



Revisiting the definition of dyslexia

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Abstract

The International Dyslexia Association definition of dyslexia was updated 20 years ago and has been referenced frequently in research and practice. In this paper, researchers from the Florida Center for Reading Research consider the components of the definition and make recommendations for revisions. These include recognizing the persistence of word-reading, decoding, and spelling difficulties, acknowledging the multifactorial causal basis of dyslexia, clarifying exclusionary factors, and denoting comorbidity with other developmental disorders. It is also suggested that the academic and psychosocial consequences of dyslexia be highlighted to reinforce a preventive service delivery model. Lastly, the inclusion of dyslexia within a specific learning disability category is supported.

Keywords Definition · Dyslexia · Exclusionary criteria · Multifactorial causal models · Reading disabilities

The current definition of developmental dyslexia by the International Dyslexia Association (IDA) was proposed 20 years ago (Lyon et al., 2003) and has been referenced frequently in research and practice. Most states in the USA have adopted the definition in their dyslexia legislation or guidelines. Despite the widespread acceptance of the definition, it is important to revisit it on occasion to assure it continues to be aligned with current research findings. In this paper, researchers affiliated with the Florida Center for Reading Research at Florida State University comment on the various components of the IDA definition, pointing out where there continues to be support for components and where revisions are warranted. Recommendations are provided at the end of each section (italicized) and summarized in the conclusion.

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Neurological basis

The IDA definition states that dyslexia is neurobiological in origin. Reference to a neurobiological basis is important for several reasons. First, it dissuades the mistaken view that dyslexia is caused primarily by environmental factors (e.g., poor instruction) or by lack of motivation. This is not to say that environmental or motivational factors do not play a role in dyslexia. As noted below, dyslexia has a multifactorial causal basis that includes neurobiological, psychological, and environmental influences. Second, reference to a neurological origin is consistent with a large and growing body of research concerning the brain basis of dyslexia. This work has been conducted across numerous labs, using a variety of approaches, including most recently ones directed at genetics and neurochemical causes. Research clearly documents brain differences between individuals with and without dyslexia in both structure and function (Fletcher, 2009; Norton et al., 2015). These differences have typically been identified in the perisylvian and occipito-temporal regions of the left hemisphere. But differences are quite variable across studies and participants, and no specific brain-based biomarker of dyslexia has been identified (Ramus et al., 2018). In addition, most of the research has included individuals who have already experienced reading difficulties; and therefore, some of the reported differences could be the result of variability in reading experience rather than a precursor of reading difficulties. This conclusion is countered by studies finding reduced brain activity in students with dyslexia compared to younger students who read at the same level (Hoeft et al., 2006). There is also emerging evidence of neurological differences prior to reading instruction in those who later evidence dyslexia or related phonological processing difficulties (Raschle et al., 2011; Yu et al., 2022; Zuk et al., 2021). This work is quite limited compared to that involving those who already show reading difficulties. Thus, more attention needs to be given to the neurobiological precursors of dyslexia to better understand the brain basis of this condition.

The observed brain differences associated with dyslexia are not necessarily indicative of an abnormal or dysfunctional brain. There were early reports of what appeared to be abnormal brain structures in dyslexia (Galaburda et al., 1985; Humphreys et al., 1990), but most studies reveal what seem to be differences rather than deficits in brain structure and function. Some have suggested that these differences are better characterized as representing normal variation in neurological development, similar to the variation related to musical talent or physical agility (Protopapas, 2019). This variation could well have been encoded, at least in part, in the human genome for thousands of years but the impact only became apparent when reading was more widespread (Grigorenko, 2022). At that point, neurobiological variation began to contribute to a culturally valued skill and those with limitations were eventually seen as having a disability.

Recommendations

Reference to the neurobiological basis of dyslexia in the IDA definition is well supported. However, more evidence is needed to understand what aspects of the neurobiological basis are causes versus consequences of dyslexia. Also, the characterization of the neurobiological basis as a disorder or deficit should be avoided as it is in the current definition. In addition, it should be made clear that although a neurobiological basis is primary, environmental factors may also play an additive role to increase (or decrease) the likelihood of dyslexia.

Difficulties in word reading

The primary characteristic of dyslexia according to the IDA definition is unexpected difficulties in word reading, spelling, and decoding. We discuss the unexpectedness of these difficulties in a later section and focus here on the difficulties themselves, primarily those involved in word reading. One of the challenges of operationalizing this aspect of the definition is that the presence of difficulties in word reading is not a categorical condition. It is not something you have or do not have, like a broken bone. Rather word-reading ability is distributed in a continuous fashion with the majority of students at or near the middle of the distribution and smaller numbers of students toward the lower and higher ends of the distribution. As such, there is no point on the distribution that represents where typical word reading ends and problematic word reading begins. The decision concerning this point is left to practitioners, researchers, and policymakers. Some argue that the division is higher on the distribution, and that one in five children has the condition (Shaywitz, 1996), whereas many others, our group included, argue that dyslexia represents a more severe condition experienced by 5–10% of students (see Fletcher et al., 2019). Regardless, the continuous nature of word-reading ability highlights the fact that those with more severe and less severe word-reading problems are on the same continuum of word-reading ability and differ by degree. As a result, they likely share many of the same risk factors and consequences and can both benefit from intervention tailored to their needs (Catts & Petscher, 2022). Thus, the current national focus on dyslexia could have wider implications for all readers on the lower end of the word-reading distribution.

