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Assessment of Dyslexia

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In recent years, interest has increased in the specific reading disability known as dyslexia. Frith (1999) observed: "From being a rather dubious term, dyslexia has blossomed into a glamorous topic" (p. 192). At this point in time, 39 states have some type of legislation that addresses the identification and provision of appropriate services for students with dyslexia (Eide, 2016). Furthermore, on October 23, 2015, the Office of Special Education and Rehabilitative Services (OSERS) issued a policy statement that encouraged state and local education agencies to use the term dyslexia when it is appropriate to address a child's needs. OSERS clarified that the term *dyslexia* may be used in both evaluations and eligibility documents.

School psychologists are often involved in evaluating students who have been referred for reading problems or are suspected of having dyslexia. To accomplish this task, it is important to have a thorough understanding of dyslexia, and know what factors to consider. Therefore, the purposes of this article are to describe: (a) the primary and secondary characteristics of dyslexia, (b) the most common cognitive and linguistic correlates, and (c) the concept of unexpectedness (the ability to learn when reading is not required). Information for this article was partially derived from several related sources (Mather, Stephens, & Proctor, 2016; Mather & Wendling, 2012; Proctor, Mather, & Stephens, 2015; Proctor, Stephens, Mather, & Jaffe, 2016; Texas Education Agency, 2014).

What Is Dyslexia?

The word *dyslexia* is derived from the Greek words "dys," meaning "impaired", and "lexia," meaning "word." Dyslexia is a cognitive disorder of neurological origin that is manifested in deficiencies in decoding (the ability to read single words) and encoding (the ability to spell words in print; Mather & Wendling, 2012; Vellutino & Fletcher, 2007). These difficulties lead readers to overrely on context and guess at words, resulting in slow reading and difficulties with accuracy and prosody, all of which can affect comprehension. Nearly all states identify dyslexia as a type of learning disability that warrants services through special education.

Parents and educators are often puzzled over the use of the terms *specific learning disability* versus *dyslexia* even though dyslexia is one of the specific types of disorders included in the category of Specific Learning Disability (SLD) within the Individuals with Disabilities Education Improvement Act (IDEA, 2004). Part of the confusion stems from the fact that a variety of terms are used interchangeably to describe dyslexia. In some states, it is referred to as a "specific reading disability" or a "specific learning disability in basic reading skills or rate." The *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5), describes dyslexia as an alternative term for "Specific Learning Disorder 315.00 (F81.0) with Impairment in Reading." Dyslexia is further described as "a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities." The DSM-5 also notes, "If dyslexia is used to specify this particular pattern of difficulties, it is important also to specify any additional difficulties that are present, such as difficulties with reading comprehension or math reasoning" (American Psychiatric Association, 2013, pp. 36–37).

As with all disorders, the definition and defining characteristics guide the process of identification. The following is the most commonly used definition in the United States developed by the International Dyslexia Association (IDA) and also used by the National Institutes of Child Health and Human Development (NICHD, 2002):

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.
(Adopted by the IDA Board, November 2002)

Most definitions of dyslexia identify it as a "neurobiological" disorder, meaning that the difficulty in learning to read and spell is caused by differences in brain function. The IDA definition also describes dyslexia as a problem in processing language at the phonological level (i.e., the level of individual sounds). Other, international definitions of dyslexia recognize other cognitive factors as contributing to dyslexia. For example, the British Dyslexia Association (2007) uses this definition:

Dyslexia is a specific learning difficulty which mainly affects the development of literacy and language related skills. It is likely to be present at birth and to be lifelong in its effects. It is characterized by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities.

Complicating Factors in Determining Dyslexia

The diagnosis of dyslexia is complicated in certain situations, such as when a student has dyslexia and an oral language impairment or another comorbid disability. In these cases, a student may score low on both reading and oral language measures. Often measures of nonverbal reasoning can help an evaluator determine if the low reading scores are primarily due to dyslexia or more general

cognitive impairments. High comorbidity also exists between dyslexia and ADHD (Pennington, 2009). It is often difficult, particularly with younger children, to determine if the reading problem stems from dyslexia or limited attention or a combination of the two disorders.

