading. She said, "You were right, there was an actual message board!" And, she spontaneously made a prediction, "I think Fiver can predict the future and there probably is danger coming their way… maybe humans!" When Dylan arrived for her next session, she was able to provide accurate summaries for chapters 2 and 3, and she reported using all 5 Ps, even providing examples of how she used each one. In only two, 1-hour sessions, Dylan had shown substantial growth in her ability to comprehend narrative texts. And, in the subsequent two sessions, Dylan and I worked to build connections between the narrative and what she had learned in social studies about battles and wars. Dylan was beginning to independently reflect on how the knowledge gathered from expository texts in her social studies class was helping her to engage with and understand the narrative, and how her reading of this narrative was helping her learn more from her social studies text about battles and wars.

Mateo

Mateo was a 15-year old male with a diagnosis of dyslexia. Like Dylan, he also had above-average language comprehension skills, but his reading skills were less strong. Efficiency was certainly a problem, but he still continued to struggle with accuracy when reading multi-syllabic words. His difficulties impacted his reading comprehension, learning, and academic performance across most content areas, but particularly in social studies and science. Mateo had also become completely dependent on his mother to help him complete his homework assignments and study for tests. This dependence had led to anxiety about his ability to get through high school without her help. Unfortunately, he was beginning to think that college was not a possibility. Studying for tests involved memorizing notecards, and the information was consistently forgotten after the test had been taken. Outside of school, Mateo enjoyed and excelled in music.

It was clear in the first session that Mateo's dependence on his mother was going to require substantial attention. When asked how he would approach answering assigned questions about his social studies chapter, he said that he would have his mother find the answers and tell him what to write. When asked what he would do if she were not available, he appeared panicked and said, "I don't know." He had no strategies for approaching his school readings and assignments. He was going to need to learn some skills and strategies, gain confidence in himself as a learner, and see that he could be successful without relying on his mother's help.

Using the 5S Framework for Balanced Intervention, Mateo's parents and I developed goals and objectives around improving his independence with social studies readings, so that over time, we might see his anxiety fade and his confidence climb. For Skills, the focus was on increasing his familiarity with informational text structures, and more specifically, his social studies text structure; this would help him read more purposefully. For Strategies, the focus was on improving Mateo's ability to not just comprehend, but to learn from his texts rather than forgetting the information after each test was taken. Moreover, he needed to learn how to *read to learn*. I planned to help him use the 6 Ps with every chapter he read. For School, in addition to making use of his curricular materials, periodic conversations with his social studies teacher ensured that we were focusing on the right information when we worked on preparing for tests. Student Buy-in was tough. Mateo was so overwhelmed with school work that he believed time spent with me was taking away from finishing his homework. We had to try to make notable gains quickly so Mateo would buy-in before giving up. Finally, Mateo's mother was an integral part of therapy. Not only was it important for her to watch what we were doing so that she could reinforce the taught skills and strategies at home, but we also had to help her stop enabling Mateo by completing his homework for him.

During Mateo's second meeting with me, he was presented with a simplified version of the goals and objectives. To help with buy-in, we set a very short-term plan: four, 1-hour sessions that would take place over 4 weeks. Using clinician-developed self-report scales, Mateo and his mother would independently rate Mateo's dependence on his mother for homework help, and each would also rate Mateo's stress/anxiety levels (see Figures 3, 4, and 5). Their ratings would help gauge progress in these areas. I then told Mateo we were going to try to read his social studies chapter "without really reading it." Mateo smiled; it was hard to be opposed to that. A timer was set so Mateo would not be able to dispute the amount of time it took us to 'read' his chapter. I took the lead and told Mateo that he should just listen and contribute when he felt comfortable.

Without explicitly introducing the 6Ps, I modeled each of them as I 'read' (**previewed**). I started by asking Mateo for the questions the teacher wanted him to answer, and before and after I read them aloud, I said, "This is what we want to be listening for – this is our **purpose**." Next, I read the title ("Ancient Greece"), and I activated my own **prior knowledge** by talking about wanting to visit Greece, loving Greek food, knowing that the Olympics started in Greece, remembering something about Greek philosophers, recalling the Greek alphabet, and recollecting that some Greek letters are used in math and science. Mateo added that he had read a lot of Greek mythology, so he knew about Greek gods, like Zeus, which he couldn't imagine believing in. I made sure to express the value of Mateo's contributions. Then, I explicitly **predicted** that the chapter would probably tell us something about the history of Greece, going back a long, long time ago to ancient times. Mateo made reference to the timeline at the bottom of the title page and noted that the chapter was likely going to be covering that span of time. Again, Mateo's contribution was acknowledged as valuable to the discussion. Then, I noted the picture of the map of Greece on the title page and reflected on the fact that the country was surrounded by water and that could make Greece vulnerable to attacks from enemies, which was one of the teacher's questions that we were going to have to answer. I noted, "Mateo, we haven't even passed the title page, and we've already answered one of your questions!"

As we continued to read and discuss titles, subtitles, figures, and bold words, we came to a picture of the philosopher, Socrates; the caption indicated that he was sentenced to death by drinking hemlock. Mateo commented that his name was Socrates, but he wasn't wearing socks. I said, "That's true. I bet you'll be able to **picture** that picture of Socrates without socks being poisoned! It says he was actually killed for asking too many questions and not accepting others' beliefs about the Greek gods. You and Socrates were a lot alike! Are you wearing socks (joking)?" We then came to a section about the Roman rule in Greece, Mateo stopped me because of some confusion about whether the Romans referred to people from Italy, so we **paused** and looked at the map to check our comprehension. I praised Mateo for his pausing to get clarification and told him that skilled readers do that all of the time. By the time the chapter had been 'read,' only 23 minutes had passed, and Mateo was shocked that it took so little time. He was even more shocked that he was able to recount most of the chapter to his mother and answer about two-thirds of the questions without going back to the text. Furthermore, for those questions he couldn't answer, he knew exactly where to look in the text to find the answers. He was beginning to buy-in. So, while he was feeling positive, I provided Mateo and his mother with scripts that they could use while reading to help him learn how to learn from his readings (see Figure 6).

Figure 3. Student Dependency Rating Scale.

Date: _____

Activity(ies): _____

	By myself	With minimal help	With some help	With a moderate amount of help	With a lot of help	Couldn't do at all by myself
I was able to complete this task.						

Comments: _____

Figure 4. Parent Dependency Rating Scale

Date: _____

Activity(ies): _____

	Not at all	Minimally (less than 10%)	Less than 1/3 of task	About 1/2 of task	Most of task (2/3 or more of task)	All of task
I assisted my child . . .						

Comments: _____

Figure 5. Stress Rating Scale.

Date: _____

Activity(ies): _____

	None	Very Low	Low	Medium	High	Very High
Level of stress experienced doing homework/studying:						

Comments: _____

Figure 6. Scripts for Boosting Connections

Pre-reading	• What does the title mean?
	  ○ How does the title relate to what I've learned in class?
	  ○ To my own knowledge and experiences?
	• What do the headings mean?
	  ○ How do the headings relate to the title?
	  ○ To what I've learned in class?
	  ○ To my own knowledge and experiences?
	• What do the bold/italicized words mean?
	  ○ How do the bold/italicized words relate to the heading?
	  ○ To the title?
	  ○ To what I've learned in class?
	  ○ To my own knowledge and experiences?

During reading	• What is the main idea of this paragraph?
	  ○ How does the paragraph relate to the heading?
	  ○ To the title?
	  ○ To what I've learned in class?
	  ○ To my own knowledge/experiences?
	• What is the main idea of this section?
	  ○ How does the section relate to the heading?
	  ○ To the title?
	  ○ To what else I've learned in class?
	  ○ To my own knowledge/experiences?

Post-reading	• What is the main idea of this chapter/article?
	  ○ How does this chapter/article relate to what else I've learned in class?
	  ○ To my own knowledge and experiences?