Nature of word-reading difficulties

The nature of the word-reading difficulties associated with dyslexia varies with the orthography being read (Seymour et al., 2003; Ziegler & Goswami, 2005). The complexity of the orthography affects early reading acquisition, with difficulty increasing as the orthography moves from simple to complex in syllabic structure and from shallow to deep regarding inconsistencies and complexities in orthography-to-phonology relationships. English tends to be an outlier in terms of alphabetic orthographies in that it is both deep and contains complex syllable structure. This puts particular pressure on developing readers who are reliant on applying orthographic-to-phonological relationships to read unfamiliar words. Seymour et al. (2003) reported that the acquisition of word recognition and decoding skills occurs more slowly in deep orthographies (e.g., English, French, Portuguese) than in shallow orthographies (e.g., Finnish, Greek, Italian, Spanish). The effect of the orthographic complexity also impacts the primary symptoms of dyslexia. In shallow orthographies, such as Spanish, in which there is a consistent relationship between speech sounds and symbols, individuals with dyslexia have particular problems with the speed of word reading. In more opaque orthographies such as English, those with dyslexia show persistent problems in both speed and accuracy of word reading.

Descriptions of the diversity in written language systems and the impact on acquisition are deeply entrenched in Anglophone and Eurocentric/alphabetocentric perspectives. Little consideration is given to non-European writing systems promoting a one-dimensional view of script variation, namely, spelling–sound consistency (see Daniels & Share, 2018). Reductionist approaches to describing similarities across orthographies suggest that writing systems show a certain amount of accommodation to the properties

of the language they represent (see Verhoeven & Perfetti, 2017), with the understanding that reading universally involves phonology at the lowest level allowed by the writing system (Perfetti, 2003). As such, dyslexia in non-alphabetic languages varies in how the writing system makes demands on both phonology and non-phonological systems. For instance, while Chinese reading depends on basic phonological skills of the readers, it also places unique demands on orthographic skills and knowledge sources. Specifically, visual-orthographic processing difficulties have been suggested to be associated with dyslexia in Chinese (see McBride et al., 2022). Although our focus here is on possible revisions to the current IDA definition of dyslexia, it is important to consider that some of the limitations associated with the current definition may extend to other non-alphabetic orthographies, whereas others may not.

Returning to English, much of the ambiguity associated with pronunciation concerns vowels, with variation being resolved by considering the consonantal context in which vowels occur (see Venezky, 1999). In a corpus analysis, Kessler and Treiman (2001) found that the consistency of vowel pronunciations increases significantly when the syllable coda is considered. There is a large body of evidence suggesting that English requires developing readers to process multiple grain sizes between orthography and phonology to help resolve vowel ambiguity (e.g., *beat* vs. *head*; see Ziegler & Goswami, 2005). Thus, the evolution of decoding skills to support the use of multiple grain sizes between orthography and phonology allows vowel pronunciations to be “tuned” to represent the probabilistic constraints of the orthographies (see Steacy et al., 2019; Treiman et al., 2006). Difficulties with phonological skills associated with dyslexia limit the growth of important decoding skills at multiple grain sizes, which results in children with dyslexia exhibiting a general tendency to process only partial information about words and to further rely on other sources of information that are considerably less efficient (see Harm & Seidenberg, 2004; Stanovich, 1984). This is consistent with the view that children with dyslexia may be over-reliant on a global processing strategy that affords insufficient attention to individual letters or groupings of letters (Compton et al., 2014; Ehri & Saltmarsh, 1995) and the corresponding phonological representations. Furthermore, a lack of sufficient attention to orthographic-to-phonological connections when reading words limits the ability of children with dyslexia to tune vowel pronunciations to better represent the probabilistic constraints of the orthographies (see Steacy et al., 2021a, 2021b; Steacy et al., 2021a, 2021b), significantly limiting word reading development over time. Thus, linguistic complexities related to English orthography, along with phonological processing difficulties associated with dyslexia, result in a unique set of symptoms involving word reading.

Another aspect of word-reading difficulties that should be considered in defining dyslexia is the persistence of these difficulties. At the beginning of instruction, a sizable number of children may score at the lower end of the distribution and below a designated cutoff score (Catts et al., 2009). Some of these children will have dyslexia, whereas others will be off to a “slow start” because of other factors, such as limited preschool literacy experience or speaking one or more languages at home that differ from the language of instruction in school. With quality instruction and experience, most children will respond well in the short term and no longer perform below the cutoff score in word reading (Blachman et al., 1999; Kieffer, 2008). However, for children with dyslexia, it is expected that without early, intensive, and ongoing intervention, word reading, decoding, and spelling problems will persist, even into adulthood (Shaywitz et al., 1999). Even with such instruction, children with dyslexia may continue to experience some difficulties, especially in spelling (Maughan et al., 2009). Therefore, including the notion of persistence in defining dyslexia

should help differentiate children with dyslexia from those who initially show some word-reading limitations but who later perform in the expected range.