The diagnosis can also be complex when English is not the student's first language. Dyslexia occurs across all languages; however, it affects students differently depending on the characteristics of their language (Mather & Wendling, 2012). The nature of the writing system of a language, its orthography, impacts the reading process. Thus, the most salient characteristics of dyslexia may differ with the language. For example, shallow or transparent written languages, such as Finnish, Spanish, or German, have more predictable sound (phoneme)/letter (grapheme) correspondences; consequently, mastery of phoneme–grapheme correspondences is more easily developed in these languages. Thus, in more transparent languages, a slow reading rate is more characteristic of dyslexia than is poor phonological processing (Alvarado & Bilingual Special Education Network of Texas, 2011; Mather & Wendling, 2012; Texas Education Agency, 2014).

Another complication is the identification of gifted students with dyslexia. These students, who are often referred to as twice-exceptional learners, are often not diagnosed appropriately because they may excel in some subject areas, including reading comprehension. Strengths in oral language, knowledge, and reasoning enable them to compensate for weak decoding and encoding (spelling) skills. They may skip or misread many words when reading but still understand the gist of the material. Their difficulties in decoding may be attributed to carelessness, inattention, or limited motivation; therefore, their dyslexia is often not identified (Uhry & Clark, 2005). When evaluating gifted students for dyslexia, one needs to consider carefully the extent to which discrepancies between the student's strengths and weaknesses cause frustration and interfere with the full development of the student's abilities (Silverman, 2009, 2013). Rather than relying on below average scores on standardized tests, school psychologists can document relative weaknesses that are unexpected in comparison to the student's strengths (Silverman, 2013). Thus, a gifted student with dyslexia may obtain scores in basic reading skills in the average range and still experience a significant impairment. This is even more likely if the student has received systematic, explicit reading interventions in the past. Furthermore, a student with dyslexia, gifted or not, who has had effective intervention, may have average scores in reading, but still demonstrate a significant weakness in spelling.

A further complicating factor is that there is no one test that adequately assesses for dyslexia. School psychologists are often confronted with the challenge of assembling an appropriate set of tests from several different instruments that will contribute to a comprehensive evaluation. In addition to norm-referenced scores, an evaluation should also include other types of information, such as the type of reading instruction the student has received, informal work samples, and criterion-referenced assessments. Knowledge of the type of reading instruction helps a school psychologist judge the skills the student has been taught or should have mastered. Criterion-referenced assessments provide functional information by measuring a student's performance against a set of predetermined criteria or standards of achievement. They indicate whether a student has learned a specific body of knowledge or has acquired a specific skill set.

Primary Characteristics of Dyslexia

The primary characteristics that are typical of dyslexia are weaknesses in letter–sound associations (when beginning to read), basic reading skills (sight word identification and phonics), reading fluency (rate and accuracy), and spelling. The assessment team should assess each of these skills and describe the results in the evaluation report.

Letter–sound associations. In order to learn to read, beginning readers must understand the alphabetic principle, the concept that graphemes (printed letters) represent the phonemes (sounds) of our language—that print is "talk written down." They must know the letter names as well as their associated sounds, which provide the foundation for the development of word identification and spelling skills. Weaknesses in letter–sound associations impede development in basic reading and spelling skills. Letter–sound associations are often assessed informally by asking the student to identify the names and sounds of randomly ordered letters of the alphabet, as well as letter combinations such as digraphs, that represent only one sound (e.g., th, ea).

Basic reading skills. Basic reading skills include measures of sight-word reading and phonics. Sight-word reading involves recognizing real words instantly, without an analysis of the sounds or parts. Phonics involves using one's knowledge of letter–sound associations to pronounce unfamiliar words. This ability to apply phoneme–grapheme relationships to reading is typically measured by reading and spelling nonsense words (sometimes called nonwords or pseudowords) that conform to English spelling patterns. An evaluator often begins an evaluation for dyslexia with nonsense word reading so as to determine the student's ability to apply knowledge of phonics to unfamiliar words.