Conclusions

While students with dyslexia may not experience generalized language comprehension difficulties, they can experience difficulties with comprehension of and learning from written texts. When a careful assessment of oral and written language skills reveals deficits in awareness, understanding, and/or use of metacognitive reading strategies, there are effective approaches available for helping these students *learn how to learn* from written texts.

Using the 5S Framework for Balanced Intervention (see Fallon et al., in press; Katz & Fallon, 2015), clinicians can make certain to consider the five essential components in developing an intervention plan: *skills*, *strategies*, *school*, *student buy-in*, and *stakeholders*. Depending upon the student's individual needs, one or more 5S's may need more or less attention than the others. In order to become more efficient and proficient comprehenders and learners, many students with dyslexia will continue to require direct instruction in word reading *skills* (such as sound-to-letter mapping, syllable division, and morphological analysis). However, for many older students with dyslexia, metacognitive *strategy* instruction is a necessary supplement. The 6 Ps (prior *knowledge*, *purpose*, *predict*, *preview*, *picture*, and *pause to check in)* are effective reading comprehension strategies for increasing efficiency, enhancing engagement, identifying the central messages and themes found in texts, boosting understanding and connections with prior knowledge and knowledge that is yet to come, and, importantly, improving learning more broadly, not just comprehension, which is the ultimate goal. Furthermore, utilizing material from the *school* curriculum provides a natural link to the setting in which students spend most of their time engaged in literacy learning, which also provides increased chances for *student buy-in*. In working with our students with dyslexia, helping to ensure that they are getting additional support from school personnel, as well as other *stakeholders,* is also important in contributing to their academic success.

We have provided case descriptions of two students for whom the use of the 6Ps within the 5S framework proved to be successful in improving reading comprehension for both narrative and expository texts within a very short timeframe -- 4 one-hour sessions. This model is easily adaptable to a group therapy setting. When intervention focuses on the 6Ps within a particular curricular content area using the 5S framework, students with dyslexia will be armed with new tools and strategies that they can then utilize in other curricular areas. As a result, they become more independent and confident learners, which can further empower them as they tackle new problems and challenges in school and life.♦

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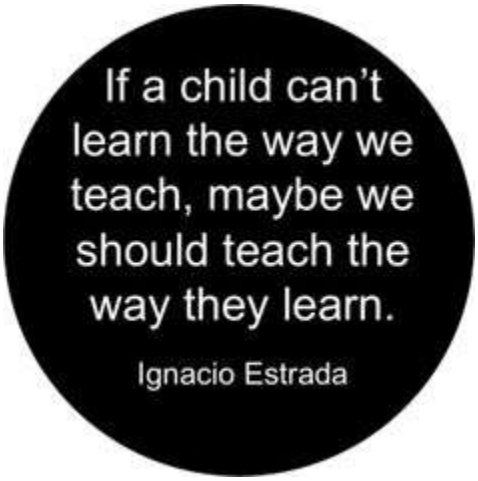

Halftime: Reflections from a Speech-Language Pathologist about Teaching Reading in the Schools

Steven M. Griffin

Abstract

This article captures the reflections of a school-based speech-language pathologist (SLP), who for sixteen years has been heavily involved in literacy. At the midpoint of his career, the author outlines and discusses nine principles that he has learned along the way in the areas of literacy and leadership. This practical advice is an effort to assist other SLPs interested in becoming more directly involved in teaching early literacy skills and working collaboratively with other school professionals on students' literacy teams.

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I have been a school speech-language pathologist (SLP) for 16 years, and been involved in reading since year one. My initial motivation to address literacy came my very first year after meeting a high school student that could not read. He was on my caseload for only a vocabulary deficit. Yet, he still could not read! Who was addressing his glaring deficit in reading? It did not make sense to me. Why was I treating the symptom and not the cause? So I changed my treatment approach. I changed his vocabulary goals to reading decoding and reading fluency goals. His best shot at improving his vocabulary and experiencing educational success was learning to read. My journey into reading started there, and 16 years later it is still going strong.

I have had significant experiences and tasted some level of success. At the midpoint of my career, much like a coach after the first half, I find myself reflecting and taking a clear look at what it will take to make the coming years my most rewarding. For SLPs involved with or interested in teaching reading, here are some of the principles I have learned up to this point in my career, at halftime. I share them in the hope that they can assist you in the coming years; to help maximize the positive impact our profession has on children.

Principle #1: You know more about reading than you think.

A complete and thorough understanding of the phonology of language is an absolute prerequisite to effective reading instruction. You have this training. Your phonology knowledge, combined with skills in using diagnostic-prescriptive approaches to assessment and intervention, make you particularly valuable in the educational setting (American Speech-Language-Hearing Association, 2001). We know from a 20-year mountain of research that phonemic awareness and knowing the correspondence between the sounds of our language and the symbols are two of the strongest determinants of future reading success. Identify this weakness as being the first possible indicator of dyslexia (see *Overcoming Dyslexia* by Dr. Sally Shaywitz or Louisa Moats' *Speech to Print* for more about Dyslexia). Your knowledge positions you to understand reading instruction at a level that, without it, most cannot.

In her book, *Why Our Children Can't Read and What We Can Do about It*, Diane McGuiness (1999, p. 74) underscores the importance of understanding speech sounds,

> *Ask a few of your teaching colleagues how many sounds exist in the English language and when most tell you twenty-six, or that they*

have no idea, you will realize that no one ever taught teachers the sounds in English for which the code was written. Phonics programs do not solve the problem either. Phonics programs used in most schools simply do not teach the sounds in English for which the English alphabet code was written. They teach the "sounds of letters". How is this supposed to work when there are twenty-six letters and forty-three sounds? Our children are not ever told what the alphabet code really is. This is because, truth be told, no one is telling our teachers what it really is either.

SLPs understand not only the sounds of English and how many exist, we also understand how sounds are produced, organized, and relate to one another. This unique understanding allows us to easily make sense of the alphabet code for our colleagues who do not know it, and most importantly, for our students. So, do not be afraid to shine the light on your own expertise, but realize . . .

Principle #2: The biggest problem is our code.
When reading does not come easily for our children we have our choice of potential causes, but the biggest cause is our written code. In a perfect world, the English alphabetic code would consist of just basic code—a code in which each of the 43 sounds in our language would have just one symbol assigned to it. The relationship between sounds and letters would be logical and easy to understand; learning to read would be easy. Reading problems would reduce dramatically. Unfortunately, our written language is complex. Why isn't phonics spelled phonetically? It is because the 43 sounds in our language are represented in various ways with multiple patterns. As children develop the understanding that letters are used to represent the speech sounds of our language (alphabetic principle), they must also learn that we use the letters of the alphabet often alone (basic alphabetic code), but also combined in groups of two, three and four letters (advanced alphabetic code) to represent the sounds in our language. This complexity of our written language causes more reading problems than you can imagine, and the English alphabet code lies at the core of many students' learning problems. Even if you have not been trained in a specific research based reading program, you can still help students crack this code by knowing the red flags and providing treatment in the areas of phonemic awareness, letter identification, sound-letter correspondence, segmenting and blending of CVC, CVCC and CCVC words, and then making appropriate referrals if adequate progress is not made. Again, speech-language pathologists are uniquely positioned to help in areas of reading, but they are primarily underutilized in this capacity. So do not forget . . .

Principle #3: You've got options (service delivery options, that is).
The continuum of roles an SLP can assume is extensive. In general, most roles fall into one of three general categories: (1) planning team member, (2) direct service provider, or (3) indirect service provider (consultant). I have two pieces of advice. First, be strategic. Initially, assume a role that best matches your degree of expertise and one that is readily available to assume in your school. If you stay alert for opportunities, they will surely present themselves. Secondly, try to assume roles in all three categories. For example, during my first year I initially assisted in the development of early literacy screenings, then provided direct services for phonemic awareness, and finally ended up consulting with special education teachers to develop appropriate reading goals for students on my caseload with academic goals on their individualized education plans. My roles progressed on their own. Early on, it was enough for me to focus solely on early literacy and phonemic awareness skills, but quickly, as my knowledge of written language grew, I began providing direct, explicit instruction in decoding skills for my students with language and learning disabilities. These types of direct experiences with reading have a tendency to keep evolving and creating an ever-increasing number of opportunities. Try not to over think it! Just stay alert, and jump in when opportunities arise. You will be pleasantly surprised how quickly you will learn and how far you will progress, but….