Word-reading difficulties as a synonym for dyslexia

Rather than including word-reading problems as a symptom of dyslexia, some have argued that dyslexia is best thought of as a synonym for a reading disability (Elliott & Grigorenko, *in press*; Protopapas, 2019). According to this view, dyslexia is not considered a condition that underlies word-reading difficulties but rather the name or label for the disability. This view does acknowledge that the disability is not due to a lack of reading instruction or the result of an intellectual, hearing, or visual disability. A definition focusing on word-reading difficulties is more easily operationalized in most contexts and is especially well suited for educational settings. Schools are well equipped, for the most part, to assess and evaluate reading performance. Defining dyslexia exclusively on the basis of difficulties learning to read words could provide educators with a clear target for diagnosis and intervention. Of course, decisions still would need to be made concerning how severe and persistent the word-reading difficulties need to be, but focusing specifically on children's reading development could take some of the mystery away from dyslexia and offer clear directions for educational practice.

However, defining dyslexia on the basis of reading difficulties alone has some potential shortcomings. Primary among these is the lack of consideration of the cognitive precursors associated with dyslexia. Whereas it is acknowledged below that these precursors are often quite variable, taking attention away from them has implications for early identification and treatment. Word-reading measures often have floor effects in the early stages of learning to read, and as such, it can be difficult to determine which children will have persistent difficulties based on these measures alone (Catts et al., 2009). Therefore, also considering underlying cognitive factors could provide useful information for early identification. Specifically, early difficulties in phonological processing and other aspects of oral language often foretell word-reading problems and could serve to identify risk for dyslexia prior to reading failure (Catts et al., 2015; Compton et al. 2006). Furthermore, linguistic difficulties associated with dyslexia can impact academic performance well beyond word reading. For example, limitations in phonological memory can be especially problematic for listening comprehension across a variety of academic situations such as teacher-directed oral reading or note taking and comprehension of classroom discourse or lectures. Phonological memory difficulties can also impact reading comprehension. Thus, failing to acknowledge limitations in phonological processing and other precursors could lead to these problems being ignored in intervention.

Recommendations

The primary characteristic of dyslexia is severe and persistent difficulties in the accuracy and/or speed of word reading, decoding, and spelling. The continuous nature of word-reading ability should be taken into consideration in operationalizing the definition. Whereas there are some advantages to defining dyslexia solely on the basis of word-reading difficulties, definitions should also specify potential underlying causal factors to assure early identification and intervention to address difficulties beyond word reading. More evidence is needed, but such a definition may better distinguish children who are at risk for persistent reading difficulties from those with more short-term difficulties.

Difficulty with the phonological component of language

The current IDA definition proposes that word-reading difficulties “typically result from a deficit in the phonological component of language.” Indeed, there is considerable evidence of a link between dyslexia and significant difficulties in the storage, retrieval, and awareness of the sounds of language (Melby-Lervåg et al., 2012; Peterson & Pennington, 2012; Snowling et al., 2019). Whereas the evidence linking phonological processing difficulties to dyslexia is quite strong, there is notable inconsistency in the association (Catts et al., 2017; Pennington et al., 2012; Snowling, 2008; Snowling & Melby-Lervåg, 2016). This work suggests that not all individuals with dyslexia have difficulty with phonological processing and not all those who demonstrate such difficulties develop significant word-reading problems. There are, however, alternative explanations for finding inconsistency in the association. First, when cut-points are placed on continuous distributions, measurement errors can produce spurious changes in classification from one time or measure to the next. Second, when groups are defined by extreme scores in phonological processing or reading at time one and the other at time two, regression to the mean will produce additional spurious changes in classification. It should be possible to model the magnitudes of these spurious effects and thereby determine the extent to which true differences in classification exist. Regardless of the outcome of this work, there is growing evidence that factors beyond phonological processing play a causal role in dyslexia. These include limitations in oral language (Price et al., 2022; Snowling & Melby-Lervåg, 2016), processing speed (Norton & Wolf, 2012), visual processing (Bosse et al., 2007; Joo et al., 2018), and procedural learning (Lum et al., 2013; O’Brien & Yeatman, 2020; but see West et al., 2021). Family history and environmental factors, such as childhood trauma, heavy metal exposure, and poverty, have also been linked to reading difficulty (Blodgett & Lanigan, 2018; Delaney-Black et al., 2002; Evens et al., 2015; 2016). As noted above, the latter adverse environmental factors are not viewed as primary causal factors, but can interact with other risk factors to increase the likelihood of experiencing severe and persistent reading difficulties.