Reading fluency. Reading fluency is often described as the bridge between basic reading skills and reading comprehension (Shaywitz, 2003). The ability to read fluently requires reading words accurately and easily, with adequate rate and expression (prosody; National Reading Panel, 2000). Any evaluation of dyslexia should include two or more measures of reading fluency.

Spelling. Spelling involves many of the same skills as reading, such as using phoneme–grapheme associations and common orthographic spelling patterns; however, spelling is much more difficult since it requires the writer to reproduce the entire word rather than just recognize it. A beginning speller must mentally segment the sounds in the word, retrieve the appropriate grapheme used to represent each sound, and then produce the word (Mather & Wendling, 2012). A student with more advanced spelling skills retrieves a mental image of the entire word without having to analyze the sounds.

It is important to analyze a student's ability to spell words in a list, as well as the ability to spell words in context. Some students are able to memorize words for spelling tests, but then forget how to spell these same words when using them in written passages, or cannot attend sufficiently to the spelling of a word while simultaneously trying to express his or her ideas in writing.

Secondary Characteristics of Dyslexia

A dyslexia evaluation may also include an evaluation of reading comprehension and written expression, because dyslexia typically affects the development of these abilities. An evaluation report should specify whether or not a student's weaknesses in basic reading and spelling skills are factors contributing to his or her present difficulties in reading comprehension and written expression.

Reading comprehension. Difficulties with basic reading skills and/or reading fluency are likely to adversely impact reading comprehension. If the student can't "get the words off the page," he or she will not be able to understand the meaning of the passage. However, because many students with dyslexia have average or advanced oral language abilities, their performance often improves with increased context and meaning. Thus, a common pattern for these students on reading comprehension tests is higher scores on longer passages, lower scores on sentence-length measures, and the lowest scores on measures of single words. These scores may fall within the average or above average ranges depending on prior interventions and the student's cognitive and linguistic abilities.

Written expression. Although difficulty in written expression is not a primary characteristic of dyslexia, poor spelling may negatively affect the composition and transcription of text regarding accuracy, fluency, and clarity (Moats & Dakin, 2008). Some students limit their writing to words that they know, or think they know, how to spell. Others are unable to retain the ideas they want to express while simultaneously trying to sound out or retrieve the orthographic images of the words they want to use.

Cognitive and Linguistic Correlates of Dyslexia

The reading and spelling difficulties of students with dyslexia typically stem from underlying cognitive and linguistic weaknesses. Contributing factors may include: phonological awareness, orthographic awareness, memory, rapid automatized naming, and processing speed (Berninger & Wolf, 2009; Mather & Wendling, 2012). An evaluation for dyslexia should explore these possible cognitive correlates. The evaluator should state whether or not the weaknesses in basic reading and spelling skills appear to be related to specific cognitive weaknesses and, if so, explain the cognitive weaknesses involved and how they appear to affect these skills.

Phonological awareness. Learning to read and spell depends on the ability to perceive and manipulate the individual sounds within words. Weaknesses in phonological awareness contribute to weaknesses in basic reading and spelling skills. A critical first step in phonological awareness for beginning readers is becoming aware that speech can be divided, or segmented, into a series of discrete sounds. Another critical phonological awareness skill is the ability to blend discrete sounds to form a whole word, and to segment the sounds to spell a word. The best way to assess more advanced phonological awareness skills is through manipulation tasks that require a student to add, delete, or change sounds in words to make new words (Kilpatrick, 2015).

Two notes of caution are relevant. If the student exhibits reading and spelling difficulties and currently has average phonological awareness, review the student's history for evidence of prior interventions. Previous effective instruction in phonological awareness may remediate these skills in isolation but

the student may not yet be able to apply them to reading and spelling (Texas Education Agency, 2014). Use caution as well when evaluating students who are bilingual. These students may have weaknesses in phonological awareness due to a lack of exposure to and instruction in English language sounds, rather than having dyslexia.