Principle #4: You probably need more training.
Learning how to apply your spoken language expertise to problems of our written language is not difficult, but you will eventually need direct experiences teaching reading. My strong understanding of the language underpinnings of literacy has served me well as a member of Response to Intervention (RtI) teams, and initially when performing screenings or providing phonemic awareness intervention. However, it was not

until I learned more extensively about our written language that I was able to provide direct reading intervention, remediation and assessment. University programs and other agencies are providing ever-increasing information about reading, writing, and spelling. Educational Service Centers throughout Ohio routinely provide information about dyslexia, as well as introductory training in reading programs that are recommended for the treatment of those identified with dyslexia. Many SLPs are contributing to the current body of information about reading from their own research and experience (Boswell 2010), and it is easier than ever for SLPs to take advantage of in-service education programs and literacy tracts at conferences. Training opportunities are more readily available than they once were, but before you begin any training I want you to realize one thing:

Principle #5: It's about leadership as much as it is reading.
More than anything, reading education in the schools needs great leadership. Teaching reading IS rocket science, and we need people who know what they are doing and who can also influence others. As you venture into the reading role, evaluate everything through a leadership lens. Read books on leadership. Read books on relationships. Engage people in conversations. Train yourself to think in terms of mobilizing people, mobilizing yourself, and harnessing resources. Learn to trust your intuition. Understand the complexities of change (Heath & Heath, 2007). Carefully chart your course. John Maxwell, author of *The 21 Irrefutable Laws of Leadership* (2007), uses an effective acrostic for his own navigation process.

> **P**redetermine a course of action
> **L**ay out your goals.
> **A**djust your priorities.
> **N**otify key personnel.
> **A**llow time for acceptance.
> **H**ead into action.
> **E**xpect problems.
> **A**lways point to the successes.
> **D**aily Review your plan. (p. 43).

I can say for certain, each of my successes and certainly each of my failures over the past 16 years have been in some way directly correlated to my success or failure in leadership. Maxwell says (2007), "In the end, it's not the size of the project that determines its acceptance, support, and success. It's the size of the leader." (p. 45).

If you have taken the time to read this far in the article, you have natural leadership ability whether you realize it or not. How do I know? I know because leaders are learners. It is the #1 trait that distinguishes leaders from their followers. But, …

Principle #6: Expect roadblocks.
You do not need me to list the obstacles. You know them well. You are an SLP in the schools. The job is not easy (Blood et al., 2002; Katz et al., 2010). What you do need is motivation: motivation to remove the obstacles, to work through the obstacles, or to work around them. You need motivation to embrace a new role because it is not easy, especially in the beginning. Find a student in grades three through twelve who cannot read. You will not have to look too far —they are there. They may even be on your caseload. Get to know this student as a struggling reader. Intimately experience how their reading struggles negatively impact their lives and their self-esteem. They need a game changer. Because of your strong training in phonemic awareness, the hierarchy of language development, and clinical decision-making, that game changer could be you. I became absolutely convinced early in my career that every child could learn to read given the proper screenings, early identification, and interventions in place; this has always minimized the obstacles for me. Even when it got hard, working through the obstacles has always been worth it because I have learned first-hand what is at stake for our struggling readers. But know, …

Principle #7: You need administrative support.
I ventured into literacy solo, but securing administrative support along the journey was key. Without it, I would have been met with only limited success. Working collaboratively with district leaders provides the complimentary knowledge needed to script the critical moves within the world of education to expand your reach into literacy. With Response To Intervention initiatives (RTI) and the new Third Grade Reading Guarantee legislation, which places SLPs on the list of "approved" providers of reading instruction, (Ohio Department of Education, 2014) it is now easier than ever for SLPs to participate in reading initiatives. Administrative support is key (Ehren 2007), but to get it, you need to be willing to shine the light on your

unique skill set because most people simply do not understand what we do. Which leads me to my next principle . . .

Principle #8 - Don't go-it alone.
Find your allies. Do not go-it alone! Not only do you need administrative support, but it is also invaluable to tap into the expertise and opinions of those professionals around you who are working with the same children you are on a daily basis. I have met some incredibly gifted colleagues along the way. Nobody succeeds alone. Why? No one does *everything* well. I would have accomplished little the past 16 years without the help from others. Mother Teresa summed it up best, "*You can do what I cannot do. I can do what you cannot do. Together we can do great things*" (Camp, 2010).

Principle #9 – My final principle is more of a reflection than a principle: It's worth it.
I am not passionate about reading because I know a lot about it. I know a lot about reading because I became passionate about it. Learning to read is a game-changer, but so is *not* learning to read. I have the utmost respect for the field of speech-language pathology because it is based upon the simple premise of helping others. We figure out how to improve lives. SLPs are problem solvers. Learning to read is a big problem for too many children in our schools. Despite the challenges, I do not believe you will ever regret being part of the reading solution. The students you help take from "non-readers" to "readers" will not regret it either. ♦

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Understanding Dyslexia: My Personal Journey

Cheryl Kleist

Abstract

This article recounts a mother's journey into the world of dyslexia and special education. This journey has spanned nine years to date. It all started when her oldest son was three, and he exhibited difficulty with articulation, language acquisition and fine motor skills. However it wasn't until he completed 1st grade that she realized he seemed to be also showing signs of dyslexia. This article describes her expedition into the world of special education (e.g., Instructional Support Teams, Individualized Education Plans), and independent evaluations by psychologists, speech-language pathologists and occupational therapists. She waded through a great deal of conflicting information to learn about the legal and ethical responsibilities of school systems while trying to get the school system to help her child succeed. This journey has been frustrating for her and her family, but with the challenges she found another purpose. The author has become an advocate for not only her children but for many other individuals with dyslexia.

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Looking back, my journey with dyslexia started nearly nine years ago when my sons were toddlers. I had pieces of the puzzle, but did not understand the bits of the picture that I was seeing nor how they fit together. Both of my sons had Individualized Education Plans (IEPs) for speech services by three years of age.

My Journey Begins: Connor

Connor is my oldest son. At Connor's three-year checkup, the pediatrician suggested that he needed a speech evaluation and referred me to my school district. While my son had a good vocabulary, his speech was difficult to understand, especially for those who did not interact with him on a regular basis. He qualified for an IEP, primarily for articulation problems. At the time, I was not overly concerned because I thought the articulation issues stemmed from his need to be taught how to move his mouth to make the appropriate sounds. Connor's early articulation errors were typically general articulation errors characterized by his inability to say the correct number of sounds in the correct order in multi-syllabic words. For example, he would say "bisghetti" for spaghetti and "aminal" for animal.

As time progressed, I started seeing more pieces of the puzzle, but still had no idea what they meant. We always had books available and read books to our boys on a daily basis. But for Connor, books were something that he had a tendency to destroy, even beyond preschool. He preferred to rip the pages out of books rather than to look at them. He did not like to color and showed no interest in learning how to write the alphabet. I thought that this was because he was a boy and just did not like sitting for any length of time doing something. Counting also proved to be a challenge for him; he knew the numbers, but putting them in the right sequence was a struggle. Skip counting by 2's, 5's, and 10's was very frustrating. Learning the days of the week and the months of the year in order was also very challenging for him. The one thing that perplexed me the most was that he did not know his colors, even towards the end of kindergarten. My husband is red/green color blind, so we thought that might be the issue, but testing revealed Connor was not color blind. Finally, sometime during the middle of first grade, I realized that Connor finally knew his colors, but at this point, knowing his colors was the least of my concerns.