Collectively, these findings have led to the proposal of multifactorial causal models of dyslexia (Catts et al., 2017; Catts & Petscher, 2022; Compton et al., 2006; O’Brien & Yeatman, 2020; Pennington, 2006; 2012; Snowling, 2008; Spencer et al., 2014; van Bergen et al., 2014). These models propose that multiple factors combine and interact to increase the probability of difficulty in learning to read. As such, multifactorial causal models are probabilistic rather than deterministic. In other words, multiple risk factors work in conjunction to increase the probability of difficulties in learning to read rather than any one factor or combination determining that an individual will have these difficulties (Catts & Petscher, 2022). In addition, risk can be moderated by positive influences that serve as protective or promotive factors to counteract risk factors (Haft et al., 2016).

In multifactorial causal models, phonological processing difficulties continue to be viewed as a prominent causal factor, but other factors operate in combination with it, and, in some cases, in place of it, to increase the likelihood of dyslexia (Catts & Petscher, 2022). Such a proposal is consistent with recent arguments that developmental disorders in general are best explained by a constellation of strengths and weaknesses rather than “core deficits” (Astle & Fletcher-Martin, 2020). This would seem to be especially true for difficulties with reading development. The development of accurate and fluent word-reading abilities relies on numerous linguistic, cognitive, socioemotional, orthographic, and instructional factors that act and interact in various ways and change over time (Cain et al., 2017; Catts & Petscher, 2022). As such, difficulties in learning to read are likely due to

individual differences and experiences across many factors. An important implication of the multifactorial causal basis of dyslexia is the recognition that there is variability in the cognitive and neurobiological presentation of the condition. That is, beyond word-reading difficulties, there will be no consistent cognitive or neurobiological profile or profiles that characterize those with dyslexia. These individuals will vary in their cognitive strengths and weaknesses and environmental influences that have led them to have difficulties in learning to read. Highlighting the multifactorial basis of dyslexia also allows the definition to apply to both alphabetic and non-alphabetic writing systems. Whereas phonological processing difficulties are also a risk factor in the latter orthographies, other factors (e.g., visual-orthographic processing) may play a more prominent role (McBride et al., 2022).

Recommendations

The IDA definition should highlight the multifactorial causal basis of dyslexia, while also referencing phonological processing as a primary difficulty given its strong support as a causal factor. We also prefer the phrase “difficulty in phonological processing” rather than “deficit in the phonological component of language.” The latter suggests a more general disorder in phonology rather than the specific variation in phonology associated with dyslexia. Moreover, difficulty with the phonological component could include an articulation disorder, which is not central to dyslexia, but may sometimes be present as a comorbid condition.

Exclusionary criteria

The IDA definition also states that “a deficit in the phonological component of language is unexpected in relation to other cognitive abilities and provision of effective classroom instruction.” Most definitions of dyslexia include exclusionary criteria such as these, but these criteria are typically in reference to word-reading difficulties, not difficulties with phonological processing. This distinction may not be problematic for some when referencing phonological abilities relative to “other cognitive abilities,” but as discussed below, there is still disagreement concerning this criterion. What is particularly problematic with this part of the definition is the implied relationship between difficulty with phonological processing and effective reading instruction. Indeed, reading instruction, once underway, has been shown to impact phonological processing (Hogan et al., 2005), but the phonological processing difficulties that often underlie dyslexia are generally believed to be constitutional in origin and independent of reading instruction (Snowling et al., 2019; cf. Castles & Coltheart, 2004). This does not take away from the importance of considering reading instruction in the identification process; rather it requires that reading difficulties and not phonological processing difficulties be unexpected on the basis of effective classroom instruction.

Referencing instruction

The IDA definition does include an important qualifier concerning instruction. Specifically, it states that instruction should be “effective.” A criterion related to effective instruction is an important part of the definition because it helps to distinguish between those children who have not been taught to read from those who have been taught but have not learned to

read. Without such a qualification, children who experience less than optimum early reading instruction could be wrongly identified as having dyslexia. Reports that many children find themselves in such conditions should encourage caution in considering how best to account for the role of instruction in the identification of dyslexia (Seidenberg, 2017).

Even with the qualifier of effective instruction, there is the challenge of quantifying it. Research clearly documents the components of effective instruction in word reading, which has been captured in meta-analytic summaries (Suggate, 2016; Wanzek et al., 2016), and increasingly, teachers are being trained in how to use them (Drake & Walsh, 2020). However, there are important obstacles that limit the transmission of increased teacher's knowledge that result in variability in quality of instruction (e.g., Denton et al., 2003). This variability is seldom well quantified and incorporated into decisions concerning dyslexia identification. For example, in practice, eligibility decisions are rarely focused on how well teachers are teaching and only coarsely measure response to instruction via progress monitoring. Such distinctions may not be worrisome for decisions involving students with the most significant word-reading difficulties, but it could be problematic for decisions concerning students performing slightly above or slightly below a cutoff score or students who encounter many challenges to reading achievement in school. More attention needs to be given to how to account for the quality and quantity of instruction in diagnosing and identifying dyslexia.