Orthographic awareness. Orthography is the system of printed symbols that are used to represent a spoken language. Because it is less understood, we discuss this ability in more depth. Orthographic awareness, or orthographic mapping, is the ability to accurately form images of individual letters and the spelling patterns of our language in memory. Kilpatrick (2015) defines orthographic mapping as: "... the process readers use to store written words for immediate, effortless retrieval. It is the means by which readers turn unfamiliar written words into familiar, instantaneously accessible sight words" (p. 81).

Typically, after a reader has sounded out the same word several times, the word is converted into an orthographic image and stored, along with its sound, in memory. As the reader encounters more words, the images and sounds of frequently seen letter combinations (e.g., ing, er, tion) are also stored in memory. When the reader encounters the word or one of these letter combinations again, the image stored in memory is activated along with its sound. For example, a student may learn the words *it* and *going*. These are stored in memory. Later, when encountering the word *visiting*, *it* and *ing* are activated and only *vis* to needs to be decoded to figure out *visiting*.

A student who has a weakness in orthographic mapping is less likely to perceive and retain the patterns; thus, no image, or only a partial image, is created in memory. Subsequently, when the student sees a word or word part (even if seen multiple times before), it does not register as familiar or activate its sounds. Consequently, the student continues to depend on sounding words out for recognition, acquires sight words and irregular words more slowly, and reads less fluently.

Orthographic retrieval is the ability to recall those images from memory, as needed for spelling. Once the writer has retrieved and written the word, orthographic *recognition* indicates if the word "looks right." For example, *smoke* and *smoak* are both phonically accurate, but only one is spelled correctly. Knowing which one is the correct spelling depends on having a stable orthographic image to match it against.

Consequently, orthographic mapping is fundamental to quick and effortless word pronunciation and spelling. A student's recognition and retrieval of orthographic patterns may be ascertained by analysis of his or her patterns of responses on measures of irregular word reading and spelling. Students with a weakness in orthographic mapping are more successful in reading and spelling phonically regular words than irregular words and tend to spell irregular words the way they sound, rather than the way they look (Mather & Wendling, 2012).

Memory. Memory is the ability to store and retrieve information. Working memory involves the ability to hold information in immediate awareness while manipulating or transforming the information in some way. Associative memory is the ability to pair unrelated information to known information or to other new information and retrieve it at a later time (Schrank, Decker, & Garruto, 2016). Both working memory and associative memory can affect reading development.

Rapid automatized naming. Rapid automatized naming (RAN) refers to the ability to rapidly retrieve the names of familiar objects or symbols. A weakness in RAN can contribute to weaknesses in reading accuracy, reading rate, and reading comprehension (Wolf & Bowers, 1999). In kindergarten and first grade, early naming-speed deficits are good predictors of students who will struggle with reading fluency later in school (Wolf, 2007). This may be due to the fact that both RAN and reading involve multiple perceptual and lexical processes as well as the rapid integration of visual-verbal information. This smooth integration of visual (orthographic symbols), verbal (phonological labels and sounds), and attentional (conscious effort) systems is essential for skilled reading (Neuhaus & Swank, 2002). Weaknesses in RAN can help school psychologists differentiate students with dyslexia from other types of learning disabilities (O'Malley, Francis, Foorman, Fletcher, & Swank, 2002).

Processing speed. Processing speed refers to the speed of perception (input), speed of output (e.g., oral or motoric response), or speed of integration of perceptual, cognitive, and output processes (Mather & Wendling, 2012). Processing speed is a measure of the ability to automatically and fluently perform cognitive tasks (Schrank et al., 2016). Processing speed deficits have been noted on both linguistic and nonlinguistic tasks for students with dyslexia (Shanahan et al., 2006). Weaknesses in processing speed are directly related to weaknesses in reading accuracy and reading rate.

The Unexpectedness

One of the hallmarks of dyslexia is that its primary and secondary characteristics as well as weaknesses in the related cognitive abilities are "unexpected" in relation to the student's other cognitive and oral language abilities, and academic achievement—in other words, the ability to learn when reading is not required. This unexpectedness can be determined by comparing a student's strengths to his or her present levels of reading and spelling development. Areas of strength may include general intelligence, reasoning, oral language, mathematics, and/or knowledge.