After Connor completed his kindergarten year in Michigan, we moved to Ohio. In kindergarten, he

struggled to learn the names of the letters and did not have them completely mastered by the end of kindergarten. For Connor, learning to write the letters of the alphabet was like learning to write the letters in Greek. Not only did he not recognize the letters but he struggled to learn how to hold his pencil correctly and to form the letters correctly. To compound his struggles in writing, he began kindergarten in Michigan learning to write his letters using the D'Nealian style, but when he started first grade, his new school used the more traditional Zaner-Bloser style. Writing was very frustrating for Connor. Within the first week of school, the teacher contacted me stating that "writing slows him up" and mentioned the possibility of occupational therapy and modifying the amount of writing, but he was never screened for services. I also expressed my concern that he tended to write things backwards, especially his numbers, and questioned whether this was a common problem for other first graders. I also asked if Connor should be evaluated for dyslexia, especially because he was also having problems with sounding out words when he was reading. His teacher's response was, "Writing letters backwards is VERY common in first grade. He does struggle with some simple sight words and that can hinder his writing. He seems to struggle the most with writing assignments, but when I ask him questions orally, he is right on."

I kept in touch with his first grade teacher throughout the year, questioning his progress and stating that he was not understanding the long vowel patterns that she had introduced. He added letters that did not belong when he would read words and when he would try to spell them. Just before the end of the school year, I became concerned that Connor would regress over the summer; his teacher was also concerned. She offered, "I feel you should DO as much as you can for him this summer. He has grown so much and has amazing potential but still presents below grade level. I commend you both for how hard you work with your son." During the summer break, I worked with Connor, trying to reinforce the concepts he had learned during first grade. We practiced math facts, reading and spelling sight words. After seeing the patterns of errors that Connor was making that summer, I became more convinced than ever that he had an underlying learning disability. I also did a lot of research on dyslexia that summer. After reading the book From ABC to ADHD: What Every Parent Should Know About Dyslexia (Tridas, 2007), I became even more convinced that dyslexia was the culprit behind Connor's reading problems. The types of errors that Connor made when he was reading, such as his inability to sound out unfamiliar words, adding/deleting/substituting letters in words and his inability to recognize sight words that he had already been taught, fit a pattern of dyslexia rather than Attention Deficit Hyperactivity Disorder (ADHD).

The principal of the elementary school that Connor attended had a background in special education, so I thought that she would be a good person to discuss my concerns about an underlying learning disability. The night before the first day of second grade, at the school's Open House, I approached the principal with my concerns. I was genuinely surprised by her response as she held her hands high in the air and took a step back she said, "We do not test for, nor recognize, dyslexia". I was taken by surprise and followed up our brief conversation with the following email:

> *My son struggled in first grade, and was very inconsistent when it came to the weekly spelling/comprehension testing: sometimes he did so poorly that his teacher had to retest him verbally. He is a poor speller. He is able to learn the words (with great effort) short term for the weekly spelling tests, but does not retain the correct spelling long term. He misreads a lot of words, has difficulty remembering sight words, he gets overwhelmed by lots of words on a page and small print, has poor handwriting, and reverses letters, mainly b/d, p/q, P/9 and has told me more than once that "he cannot tell the difference, they look the same to him." He is also starting to notice that his younger brother now in 1st grade is better than him when it comes to writing and is starting to surpass him in reading. He told me his brother is reading a hard book, and when I asked what about it was hard, he said it had "lots of words on the page and the print was small."*
>
> *Thank you for taking the time to listen to my concerns and hopefully we can figure out what we need to do so my son can have a good learning foundation to build on for future success.*

In response to my request, the principal called an Instructional Support Team Meeting that included herself, his second-grade teacher, the school psychologist, the guidance counselor, the intervention reading specialist, and another second- grade teacher. At this meeting, the team informed me, once again, that the school does not recognize "dyslexia". There was no mention of evaluating for a specific learning disability. Although I suspected that Connor had dyslexia, I did not know that I needed to formally request an evaluation. I was a parent who was trying to understand how to help Connor learn to read, but all of the professionals around me dismissed my efforts to get help for my son. I felt very isolated, frustrated and confused and didn't know where to turn for help. The more I read, the more convinced I was that Connor had symptoms of dyslexia, but none of the educational professionals around me seemed to understand what I was saying or knew how to help Connor in his struggles to learn to read and write.

Second grade was a horrible year for Connor. He cried in the morning, not wanting to go to school. He complained about his stomach hurting, and was not able to eat breakfast. His pediatrician became concerned about the constant stomach complaints, so she ordered an upper GI scope and referred us to a pediatric gastroenterologist to test for gastro-esophageal reflux disease. I explained that he did not have stomach complaints during long breaks like Christmas or summer; his stomach problems seemed related to periods when he was at school. Getting him to do homework resulted in epic battles. It was not uncommon for me to spend 30 minutes arguing with him that he had to do his homework, which resulted in a meltdown before he was able to do his homework. Connor could not do the homework that he was assigned independently, so I had to guide him through it. The time spent doing homework was approximately one and a half hours per night, considerably more time than it should have taken. Connor started making comments about being stupid. It was clear that Connor's struggles in reading and spelling were beginning to affect his self-esteem. I knew enough to know that once his self-esteem became affected, that my struggles with Connor would involve much more than teaching him to read and write. I was still confused about what to do, so I turned once again to the professionals for help.

I had Connor evaluated by his pediatrician who referred Connor for evaluations in speech-language, auditory processing, physical therapy for gross motor skills, and occupational therapy for fine motor skills. The evaluation results indicated the Connor had deficits that required both speech and occupational therapy. He was also evaluated by a psychologist. Prior to the evaluation, I expressed my concern to the psychologist that I thought my son might have an underlying learning disability, specifically dyslexia, and I provided many work samples of his writing and spelling. The psychologist told me to stop reading and researching - that there was a lot of misinformation out there, and that I needed to trust the professionals. The evaluation confirmed my suspicion that Connor had ADHD, but he was not identified with a specific learning disability, instead he was diagnosed with an Anxiety Disorder. After the evaluation, the psychologist told me that I could have further testing done for Connor, but that she "would have to question my motives." In hindsight, the evaluation did not include any phonological awareness or non-word reading assessments, which I understand now, are crucial parts of an evaluation in which dyslexia is suspected.

Beginning in first grade and continuing in second grade, the school staff and I met regularly in "Instructional Support Team" meetings to discuss and monitor Connor's progress. I gave the team the outside evaluations that had been done and I was given permission to take him out of school during lunch several days a week for occupational therapy and speech services at my own expense throughout the year. His third-quarter report card stated, "His reading fluency is still a big concern, with his scores running between 33 wpm and 51 wpm. He is putting "more effort" into his comprehension and written work, but this is still a challenge for him." Little did they know that as a student with dyslexia, he was actually using nearly 5 times more brain activity just to decode and recognize words, after that there is not a lot of brain capacity left over for the higher level skills required for comprehension (Berninger & Richards, 1999). In retrospect, all of the signs for a specific learning disability in reading were present in my son's struggles, yet not once did any representative from the school suggest my son be evaluated by them for a specific learning disability. I began to realize that the professional "experts" that I had been asking for help

had a lot to learn; I realized that the time had come I had to take matters into my own hands.

I decided not to listen to the private psychologist, and continued to research, read and learn more about dyslexia. I became convinced that Connor's primary problem was that he was a student with dyslexia. I had my son evaluated by a certified Wilson tutor. She administered the Wilson Assessment of Decoding and Encoding (WADE, 2010) which confirmed my suspicion that my son was not able to read or spell unfamiliar words. In the summer of 2011, just before third grade, I took my son to a school psychologist in private practice that specialized in the diagnosis of dyslexia. She evaluated Connor and identified him as having dyslexia. Being diagnosed with dyslexia made all the difference in the world to Connor. He began to understand that the reason why he was struggling with reading, writing, and spelling was that he learned differently. The diagnosis also helped him to understand that he was not stupid, on the contrary, he was very smart but he had dyslexia. He began to understand that he just had a different kind of brain. His attitude towards school changed: he no longer cried about not wanting to go, he no longer fought me about doing homework, the stomach complaints stopped, and most importantly, he stopped saying he was stupid. While my struggles with Connor over school had eased; my battle with the school was only just beginning.