Referencing intelligence

As noted above, the IDA definition references “other cognitive abilities” in defining dyslexia, but does not specify them. This lack of clarity can be problematic in practice. For example, there is a long and well-documented history of educators, clinicians, and families conflating “cognitive abilities” and “intelligence,” even relying on the now debunked IQ-achievement discrepancy to determine diagnosis of learning disabilities, including dyslexia (Mercer et al., 1996; Stuebing et al., 2002). Although requirements for an IQ-achievement discrepancy have been removed from some definitions and eligibility criteria for dyslexia, intelligence is often still referenced. One need look no further than the definition in the 21st Century Dyslexia Act (2021–2022), a bill introduced in the 2021–2022 US Congress to designate dyslexia as its own category within Individuals with Disabilities Education Act (IDEA). This bill defines dyslexia as characterized by “... unexpected difficulty in reading for an individual who has the intelligence to be a much better reader.” Unfortunately, many are drawn to this way of conceptualizing dyslexia, especially given the portrayal of highly intelligent or creative individuals with dyslexia in popular media (e.g., Davis & Braun, 2004; Eide & Eide, 2023). To be clear—there are extraordinary individuals with superior intelligence who also have dyslexia. However, like the majority of the population, most individuals with dyslexia have normal or even below normal intelligence (Siegel & Himel, 1998). Furthermore, children with dyslexia who have lower IQs demonstrate reading difficulties, underlying causal factors, and instructional response patterns similar to children who have higher IQs (Stuebing et al., 2015; Tanaka et al., 2011).

Referencing listening comprehension

Given the limitations of applying an IQ-achievement discrepancy to the definition, researchers have proposed using differences between listening and reading comprehension levels as an alternative criterion (Badian, 1999; Erbeli et al., 2018; Stanovich, 1991;

Wagner et al., 2020). Importantly, poor reading comprehension relative to listening comprehension may have a functional use in educational contexts. One example is the provision of assistive technology. Assistive technology in the form of text-to-speech improves reading comprehension for individuals with reading disabilities, including dyslexia (Wood et al., 2018). However, there is no reason to expect that listening to text-to-speech would be helpful for individuals whose listening comprehension is no better than their reading comprehension. In addition, an individual who demonstrates difficulty with both listening and reading comprehension would seem to have a greater need for language enrichment or intervention than would an individual whose difficulties are limited only to reading. These distinctions could inform both identification and treatment of reading difficulties and disabilities, including dyslexia.

Wagner and colleagues (2020, 2022) investigated these possibilities in a series of studies examining the population prevalence of dyslexia operationalized as reading comprehension that is worse than listening comprehension. Obviously, other operationalizations of unexpected poor reading could have been used; however, their reasoning was quite simple: if one struggles to read the words on the page fluently, then reading comprehension should be worse than listening comprehension. Three main conclusions emerged from these studies. First, samples of poor readers will contain more readers whose reading is consistent with their listening comprehension than unexpected poor readers. Second, individuals with unexpected poor reading can be found across the distribution of reading performance. Individuals with well-above-average language skills who struggle with word-level reading may demonstrate relatively poor reading compared to oral language but still perform near average relative to peers. Third, the prevalence of dyslexia is better represented as a distribution that varies as a function of severity as opposed to any single number. Moreover, that distribution can be modeled and used for identification purposes (Wagner et al., 2023). One challenge facing a discrepancy approach like this is the complexity of measuring reading and listening comprehension. There can be considerable variability from one measure of comprehension to the next (Cutting & Scarborough, 2006; Keenan & Meenan, 2014). As such, if measures are not carefully chosen and matched, interpretation of discrepancies between reading and listening comprehension can be compromised.

Referencing race, ethnicity, linguistic diversity, and poverty

The IDA definition states that dyslexia is a specific learning disability (SLD), aligning it with the SLD category of IDEA. Although the IDA definition makes no mention of race, linguistic diversity, or poverty, IDEA does so explicitly, stating that SLD does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of intellectual disability, of emotional disturbance, or of environmental, cultural, or economic disadvantage (Individuals with Disabilities Education Act, 2004). Reauthorizations of IDEA go one step further, requiring states to monitor regularly whether “significant disproportionality” based on race and ethnicity is present at the state and local education agency levels for three indicators: (1) identification of children with disabilities, (2) placement of children with disabilities in educational settings, and (3) incidence, duration, and type of disciplinary actions for children with disabilities.

On the surface, these exclusionary criteria are important, scientifically and practically. They help to clarify the genesis of the reading difficulty that children may be experiencing and inform how it might be best treated. Yet, despite these provisions in the law and in policy, disproportionality in special education by race and ethnicity has been observed for

over half a century (Skiba et al., 2016; Terry et al., 2023; Office of Special Education Programs, 2023). The evidence base exploring factors that may contribute to disproportionality is mixed. Historically, research findings have pointed to a general over-representation of students from specific race and ethnic subgroups (Cruz & Rodl, 2018; Sullivan & Bal, 2013). Alternatively, recent research findings have pointed to a general under-representation (Morgan et al., 2015, 2017). Differences in the findings make clear that disproportionality is complex and multi-dimensional, and requires approaches that elevate the intersectionality of factors associated with the educational experiences of racially, ethnically, culturally, and linguistically diverse students with disabilities, including dyslexia. Multifactorial causal models of dyslexia, like those proposed earlier, may prove quite beneficial in this regard.

