Testing Accommodations for Students with Dyslexia: Key Opportunities to Understand Student Thinking

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Both standardized and classroom assessments are designed to measure what students know and can do in a particular content area. The federal Department of Education (2015) in its most recent Peer Review guidelines denotes that for statewide standardized assessments processes should in place "to ensure that each assessment is tailored to the knowledge and skills included in the State's academic content standards, reflects appropriate inclusion of challenging content, and requires complex demonstrations or applications of knowledge and skills (i.e., higher-order thinking skills)." The Peer Review guidelines also stipulate the state must document that it has used, "reasonable and technically sound procedures to develop and select items to assess student achievement based on the State's academic content standards in terms of content and cognitive process, including higher-order thinking skills. Because teachers want to measure standards in a similar manner in their classroom, it is important that teachers also consider measuring challenging content with complex demonstrations or applications of knowledge and skills.

Oftentimes in assessment situations reasoning and problem solving are accessed through reading; whereas, in the real world few reasoning contexts are presented in this manner. Shaywitz (1998) has estimated that up to 17.5% of the population may be dyslexic, and as a result, assessments focused on problem solving using only reading and writing may not capture the reasoning processes of almost 20% of the population. Kortez and Barton wrote in 2003 that the field needed better descriptive information about the populations of students with disabilities, the contexts in which they are schooled, and the ways in which they are assessed into order to effectively evaluate assessment policies. The goal of this paper is describe dyslexia, investigate current accommodation trends that are often recommended for this population, and to suggest supports teachers can use as they measure what their dyslexic students know and can do.

Overview of Dyslexia

There are a multitude of theories regarding the origin of dyslexia and varying ways of explaining it. In this section, we describe the theories most relevant to the discussions related to accommodations in the subsection section of the paper.

The International Dyslexia Association characterizes dyslexia as "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." Beginning in the 1980s, researchers and reading theorists focused heavily on the role that inefficiencies in phonological processing played in hindering the ability of

dyslexics to decode texts which also obstructs their higher-level thinking skills for analyzing texts when reading (Shaywitz et al., 1999). Shaywitz et al. noted the typical early symptoms of dyslexia may include difficulty with naming letters and difficulty associating the symbols with the sounds of language which makes decoding unfamiliar words difficult. Later as they are learning to read, dyslexics may have difficulty with the automated retrieval of words and have trouble differentiating, for example, among "where," "were," and "we're." Thus, they may often use context clues to determine the appropriate word. Even after dyslexics learn to read they will typically continue to read at a slow rate because of the residual effects of impaired phonological processing (Shaywitz et al., 1999). Both Eide and Eide (2006) and Habib (2007) noted the most persistent symptom of dyslexia over time tends to be impaired spelling.

Over the last decade, the phonological deficit model has faced increased criticism as research findings have begun to find evidence that explains the constellation of symptoms that typically accompany dyslexia such as vision processing deficits, auditory processing deficits, and motor coordination deficits (Fisher & DeFries, 2002). Clinically, Stein (2014) wrote dyslexia can be diagnosed from the pattern of symptoms a person presents. These symptoms can include among others slow visual processing and auditory processing in combination with attention, sequencing, and timing difficulties, left–right confusions, and poor short-term memory. He noted that the slower visual and auditory processing of dyslexics can be the source of their visual and phonological reading problems.

Bosse, Tainturier, and Valdois (2007) found that that visual attention span (the ability to visually process multiple letter strings) contributed unique variance to reading achievement scores beyond that of phonological measures. They concluded that visual attention span was another deficit characteristic of dyslexia with the origins of dyslexia likely being multi-factorial. Habib (2000) wrote that there is a growing body of evidence that points to a multi-system deficit in which the brain is unable to process brief stimuli in rapid temporal succession. He noted the "temporal processing impairment" theory explains the perceptual, motor, and cognitive symptoms frequently associated with dyslexia.

Fisher and DeFries (2002) reported that the presence of dyslexia in families indicates that there is also genetic component, which has been documented through the studies of identical twins. Wadsworth, Olson, and DeFries (2010) take this a step farther. Based upon their work they find that children with a higher intelligence who have reading difficulties tend to have them because of genetic influences.