In the fall of 2011, at the first Instructional Support Team Meeting of the school year, I told the team that my son had an Independent Educational Evaluation (IEE) and had been identified as having dyslexia. I told the team that I had found a private tutor for him and was willing to pay for her to tutor Connor. While I was not asking for the structured reading tutoring that was recommended, I was asking that they give Connor a 504 Plan to help him bridge the gap between his current level of functioning and third grade expectations. I explained that according to the IEE, there was a significant gap between Connor's concept knowledge and the skills he needed for third grade. I emphasized that he required both specialized instruction and classroom accommodations to help him bridge that gap to ensure that he would have access to third-grade level material. According to the IEE, Connor was reading at a first-grade reading level, yet his cognitive and linguistic concepts were well above grade level. I also explained to the team that if Connor wanted to pursue college, he would need to demonstrate a history of accommodations in order to secure these accommodations for college board testing. I was told by the school psychologist that college was too far off and that they did not do future planning when a student was in elementary school. My request for a 504 Plan was also denied. The school psychologist also said that dyslexia was a generic term, not a term used to refer to a specific learning disability (SLD), and that dyslexia was not recognized as a diagnosis because it is not in the DSM IV. At that time, I did not understand that, not only is dyslexia listed in the federal law within the Individuals with Disabilities Education Act (IDEA, 2004) as a specific learning disability, but that it is also the most common type of specific learning disability (SLD). I have since learned that approximately 70 - 80% of students identified with SLD have symptoms consistent with dyslexia (Lowell, Felton & Hook, 2014; Moats & Dakin, 2008).

Not only did the school team members refuse to accept the independent evaluation, they also denied my request for a school-based evaluation on the grounds that there was not a large enough discrepancy between Connor's classroom performance and expected performance at grade-level norms. Further, the team members argued, that based on Connor's report cards, his grades were "average," indicating that there were no issues suggesting that Connor had a specific learning disability in reading. Yet, I knew that all of the "informal" classroom accommodations that he was receiving did not appear on his report cards. There were many times he did so poorly on his classroom reading comprehension tests, that he needed to be retested orally; his performance on the oral tests typically resulted in much higher scores. Of the three teachers present at the team meeting, two were third-grade teachers who were unfamiliar with Connor or his struggles; the other had been Connor's second grade reading intervention specialist. She stated that the testing she had conducted demonstrated that Connor was again eligible to receive Title 1 Reading services, however, the school had "limited spots" available for this intervention, and that she needed to take the students who had the lowest scores first. She went on to explain that even though Connor's test results qualified him for Title I services, he would therefore not be receiving services because there were no school district openings for him. I did not understand at the time that federal law protected Connor's right to have

access to a Free and Appropriate Public Education (FAPE, 2010) and that by denying Connor the services that he needed to have access to the general education curriculum, the school was denying him FAPE. I did not understand at that time that schools are required to provide services to all students who qualify based on the student's needs, not on the resources that school district has allocated to intervention services.

Following this meeting with Connor's school, I contacted the private school psychologist who had originally evaluated and diagnosed Connor with dyslexia, Dr. Charlotte Andrist. After hearing the description of the team meeting, including the team's refusal to accept the independent evaluation, their rationale for denying a multi-factored evaluation, and the comments they made regarding dyslexia, Dr. Andrist asked me if I would be willing to come to Columbus to tell my story. She explained that she was coordinating testimony for legislation regarding dyslexia in Ohio and currently two bills were making their way through the Ohio Legislature. The hearing for House Bill 96 was scheduled to take place before the Senate Education Committee that fall. I was surprised by her request. I did not realize there was a group spearheading dyslexia legislation in Ohio, nor did I realize that the person who had evaluated my son was the person coordinating testimony from all over Ohio, and was the president of the Central Ohio Branch of the International Dyslexia Association (COBIDA), as well. Initially, I told her that I was not willing to testify, yet the more I thought about it, the more I realized that this was an opportunity that I should not pass up (regardless of my fear of public speaking). Not many people are presented with the opportunity to testify on behalf of legislation they believe in so passionately. In addition, I thought that perhaps I could use my testimony to help my son and to educate the staff at his school. I decided to I put my fear aside and drove to Columbus to testify. As I listened to others testify, I realized that similar scenarios were playing out in schools all over Ohio, and that the situation needed to change. I also felt empowered. I no longer felt isolated and alone in my battle with my school system on behalf of my bright, dyslexic son.

The dyslexia legislation proposed before the Ohio Legislature specified the following four items to be included in the Ohio Revised Code (Ohio Dyslexia Legislation):

1. A definition of dyslexia as "a specific learning disorder that is neurological in origin and that is characterized by unexpected difficulties with accurate or fluent word recognition and by poor spelling and decoding abilities not consistent with the person's intelligence, motivation, and sensory capabilities, which difficulties typically result from a deficit in the phonological component of language." ORC 3319.80 (B) (1)
2. A three-year pilot program for the early identification and remediation of students at-risk for dyslexia and other phonologically-based reading disorders. ORC 3323.25
3. A definition and qualifications of a "dyslexia specialist" as someone who has achieved training consistent with "Level II" of the International Dyslexia Association's "Knowledge and Practice Standards" (Moats, Carreker, Davis, Meisel, Spear-Swerling, & Wilson, 2010). ORC 3319.80 (B) (2)
4. Giving Ohio's Educational Service Centers (ESC) and other educational institutions permission to hire a dyslexia specialist to provide professional development in the area of dyslexia for Ohio teachers and administrators. ORC 3319.80 (A)

A few weeks after I delivered my testimony in support of dyslexia legislation, I had another meeting with the school team. This time, my husband came to the meeting with me, but after nearly three hours, the school still refused to accept the independent evaluation or to conduct their own school-based evaluation to determine whether Connor met the requirements for either an Individualized Education plan (IEP) or a 504 Plan (Wright & Wright, 2012). I then handed the team a copy of a recent "Letter of Finding" from the Ohio Department of Education (ODE) Report (CP-0130-2011). ODE had just found the Upper Arlington School District in violation of IDEA regulations for not identifying dyslexic students. This is a violation of the federal law of "Child Find" 20 U.S.C. Sec 1412 (a)(3), (Wright & Wright, 2012). I told the team that the situation with my son was very similar and that I had been advised to file a complaint against the school on several occasions by representatives of the Ohio Department of Education - Office of Exceptional Children. I also gave the school a copy of my written testimony for the dyslexia legislation. Unfortunately,

none of this made a difference. My school continued to refuse my request for a multi-factored evaluation. Once again, I spoke directly to the district school psychologist. In her response, she inferred that Connor's difficulties with reading could be a result of his not being very bright (but how could she even assert this without ever actually having conducted an evaluation).

After the meeting, I spoke with another parent who suggested contacting the president of the school board. I contacted him and he suggested that I send an email to the district superintendent requesting an administrative review. I sent the superintendent an email explaining the situation, including the advice from ODE to file a complaint, the similarity of what was occurring in our district to the Upper Arlington case in which ODE found violations of IDEA regulations. Following that e-mail the superintendent became involved. Another team meeting was scheduled, the purpose of which was to actually sign the paperwork giving parental consent for the school to conduct the evaluation to determine if Connor qualified for services in Special Education under the category of Specific Learning Disabilities (SLD). Finally, before the end of the year, the team determined that Connor was eligible for specialized instruction. That was wonderful news . . but I soon discovered the battle was only half over. The category of eligibility was not determined at that meeting. The team simply reviewed the evaluation team report (ETR) and made the determination that Connor did indeed qualify for specialized instruction. My fear was that the school was going to focus on Connor's diagnosis of ADHD as the reason why he was not reading. This happens often when school staff does not understand dyslexia and the appropriate interventions to remediate the reading difficulties caused by it. It is much easier for them to see the observable behavioral consequences of ADHD and they have the tools at hand to address it. To prepare for this possibility, I began to read *The Mislabeled Child: Looking Beyond Behavior to Find the True Sources and Solutions for Children's Learning Challenges* (Eide & Eide, 2007). This book gave me the knowledge to refute the school's focus on Connor's diagnosis of ADHD as being the reason for his struggles to read and to successfully argue why he should be eligible for services under SLD in reading, specifically, dyslexia.