It is in this context that we argue that the definition of dyslexia either as an SLD, as currently operationalized in IDEA, or as a separate category, as operationalized in proposed legislation, should attend explicitly to issues of race, ethnicity, linguistic diversity, and poverty. Certainly, one way to address this issue is to take an inclusionary approach rather than an exclusionary one. That is, the definition could state explicitly that dyslexia occurs across all languages, races, ethnicities, and socioeconomic categories. A proportion of students in all these groups will experience a severe and persistent reading difficulty that requires intensive support across the lifespan to treat the condition in the classroom, in the home, and in the workplace. However, such statements alone do little to address systemic and historical biases that permeate the identification, eligibility, and treatment processes. Indeed, there is not only evidence of over- and under-representation of specific student populations in eligibility categories but also evidence that the provision of services for treatment of these conditions differs for these groups (Terry et al., 2023). Simply put, even when provided with an IEP to treat dyslexia, some student groups are much less likely to receive effective intensive interventions that adequately respond to their needs. Such findings complicate the execution of our recommendations that, for example, the quality of instruction be considered in the definition. It will be difficult to validly and reliably identify dyslexia in conditions where some groups of students are neither receiving appropriate instruction in the classroom to simply learn how to read nor receiving appropriate intervention in more intensive settings when they have been taught but have not learned to read.

The persistent disproportionate representation of students from specific race and ethnic subgroups suggests that, in practice, the decision-making process is influenced by social factors that promote bias and discrimination. Meanwhile, the persistent under-representation of students from these subgroups in research suggests that, in science, the generation of rigorous, relevant, and generalizable evidence to address their needs as individuals with dyslexia is inadequate (Lindo, 2006; Sullivan et al., 2020). Researchers have warned of the limitations of taking a color-blind approach to studying development, disability, and educational achievement (Bruno & Iruka, 2022; Muthukrishna et al., 2020; Terry et al., 2023). Educators, too, should heed these warnings, as the negative consequences are quite real for diverse learners with heterogeneous, developmental disabilities like SLD and dyslexia. Popular media reports of dyslexia as a condition reserved only for White and affluent families, as well as the difficulties children and families from historically and systemically marginalized schools and communities face when trying to acquire appropriate diagnosis and treatment, are becoming commonplace (Carr, 2022a, 2022b). These reports create uncertainty about whether or not children in specific subgroups can or even should receive a dyslexia diagnosis and about whether or not dyslexia is a real condition at all (Kale, 2020).

Indeed, it is plausible that the exclusionary criteria were intended to offer specificity on dyslexia, for research and for practice. Yet, emerging evidence suggests that dyslexia

is a heterogeneous, developmental condition that may present differently in individuals across the lifespan. Thus, dyslexia can be present even in the absence of adequate learning opportunities in the classroom; even in the absence of optimal environmental conditions in homes, schools, and communities; and even in the presence of poverty, linguistic diversity, and racism. Although the available evidence does not provide a clear understanding of the mechanisms by which disproportionality emerges for specific student subgroups or how best to attenuate it, it seems clear that the exclusionary criteria in their current form are disproportionately unresponsive to the needs to subgroups of students and may contribute to many students not receiving the services to which they are entitled. We can offer no easy answers about how these specific exclusionary criteria should be addressed in law, policy, or the definition of dyslexia. We are certain, however, that the bias inherent in it cannot be ignored.

Recommendations

The IDA definition should be revised to compare effective reading instruction to word-reading difficulties and not a phonological deficit. Some members of our group also suggest that reference to “other cognitive abilities” be dropped from the definition to discourage the use of IQ-achievement discrepancy as a defining characteristic. Others propose the use of a discrepancy between reading and listening comprehension be included as a characteristic of dyslexia. Finally, we suggest that the definition makes explicit the intersectionality of the disability with factors like race, ethnicity, culture, linguistic diversity, and poverty and its consequences for identification and treatment of dyslexia.

Secondary consequences

Students with dyslexia face a host of negative consequences. Some are directly related to their word-reading difficulties, such as challenges with vocabulary and reading comprehension (Stevens et al., 2022) and written composition (Hebert et al., 2018). Others are indirectly related to their word-reading difficulties, such as challenges with self-esteem, anxiety, and depression (Arnold et al., 2005; Jorden & Dyer, 2017; McArthur et al., 2020; Morgan et al., 2012). These academic and non-academic challenges can make students with dyslexia more vulnerable to experiencing poorer school achievement and overall school success, including an increased likelihood of experiencing behavioral problems, dropout, truancy, delinquency, and incarceration (Baker & Ireland, 2007; Daniel et al., 2006; Grigorenko, 2006). These negative consequences, which are commonplace, are just as concerning as the primary word-reading difficulties and can seriously impact the overall quality of life of individuals with dyslexia. These consequences should be highlighted in the definition of dyslexia, both because they often accompany the condition and because attending to them can prevent or limit their impact.