Because of the different diagnostic criteria used in the field for diagnosing dyslexia there is uncertainty regarding the proportion of the population that is dyslexic. The identified students with disabilities population in public schools is typically estimated at about 12% of the population (Kortez & Barton, 2003);

though, the amount of variance in identification rates across states leads one to wonder if a proportion of the dyslexic student population is under-identified and about the cost of the under-identification at a personal and systemic level.

Research indicates girls (Shaywitz & Shaywitz, 2004), English language learners (Deponio et al., 2000), and racial/ethnic minority preschoolers (Morgan, Farkas, Hillemeier, & Maczuga, 2012) are mostly likely to be under-identified, likely because of the considerable expense in making a diagnosis. It has been found, for example, that parents of students with disabilities who took a special test administration of the SAT had a mean annual income about $10,000 higher than those of the rest of the population of test takers (Ragosta, 1987).

Accommodations and Modifications

In the testing situation the comparability of test scores is what allows stakeholders to make inferences across time, occasions, tests, and students about what students know and can do and to compare differences in reasoning abilities in the content area. The *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014) noted that uniform administrations of assessments are central to score comparability; yet, a test accommodation means some aspect of the test or administration condition has been changed to yield a more valid measure of what an individual student knows and can do. A test modification means the test or administration condition has been changed to such a degree that what is being measured by the test has changed.

Because of the complexity and variations in the way dyslexia is manifested, accommodations in practice cannot be standardized across all dyslexics (Nielsen et al., 2016). One dyslexic may need technology supports to access content both in class and on a standardized assessments and another may simply need extended time, depending on the severity of the dyslexia and where the student is in their development of compensation techniques. It is important to note compensation techniques are highly personal and likely vary across individuals (Gasparini & Culen, 2012). It is for this reason that the U.S. Department of Justice (2015) has determined that the student's IEP or 504 team is best situated to make decisions about the optimal and most appropriate accommodations for each student and that the student need not be failing in a content area to receive accommodations if a disability has been identified. However, oftentimes, teachers may not have training on how to provide accommodations to students on a day-to-day basis.

Writing Accommodations

Nielsen et al. (2016) suggested guidelines based on assessment results as a means for determining optimal accommodations for individuals. They suggested if a student has a deficit in handwriting legibility and automaticity, he or she will

likely need to have access to a scribe. Speech-to-text software can also serve this function in a classroom. A young dyslexic may need to dictate or use speech-to-text software to share composed ideas (i.e., write) until he or she has learned to effectively type because the motor coordination issues that are associated with dyslexia can hinder the automaticity process of writing with a pencil. Or, a dyslexic may compensate for a lack of handwriting legibility and automaticity by speech-to-text software throughout adulthood (Gasparini & Culen, 2012).

If a student has deficits in spelling in addition to handwriting, then Nielsen et al. (2016) noted a scribe alone may not be sufficient. Touch typing with computer keyboard and use of spell check in a testing situation may be needed. Alternately, spelling should not be graded if a student does not have access to a spell check. Spelling has implications in a large-scale assessment situation or when using writing prompts for formative purposes if an automated scoring engine is used to score the student's work. Essays composed by dyslexic students should likely not be routed to an engine unless a testing program has evidence to suggest the engine can separate the scoring of essay content from spelling errors.

What teachers can do. Because some students with dyslexia may have motor coordination deficits that affect their ability to show their thinking effectively in writing, teachers can double check student knowledge verbally if it appears if students are writing the bare minimum or are not demonstrating sufficient (that is proficient level) knowledge and skills. Dyslexic students may need more time to write, more and larger writing space, and/or a scribe with both short constructed response items and math problems, especially when they are young.

Many dyslexics do not think in words and when this occurs at the same time the child is unable to automate handwriting they need teachers who will advocate for them to have a laptop or iPAD (which has built in speech to text software) during the day, let them show their knowledge verbally, and demonstrate patience while the student begins the long process of learning to type. A child can show rich understanding of content with the correct assistive technology. Teachers can create assignments so that students can complete assignments either through typing or through writing in the classroom. For the student who is capable of typing, assignments can be emailed to the student so that he or she is completing the same work as his or her peers during class.