The team finally determined Connor qualified for specialized instruction under Specific Learning Disabilities in Reading Basic Skills due to dyslexia and agreed to write an IEP for him in this area. It took more than 6 months from the time of Connor's diagnosis of dyslexia, to when we were able to secure an appropriate IEP for him. I believe that the signing of the dyslexia legislation (described above) into law by Governor Kasich (December, 2011) had an important impact on Connor finally receiving an evaluation and IEP. What I failed to realize is that although I had been successful in finally getting Connor identified with dyslexia, securing appropriate intervention services for him to ensure that he would make appropriate progress in reading would be yet another battle.

My Journey Continues: Brendan

The more I learn about dyslexia, the more I realize that dyslexia is a language processing problem. However, I am also beginning to understand that although language is the crucial underlying skill required for reading, not every early language-learning problem is a sign of dyslexia. This is the case with my younger son, Brendan. He too, had early struggles in both articulation and vocabulary, but his struggles were of a very different nature than the articulation and vocabulary problems that Connor had had. Brendan's articulation problems followed a more typical developmental pattern of mispronouncing specific sounds. Brendan's biggest articulation problem was that he was unable to pronounce /tr/ - he consistently substituted /f/ for /tr/ (which was a big problem for a little boy that loved to talk about "trucks", as you can imagine). Still, there was something about the nature of Brendan's articulation problems that seemed less of a problem than Connor's had been. Brendan's articulation problems did not seem to affect his speech as much as Connor's had and people around him could understand what he was saying.

Brendan had other language problems as well. From the time that Brendan was an infant, he had problems with frequent ear infections. When he was almost three years old, he had tubes put in his ears in the hopes that this would alleviate the infections. Around that same time, I became concerned that he was experiencing hearing loss because he started responding with "what" to almost everything we said to him. He had his hearing tested several times, but the results were always within the normal range. He was also starting to talk more, but he was typically very vague and often confusing in his word usage. It was quite common for him to say, in

response to me asking what he wanted for breakfast, "I want what I had tomorrow". I was concerned about his language development and took him to a speech-language pathologist (SLP) for an evaluation. In retrospect, it should not have been a surprise when the SLP diagnosed Brendan with an expressive language disorder and slow processing speed, but it was; I had no idea what any of that meant. She explained that because he was a slow processor, he needed extra time to process what people were saying to him and, then, to process his response. She told me not to repeat myself assuming that he did not hear me, because it would interfere with his processing. She explained that Brendan had problems with word retrieval. Like Connor, Brendan received speech-language services, but unlike Connor, whose therapy focused on articulation, Brendan's speech services involved a focus on language, such as word retrieval, and using and understanding "direction words".

As Brendan entered school, he also struggled with learning to read - but not with decoding the words, as Connor had done. Brendan seemed to intuitively understand the sound-symbol correspondences of the "alphabetic principle." Brendan's problem with reading was with comprehending what he was reading. Even though my older son Connor could not decode the words that he was reading, somehow he was able to get the "gist" or main idea of a passage and could successfully answer comprehension questions. Brendan, on the other hand, seemed to be able to decode most words, but he could not answer questions about what he had just read. At his second-grade parent/teacher conference, the teacher complained that Brendan was not finishing his work in a timely matter; she also made a comment about his "laziness". I explained that his brother had just been identified as having dyslexia and that I also noticed language processing problems in Brendan, but of a totally different nature. The teacher's response was surprising, "Don't you think that he learned from his older brother? Don't you think that he is playing you?" I responded that in Michigan he had an IEP for speech and that he had difficulty with expressive language and processing speed. This information did not appear to matter to his teacher. I now felt that after all of my struggles, Connor was finally receiving the help he deserved with his dyslexia, but here the struggles were starting all over again regarding Brendan.

I had a comprehensive, independent evaluation conducted by a private speech-language pathologist. This evaluation ruled out dyslexia - Brendan scored in the 99th percentile on the Phonological Awareness Composite of the Comprehensive Test of Phonological Processing (CTOPP). Brendan's higher order language skills, however, were another story. Brendan's overall score on the Test of Language Competence – Expanded (TLC-E) was in the 4th percentile with composite scores for Expressive Intents in the 1st percentile and Interpreting Intents in the 12th percentile as compared to students his age. The results of this evaluation indicated that while Brendan was functioning in the superior range in phonological awareness and had average basic language skills as measured on the Clinical Evaluation of Language Fundamentals (CELF), he had a higher order expressive-receptive language disorder. Cognitive testing conducted using the Weschler Intelligence Scale for Children Fourth Edition (WISC IV) also indicated that while Brendan's perceptual reasoning was in the superior range (94th percentile), his processing speed continued to be slow as compared to his other abilities (42nd percentile).

I was confused as well regarding the fact that Brendan had the occasional letter/number reversals with 2/5, s/z, but he didn't have any trouble figuring out how to read new words. Was it true that reversals were a common development phenomenon? How were Brendan's reversals different than those of Connor? When do reversals predict dyslexia and when are they developmentally appropriate? Brendan had a great visual memory and did not need to put much effort into his weekly spelling tests to do very well; spelling was not a problem for him. The major problems that Brendan was having were in the areas of expressive writing, reading fluency (prosody) and reading comprehension. Writing a sentence was akin to pulling teeth. During oral reading, he would either misread the sentences altogether or skip the smaller words such as: to, the, and, if, of. Punctuation just did not seem to register. One day, he came to me and told me that what he was reading did not make sense, so I asked him to read it aloud. The passage was a dialogue between two characters in a story, but the way in which he read it sounded like he was just reading words in a textbook. I had to explicitly call his attention to the punctuation, explain what the punctuation marks meant, and how he was supposed to pause or stop after commas and periods. I even had to show him how you could tell

which of the characters were speaking. I could not help but think he sounded as if he was focusing so much attention on trying to figure out the meaning of each individual word, that he was not connecting the words in the sentence so that they made sense. It reminded me of when I would read in Spanish, I was so focused on translating each individual word as I read a passage, that by the time I got to the end of the sentence, I had no comprehension of what I had just read and had to go back and reread the sentence again. I wondered if that was what it was like for Brendan when he read. He could read the individual words but he just did not seem to be connecting meaning to the words as he read. If that was the case, it certainly explained why he had so much difficulty answering questions about what he had just read. I was still confused. What was the difference between reading and writing problems that were symptoms of dyslexia and reading and writing problems that were symptoms of an expressive-receptive language disorder?

Dyslexia and My Family History

My dad is a mechanical engineer, very good at math, not so good at spelling. I grew up with him asking me how to spell what I thought were easy words. I did not think too much about it, because he went to college for engineering, so I knew he was smart. When spell check became common on word processing programs, sometimes his spellings were so creative that even spell check could not figure them out. To this day, he is a poor speller. My dad could read, but I remembered him making comments about how reading made him tired; reading was always very effortful for him. He is not someone that likes to read for pleasure. In reviewing the definition of dyslexia in the Ohio statute, I realize that my dad has many of the classic signs of dyslexia. After reflecting back on my struggles with Connor, I now realize that my dad is dyslexic. Research has shown that there is a neurobiological basis for dyslexia and that dyslexia is genetic. It certainly runs in our family.

My brother is another mechanical engineer, but he did not have the typical signs of dyslexia in his early years. However, I do remember while growing up that he often expressed himself just as my younger son does today. Several years ago, when I was complaining about my son saying "What?" all the time, my brother commented that he did the same thing, in order to give himself extra time to think about what was being said and how he was going to respond. My brother does not struggle with spelling, but he is a slow reader. In reflecting back on my brother's struggles, I think that he is probably not dyslexic, but instead has a language disorder similar to the language processing problems of Brendan.