The evaluator should consider, however, the scores of the tests that comprise any cognitive composite. If any of these tests tap weak abilities that are specifically related to the student's dyslexia, they will lower the composite score and thus reduce a difference that might suggest dyslexia. For example, if a test of phonological awareness is incorporated into a general intelligence composite and weak phonological awareness is causing the student's dyslexia, the low score on this test will also lower the general intelligence score.

General intelligence. General intelligence represents overall cognitive performance, which is a good predictor of academic potential (Schrank, McGrew, & Mather, 2014). As a generalization, many students with dyslexia have strengths in oral language and reasoning, but weaknesses in one or more of the abilities of phonological awareness, orthographic awareness, memory, RAN, and/or processing speed. Typically, the more areas of weakness, the greater difficulty the student will have learning to read and spell.

Reasoning. Reasoning ability is one of the highest order factors of general intelligence. By removing tests that involve lower-level, less complex abilities, which are frequently the cause of a reading disability, measures of reasoning and oral language can provide a better estimate of academic potential (Schrank et al., 2014).

Oral language. Oral language includes verbal comprehension, listening ability, and lexical knowledge (vocabulary knowledge). In students with dyslexia, these oral language abilities are often more advanced than their reading and spelling skills. However, caution is in order as it is possible for a student to have both a primary oral language impairment and dyslexia.

Mathematics. Mathematics indicates math achievement (quantitative knowledge), including both computational and problem-solving skills. Students with dyslexia often have higher math scores than reading scores, as long as reading is not involved. As with oral language, a student may have both dyscalculia and dyslexia.

Knowledge. Knowledge refers to stored language-based academic knowledge, as well as general world knowledge. In assessing knowledge, consider that as a student grows older, limited reading affects the development of vocabulary and the acquisition of knowledge that one normally gains from reading. This situation has been described as the "Matthew effect" (Stanovich, 1986) after the Gospel According to Matthew in that the rich (good readers) get richer (gain more vocabulary and knowledge) and the poor (poor readers) get poorer (fall increasingly behind).

In the report, the Summary and Conclusions section should indicate if the student's weaknesses in reading and/or spelling are unexpected in relation to his or her ability to learn when reading is not required. This can be followed with a statement such as: Therefore, the student demonstrates characteristics consistent with a diagnosis of dyslexia. If this is not the case, the evaluator can explain that the individual's weaknesses in reading and/or spelling are consistent with most of the student's other abilities, followed by a statement such as: Therefore, the student does not demonstrate characteristics consistent with a diagnosis of dyslexia.

Other factors that may affect determination include that the student has not had consistent effective classroom instruction, or that he or she has not had the sociocultural opportunities to acquire an adequate education compared to his or her same age/grade peers. If these are rule-outs according to state or district guidelines, the student may, in fact, have characteristics of dyslexia but may not meet the criteria for the identification of dyslexia.

Conclusion

Although formal assessment can provide useful quantitative and qualitative information, the diagnosis of dyslexia involves more than just the interpretation of a student's performance on standardized tests. To make an accurate diagnosis, the evaluation team must also consider previous instruction, any previous diagnoses such as early speech–language delays, family history (including close relatives with dyslexia), school history, teacher reports, self-reports, social and emotional status, and current classroom performance.

The evaluation team; Student Support Team; §504 committee; or Individual Education Plan (IEP)/Admission, Review, or Dismissal (ARD) committee must have an understanding of the symptoms and characteristics of dyslexia, especially because a student may have dyslexia, yet not need special education. Instead, due to the success of prior interventions, he or she may need an accommodation plan, rather than an IEP, or a parent may use the services of a private facility or tutor rather than those of the public school. A well-informed multidisciplinary school team will consider and discuss these types of situations. The key focus of the evaluation, regardless of a student's eligibility for services, should be recommendations designed to increase the student's reading and spelling skills and the application of those skills to comprehension of text and written expression. Fortunately, most school psychology training programs today require a course on linking academic assessments to evidence-based interventions (Joseph, Wargelin, & Ayoub, 2016). With accurate information, school psychologists can then help identify students with dyslexia and make recommendations that are effective in helping these students become competent readers and writers.

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