Recommendations

The IDA definition currently includes secondary consequences related to reading comprehension, growth in vocabulary, and background knowledge. These consequences should be expanded to include poor academic achievement and the psychosocial impact

of dyslexia. Such explicit recognition is needed to draw attention to these consequences to prevent or reduce their impact.

Comorbidity

Dyslexia often co-occurs with other developmental conditions (Moll et al., 2020). Specifically, children with dyslexia have been shown to have a higher-than-expected occurrence of speech sound disorder (SSD; Cabbage et al., 2018; Pennington & Lefly, 2001). SSD is a phonological disorder with different symptoms from those typically described as part of the phonological basis of dyslexia (e.g., Farquharson et al., 2018). SSD involves the persistent and systematic deletion, substitution, and distortion of speech sounds, which can decrease speech intelligibility compared to same-age peers (Shriberg & Kwiatkowski, 1994). Children with dyslexia may also show subclinical difficulties with word-specific errors, such as mispronouncing “animal” as “aminal” or “specific” as “pacific,” long after correct productions are age appropriate (Catts, 1989; Farquharson et al., 2021).

Many individuals with dyslexia can have language problems that extend beyond phonology (Catts et al., 2005; Snowling & Melby-Lervåg, 2016). These difficulties vary in intensity from mild to clinically significant. Some children with dyslexia are “late talkers” who have a limited vocabulary and produce few two-word combinations by 2 years of age (Lyytinen et al., 2005; Price et al., 2022). Children who show these early language delays may continue to have difficulties in learning, understanding, and using oral language and can be diagnosed with developmental language disorder (DLD; McGregor, 2020). These children have the most severe forms of a language impairment and represent about 5–10% of the population (Tomblin et al., 1997). Their language problems are not explained by other conditions, such as hearing loss or autism, or by a lack of exposure to language. Despite the life-long nature of DLD and its impact on academic and social development, it remains an underserved condition (McGregor, 2020).

Numerous studies have documented the increased prevalence of DLD in children with dyslexia (Catts et al., 2002, 2005; McArthur, et al., 2000; Price et al., 2022; Snowling & Melby-Lervåg, 2016). Prevalence ranges from 30% in population-based samples of dyslexia (Catts et al., 2005) to near 50% in clinical samples (McArthur, et al., 2000; Price et al., 2022). Research shows that children with dyslexia and comorbid DLD have more severe word-reading problems and reading difficulties in general than those with dyslexia alone (Adlof et al., 2021; Duff et al., 2022). These findings suggest that early spoken-language difficulties should be considered a risk factor for dyslexia.

Beyond oral language problems, individuals with dyslexia have a higher incidence of attention deficit hyperactivity disorder (ADHD) and math disorder (MD). Research shows that the bidirectional comorbidity between dyslexia and ADHD is 25–40% (McGrath et al., 2020). Furthermore, it is estimated that children with MD are twice as likely to have dyslexia as those without MD (Joyner & Wagner, 2020). Because of the increased prevalence of SSD, DLD, MD, and ADHD in dyslexia, these conditions might serve as additional criteria for identifying dyslexia in diagnostic evaluations. There is research evidence for this approach. For example, Spencer et al. (2014) found that a multifactorial model of dyslexia that included the presence of comorbid conditions of MD and ADHD showed greater longitudinal stability of reading difficulties than did an alternative single-indicator model.

Recommendations

Other developmental disorders are often comorbid with dyslexia. Whereas these disorders are not a defining characteristic of dyslexia, their presence has the potential to improve the diagnosis and subsequent treatment of the condition and should be noted as such, even if not part of the definition.

Dyslexia as a specific learning disability

As discussed previously, the IDA definition states that dyslexia is an SLD, consistent with its inclusion in IDEA. However, the 21st Century Dyslexia Act (2021–2022), recently introduced in the US Congress, proposes to designate dyslexia as its own category within IDEA. This yet-to-be-enacted bill also called for adding a new provision in IDEA that clarified the obligation to provide equal access to accommodations or services for children growing up in low-income households. Proponents argue that this will draw more attention to dyslexia and ensure early identification and intervention for all children with the condition.

It is not clear whether this law is needed or if it will result in positive changes for students with dyslexia. All but two states have recent legislation covering one or more aspects of dyslexia, including early identification, intervention, and preservice and in-service teacher training (National Center for Improving Literacy, 2023). Through IDEA, dyslexia is defined and recognized in state legislation as a specific condition and services are mandated to address students' needs. State definitions and guidelines also avoid provisions that would limit identification and services for children growing up in poverty or low-income households, children who are multilingual or emerging bilinguals, and children who are from race-, ethnic-, and cultural-minority groups. Thus, federal legislation may have little additional impact on services for individuals with dyslexia; that is, it may not change everyday practices that promote or protect achievement and school success among students with dyslexia. Furthermore, removing dyslexia from the category of a specific learning disability separates it from other related learning disabilities. As noted above, individuals with dyslexia frequently have comorbid conditions that are included in the definition of a specific learning disability (e.g., math disabilities). As we argued above, recognizing the presence of these comorbid conditions could lead to more accurate diagnosis of dyslexia (Spencer et al., 2014; Wagner, 2018). Classifying dyslexia as a specific learning disability could better ensure that intervention will address not only word-reading difficulties but also limitations associated with comorbid conditions.