I am also a "math person". I have an MBA with an undergraduate degree in accounting and a minor in Spanish. I did well in school. I was reading at a high-school level by the middle of elementary school and at a college level by the eighth grade, yet to this day writing continues to be a struggle for me, and something I prefer to avoid. I loved diagramming sentences - it was so much easier to analyze a sentence than to create a sentence. It should not have been a surprise, after participating in the Ohio State University's Biology of Language Study, when I saw the results of my testing, but I was indeed shocked. I scored in the "significantly impaired" range, the 0.4th percentile, for expressive language. I know I have difficulties with word retrieval at times, and this is the primary reason that I fear public speaking, but I never imagined I was "significantly impaired." Even more shocking was my performance on a word recognition test (a key identifier for dyslexia) – I scored in the 1st percentile. This score was even lower than Connor's score in the 7th percentile. I consider him to be somewhere between moderately to severely dyslexic, but Connor has a deficit in phonological processing and I am above average in this area. I realized that my scores looked like the scores of someone with a specific learning disability, yet I never struggled in school. I always thought that I was a good reader, except when I had to read orally. I was slow, stumbled over the words and sometimes would catch myself saying a wrong word. So the more that I learn about dyslexia and language disorders, the more I realize that I probably have both. I grew up thinking there were people that either had a brain for math or a brain for language but as I read and learn more, and reflect back on my family history, I realize that it just isn't that simple.

I am still not sure why I did not have the same struggle with learning to read as my boys have had. I see the struggles my older son has with school and reading still to this day. As I reflect on his journey, I realize that the key difference was instruction. My siblings and I went to a Catholic school where reading and writing were taught very systematically and very explicitly with phonics; we had a very different type of instruction

from what my boys received in school as they were learning to read. There were no extensive sight word lists to memorize, but there was a lot of "phonics." First grade was all about "phonics," and I remember that phonics was hard for me, but in the end, I learned to read. I see some similarities between what I remembered doing in early elementary school and what I am learning in my O-G coursework. I realize now that the direct, explicit, systematic phonics instruction that I received was more aligned to structured literacy than the type of instruction that my sons received. Their instruction was based on the principles of Whole Language and Reading Recovery - which focus on teaching meaning through content, but not on explicitly and systematically teaching the basic underlying skills of reading and spelling. I understand now that instruction makes a key difference between the success and failure of students in learning to read. Reading instruction that focuses on the sounds of the English language, then pairs these sounds with the letters of our language, and practices these skills until a student can read with automaticity is crucial for students at-risk for reading failure, especially students that have a family history of reading problems such as dyslexia.

I now have four nieces and two nephews, ranging in age from two to six years old. So far, three of them started speech therapy by the time they were 3-years-old, just like my boys. The youngest one is not yet talking, only grunting and pointing. One of my nieces qualified for services due to unintelligible speech, or as my dad coined it, "Scooby-Doo speak." The other two qualified for speech services based on articulation errors (insertions, deletions and transpositions) resulting in an inability to pronounce multi-syllabic words. I understand now that these types of articulation errors can be very predictive of dyslexia. My niece and nephew also have a hard time distinguishing sounds in words. My niece likes to watch "blooty blogs" to see how to braid hair like Disney princesses. My nephew got in trouble one day for saying he was "going to piss on a rock." What he meant to say was he was "going to push the stroller on the walk." My sister is starting to become concerned that they might be showing signs of dyslexia, but when she approached their speech therapist, the SLP admitted that she did not know much about dyslexia. Then my sister met with her children's preschool teacher regarding her concerns, the teacher's suggestion was to consult with the speech therapist. The speech therapist told her she would have to get a medical diagnosis of dyslexia before the IEP could be modified. Unfortunately, this is erroneous information. The school is responsible under federal Child Find laws to evaluate a child suspected of a disability. It is instances like these that help me to understand that even though I have made progress on my own journey in understanding dyslexia, the journey is just beginning for millions of parents who are struggling to understand why their children are not learning to read and how to identify the early warning signs of dyslexia before their children fail.

Taking Action

My journey has been wrought with frustrations; the "experts" did not have answers about dyslexia nor the knowledge to help me understand how Connor's reading difficulties were different from Brendan's reading and writing problems. My children were not getting the help and support that they needed to progress in school, but no one seemed to know how to help them. I decided that if I was ever going to be able to help them, I really needed to understand more about dyslexia and how to treat it. My first step was to become active in several dyslexia related online social media groups, two of which were created by Ohio's branches of the International Dyslexia Association. I had stumbled upon them while I was trying to get the school to recognize my son's dyslexia and was very grateful for what I had learned from these groups, but the information was not always accurate. I needed to learn more so that I could understand my sons' needs in order to better advocate for them and to provide support at home. I also began to take Orton-Gillingham (O-G) courses at the Michigan Dyslexia Institute. This institute was founded by two fellows of The Academy of Orton-Gillingham Practitioners and Educators (AOGPE). The more I learned from my O-G training, coursework, and required readings, the more I was able to weed through information about dyslexia. I never realized how much misinformation continues to circulate among our educational communities.

In February 2013, I learned about a group called "Decoding Dyslexia" located in New Jersey. It is a parent-led, grassroots group interested in expanding to other states. After contacting them, I was put in touch with two other individuals in Ohio and we created the Facebook page for "Decoding Dyslexia - Ohio". My involvement with "Decoding Dyslexia" began because I wanted to help point parents in the right direction and

to help them find the legitimate information they needed to advocate for their children. I wanted to help them reduce their learning curve so that they could become better advocates for their kids in less than the nine years that my journey took. I also decided to create a website. I built it with the intention of providing information that I wish I would have had access to so many years earlier when I started my journey with dyslexia. Decoding Dyslexia has now grown to exist in all 50 states, as well as four Canadian provinces. Our basic mission is to educate, advocate, and support. There are a few states, like Ohio, that already have some dyslexia legislation, but there are many states that do not. Therefore, Decoding Dyslexia is working at both the state and national levels for legislation regarding dyslexia.

Summary Reflections

The amount of knowledge a parent needs to acquire to successfully navigate the education and special education systems is overwhelming. Luckily, I was in a fortunate position. I was a stay-at-home mom with the availability of time. Understanding dyslexia, including the early warning signs, proper diagnosis, appropriate interventions and accommodations, and the legal and ethical responsibilities of our schools and our educators, was an all-consuming, lonely, and overwhelming process. My journey has taken almost nine years, and I realize it is not yet completed. Most parents do not really stand a chance; not only is the system inherently stacked against us, but it is rife with a total lack of understanding of dyslexia.

I now realize that most school team members, including many school psychologists and speech-language pathologists, are very confused when they hear the term "dyslexia." Many think that dyslexia is a medical diagnosis that can be diagnosed only by a neurologist or medical doctor; many do not know that dyslexia is included in the federal law of IDEA under "specific learning disabilities". To compound this problem, many school psychologists and speech-language pathologists have not been trained to recognize the characteristics of dyslexia, conduct diagnostic assessments for dyslexia, or to understand that it is the most common of the specific learning disabilities (as cited above). In retrospect, I realize that much of the miscommunication and frustration I was experiencing was due to the fact that I had naively assumed that all professionals in the field of education were fully versed in the area of dyslexia. Looking back, I should have tried harder to educate the team, and help them to understand that dyslexia is the most common specific learning disability (SLD) in basic reading skills.