Implication for services

Definitions of dyslexia do not directly address provisions for services, but they do provide guidance for practice. For example, specifying primary characteristics and exclusionary and inclusionary criteria can influence procedures for identification and diagnosis. Additionally, highlighting secondary consequences can impact intervention services. We have considered the implications for services explicitly in our suggested revisions for the IDA definition. Specifically, a primary reason for including the educational and psychosocial

consequences of dyslexia in a revised definition is to motivate a preventive and comprehensive approach to identifying and treating dyslexia (Catts & Hogan, 2021; Zijlstra et al., 2021). The negative consequences we noted above are serious and have a significant impact on the quality of life for individuals with dyslexia. Consequently, it is important that efforts be in place to identify risk for dyslexia prior to reading failure and to ensure that intervention is available to address both reading challenges and secondary consequences. Research has shown that screening can accurately identify risk for dyslexia as early as kindergarten or beginning of 1st grade (Catts et al., 2015; Compton et al., 2006; Lyytinen et al., 2015) and that false positives can be addressed by follow-up testing and monitoring response to instruction (Gellert & Elbro, 2017; Miciak & Fletcher, 2020). Furthermore, drawing attention to word-reading problems as the primary characteristic of dyslexia has implications for intervention. This is especially true for the inclusion of problems in decoding and spelling. Instructional practices to support students with dyslexia should focus on building the skills necessary to promote orthographic learning through instruction that supports the learning and application of orthographic-to-phonological connections across multiple grain sizes (e.g., Harm et al., 2003; Lovett et al., 2020; Nation & Castles, 2017) in conjunction with strategic addition of word-specific entries that encourage the building of orthographic expertise (see Compton et al., 2014).

Recognizing the multifactorial causal basis of dyslexia suggests that differentiated instruction might be needed to fully address the needs of those with dyslexia. However, caution is warranted because research has yet to provide evidence of the effectiveness of such an approach (Burns et al., 2016). Nevertheless, recognizing the multifactorial causal basis of dyslexia supports the need for further investigation of differentiated instruction that takes into consideration risk and resilience factors, especially in the case of those who do not respond to standard treatment protocols.

Whereas implications for practice should not be part of the definition of dyslexia, these implications should be apparent from the definition. Practitioners often point to the definition of dyslexia when operationalizing the condition and use this information for identification and treatment in clinical settings and eligibility and service delivery decisions in school settings. We believe the current definition provides some useful clinical guidance and our suggested revisions improve this guidance by bringing practical considerations to the forefront.

Conclusions

Although the current IDA definition of dyslexia has provided a useful basis for identification, service provision, and research, accumulating evidence over the ensuing 20 years suggests ways that the definition can be refined to extend its utility into the future. As we outlined above, core aspects of the definition, including reference to a specific learning disability, neurobiological basis, primacy of word reading, decoding, and spelling difficulties, limitations in phonological processing, and secondary consequences should be retained. Other aspects of the definition should be refined, including reference to exclusionary criteria. Specifically, it should be made clear that limitations in word reading, decoding, and spelling, and not phonological processing, are unexpected when effective classroom instruction is provided. Some members of our group go further to suggest that reference to “other cognitive abilities” be dropped from the definition to discourage the use of IQ-achievement discrepancy as a defining characteristic. Others propose the use of

a discrepancy between reading and listening comprehension be included as a characteristic of dyslexia. Still, others suggest that issues of race, linguistic diversity, and poverty be elevated in the discussion and accounted for in the diagnostic and treatment process rather than dismissed as likely primary causes for reading difficulties. In addition, we also believe that secondary consequences should be expanded to include academic failure and the psychosocial impact of dyslexia. Such explicit recognition would draw attention to these consequences and potentially prevent or reduce their occurrence.

Finally, we would be remiss if we did not acknowledge the diversity of thought and expertise that informed our response to reimagining the definition of dyslexia. Indeed, we do not always agree on issues associated with diagnosis and treatment of dyslexia as a clinical disorder or identification, eligibility, and the provision of services for students with dyslexia. Nonetheless, collectively, we believe our interdisciplinary approach to understanding and addressing the needs of individuals with dyslexia across the lifespan is a strength that promotes both science and advocacy for this vulnerable population. As educators, clinicians, families, and policymakers continue this debate, we encourage transparent discussion, thoughtful consensus-building, and genuine curiosity like that presented here. It is only through such approaches that we will advance the lives of the children and adults with dyslexia that we serve.

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