Language is the crucial, underlying skill required for reading. If there is a breakdown anywhere in the processing of language, reading will be impacted. Most teachers do not understand how to recognize early signs of language difficulty that very reliably predict future reading failure. Most teachers do not understand how to differentially teach a student that is struggling with basic reading skills such as decoding words, reading fluency and spelling (dyslexia) versus a student that struggles to understand what they have read (oral and written language comprehension deficits) even though they can decode the words. In addition, most teachers do not have the depth of knowledge about the structure of language that they need to successfully teach all students to read and write, especially the almost one in five students who struggle with basic reading skills (Moats & Dakin, 2008). I am much more knowledgeable about dyslexia than when I began my journey nearly nine years ago, but I feel overwhelmed and frustrated when I think about my inability to communicate this important information to so many others. We know how to find these children before they fail; we know how to teach these children to read. The urgent question before us now is: how do we communicate this information to the professionals in our schools, and provide them the resources they need in order to provide the appropriate services to dyslexic students before they fail? ♦

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A Description of Dyslexia and Profiles of Children with Reading Disabilities

12. The most widely accepted processing deficit that underlies the reading and spelling deficits:
    a. Semantic
    b. Syntactic
    c. Attentional
    d. Phonological

13. The biological bases of dyslexia is best explained by:
    a. A sensory basis
    b. A deficit in the brain's neural circuits for mapping sounds and their corresponding letters
    c. A motor deficit
    d. An environmental deficit

14. The deficits in reading and spelling that characterize dyslexia are best treated by the following approach:
    a. Motor integration therapy
    b. Visual-perceptual training
    c. Auditory training
    d. Multisensory structured language approach

15. The primary distinction between dyslexia and mixed spoken /written language disorders is the difference in:
    a. Overall spoken language ability
    b. Spelling
    c. Hand dominance
    d. Family history

Working Memory and Dyslexia

16. The processing aspect of working memory is referred to as what?
    a. Short-term memory
    b. Rehearsal
    c. Cognitive load
    d. Dynamic processing

17. Which of the items below are not part of the core executive working memory processes:
    a. Updating
    b. Naming
    c. Switching
    d. Inhibition

18. For readers with dyslexia, in which component is a deficit most frequently found:
    a. Executive
    b. Long-term memory
    c. Visual-Spatial
    d. Phonological

19. What should be taught to a dyslexic reader who cannot retain decoded phonemes long enough to blend them?
    a. Rehearsal
    b. Monitoring
    c. Updating
    d. Fluency

What we can (and cannot) learn from spelling errors in dyslexia

20. Certain speech sounds and phoneme sequences are more challenging than others to learn to spell. These include:
    a. Irregular words and words with more than 7 phonemes
    b. Homophones and contractions
    c. Initial stops in consonant clusters and single nasals
    d. Nasals and liquids, especially inside of consonant blends

21. Which are examples of phonetically accurate, orthographically inaccurate spellings?
    a. KR (car), GOWING (going), CKLOSE (clothes)
    b. K (car), GONE(going), KOZ (clothes)
    c. CAT (car), GOE (going), KZ (clothes)
    d. RK (car), GOOG (going), CLZ (clothes)

22. A high incidence of phonologically inaccurate spellings by an older student with dyslexia suggests that:
    a. The student should respond to a visual memorization approach to word learning, such as tracing and writing whole words.
    b. The teacher should emphasize morphological structures in words, to bypass the phonological difficulty.
    c. The dyslexia is relatively severe, progress will be slow, and the student needs to work on speech sound awareness during spelling instruction.
    d. Sensory-motor therapy should be tried because basic linguistic processes are so weak.

23. Research comparing the spelling of dyslexic students with younger, spelling-match controls consistently finds that:
    a. Students with dyslexia, when analyses are sufficiently detailed, can be recognized by their distinctive spelling errors.
    b. Students with dyslexia make many errors but they are not qualitatively different from normally progressing, younger students.
    c. Students with dyslexia can be recognized by the higher incidence of errors on irregular words.
    d. Students with dyslexia compensate for universally weak phonological skills by memorizing words as wholes and relying on visualization.

Dyslexia and ADHD

24. What is a deficit that distinguishes between dyslexia and ADHD?
    a. Academic achievement
    b. Intellectual Aptitude
    c. Genetic Phenotypes
    d. Phonological Awareness

25. What is the shared cognitive risk factor?
    a. Processing speed
    b. Inattention
    c. Rapid automatic naming
    d. Working memory

26. What is the reason for moving toward a multiple deficit model for neurodevelopmental disorders?
    a. Complex models are always more complete
    b. To provide a model for sorting through environmental causes
    c. There are heritable shared deficits between disorders
    d. Neuromotor functions contribute to developmental outcomes

27. All of the items below except one make it more difficult to treat dyslexia:
    a. Comorbid ADHD
    b. Slow processing speed
    c. Large group instruction
    d. Dyscalculia

Dyslexia and Language-based Learning Disabilities

28. The International Dyslexia Association (IDA) subsumes dyslexia under the overarching term _____
    a. Reading disability
    b. Language-based learning disability
    c. Specific learning disability
    d. Language disorder

29. The diagnosis of language based learning disability _____
    a. May exist in the presence of the diagnosis of reading disability or dyslexia
    b. Is another term for language delay
    c. Rules out or precludes a diagnosis of reading disability
    d. Rules our or precludes a diagnosis of dyslexia

30. For learners with dyslexia, their disorder principally would be _____
    a. Related to deficits in vocabulary
    b. Related to deficits in background knowledge
    c. Related to deficits in phonology
    d. Related to deficits in morphology, semantics, syntax and pragmatics

31. _____ theory suggest that in order to be motivated to read and to read with comprehension, readers should have some prior knowledge of the text they will be reading
    a. Learning
    b. Schema
    c. Linguistic
    d. Semantic

Helping Students with Dyslexia Learn How to Learn from Written Texts

32. When assessing reading comprehension skills, according to this article, what areas should be taken into careful consideration?
    a. School performance, metacognitive reading strategies, and writing skills.
    b. Decoding/word recognition, spoken language comprehension, and use of metacognitive reading strategies
    c. Decoding/word recognition, vocabulary knowledge, and use of metacognitive reading strategies
    d. Decoding/word recognition, attention, and use of metacognitive reading strategies

33. To guide clinicians in developing a plan of balanced intervention, according to this article, they should consider the following components:
    a. Building skills, teaching compensatory strategies, using materials from the student's curriculum, helping increase the student's motivation and interest in therapy, and involving parents
    b. Building phonological awareness through explicit instruction, classroom dynamics, using texts of high interest to the students, improving students' organizational skills, and increasing use of compensatory strategies
    c. The student's self-concept, addressing cognitive skills such as memory and attention, increasing metacognitive strategy use, and working with the students in the classroom or in the school
    d. Decoding/word recognition, oral language comprehension, metacognitive reading strategies, and reading comprehension

34. Reading with a purpose in mind includes:
    a. Thinking about strategies for decoding unfamiliar words
    b. Picturing what it is that you are reading
    c. Understanding the text structure in front of you
    d. Pausing to check your comprehension

35. Thinking about what your teacher is likely to ask on the test ties directly to which strategy?
    a. Prior knowledge
    b. Purpose
    c. Preview
    d. Picture

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The Changing Landscape of Autism Spectrum Disorders

Much has been learned about Autism Spectrum Disorders (ASD) over the decades and much has changed. Today, we have new criteria for the diagnosis of ASD, more refined assessments, and a host of evidence based practice methods available for those with ASD. Hallmark characteristics of ASD include social-communication impairments as well as restricted repetitive behaviors. In the next issue of e-Hearsay, experts review the changes and implications of the new ASD criteria and examine the influence of evidence based practice methods designed on enhancing social-communication while reducing restricted repetitive or aberrant behaviors. Specifically, Schea Fissel reviews research on changes to the DSM criteria. Dr. Diane Williams reviews and integrates findings from the behavioral and the neurodevelopmental literature that can guide our conceptualization of ASD as well as how accommodations and interventions are designed. We then examine ASD intervention from three perspectives. Dr. Andrew Shahriani examines the use of Relationship Development Intervention (RDI) while Dr. Barry Prizant and colleague report on the use of the Social Communication Emotional Regulation Transactional Support (S.C.E.R.T.S.) model to enhance self-regulation and availability for social learning. Dr. Howard Shane and colleagues present results from their research on use of visual supports to enhance language comprehension as well as behavior.

Lisa R. Audet, Guest Editor of Autism Issue

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