Extra time

The provision of extra time in testing is viewed as one of the most essential accommodations in the dyslexic community (Shaywitz et al., 1999). Extra time is

supported by evidence that dyslexics continue to read more slowly than their peers even after they learn to read (O'Brien, Mansfield, & Legge, 2005; Parrila, Georgiou, and Corkett, 2007) and by neuroimaging studies that show dyslexics have to build alternate, compensatory pathways in their brain for reading accurately over time. Yet, these alternate pathways do not foster fluent and automated reading (Shaywitz, Morris, Shaywitz, 2008). Nielsen et al., 2016 posited that if a dyslexic has deficits with his or her rate of oral reading of real words, silent reading of real words, or rapid automatic naming then additional time on tests requiring reading is likely necessary.

Extra time is largely considered an accommodation to a test. If an accommodation has the intended effect on a test administration it should increase access to the test for the student with a learning disability and thereby increase his or her score (Fuch & Fuch, 1999). An accommodation may also increase scores of nondisabled peers but not to the same degree (Sireci, Scarpati, & Li, 2005) as those with learning disabilities. In practice extra time appears to support both students with and without learning disabilities who have content knowledge; however the effect size is greater for students with learning disabilities (Mandinach, Bridgeman, Laitusis, & Trapani, 2005).

What teachers can do. Many dyslexics will need extra time to complete classroom work, homework, and tests. Teachers can support students by working to determine how to best support providing extra time in a busy classroom. Students and teachers can negotiate schedules to support the student and also consider which parts of tests and assignments are "must haves" and which are "extras" that might be eliminated so that assignments are shorter for the student. If an assignment or test has a heavy reading load, it may make sense to allow the student to get the reading load portion of the assignment the night or weekend prior to the classroom test administration so that the student's focus during the assignment is on the answering the questions or implementing the directions. Students who are dyslexic often have to go through Herculean efforts to memorize material (such as spelling tests). Allowing students to get such material early and shortening what must be memorized can be important supports.

Another important consideration is to ensure that assignments have directions to accompany them. Because dyslexics may have auditory processing and working memory deficits they may not be able to follow multi-step directions without textual and visual supports. This can be another reason why it takes the student longer to complete assignments. If assignments are relayed verbally while other students are beginning the work, the dyslexic may have to determine what that assignment was through inferencing and observing peers or he or she may be having to convert the directions to graphics in their heads.

Read-aloud

One method dyslexics frequently use to either compensate for their slow but accurate reading or their decoding deficits which hinder comprehension is to access content through recordings (Eide & Eide, 2006; Shaywitz et al., 1999; Shaywitz, Morris, Shaywitz, 2008). Read-alouds on reading assessments have over time come to be considered modifications to the test construct with some dissenting opinions (e.g., Crawford & Tindel, 2004). In their meta-analysis of 110 studies, Garcia and Cain (2014) found listening comprehension was a significant predictor (and moderator) of the relationship between decoding text and comprehending text in the general population; however as listening comprehension skills increase the decoding–reading comprehension correlations decrease. One interpretation of this finding is that decoding text is a threshold skill to analyzing text in print form. Once students break the code of reading, the students' abilities to reason can be demonstrated equally through reading text or listening to text; however, for those with severe dyslexia they may only be able to demonstrate their reasoning skills as they listen to text.

In early elementary school, much of the focus of instruction is on decoding texts; however, by Grade 3 large-scale assessments are largely measuring students' abilities to analyze texts and find explicit and implicit evidence for inferences or conclusions. While the English language arts standards focus on reading, writing, listening, and speaking and desire the inference and evidence skills to function across those domains, on a large scale-assessment reasoning skills are measured primarily through reading and writing only due to the cost of creating, administering, and scoring listening and speaking items. Thus, half of the important information to support understanding how well dyslexics are performing in English language arts/literacy is lost if listening and speaking domains are not measured.

Li (2014), in the most recent meta-analysis of read-aloud accommodations, found read-alouds supported both students with and without disabilities; however, the effect size increases for students with disabilities was almost twice that of students without disabilities. One interesting finding was that for mathematics the read-aloud supported students when performed by a person and not by a computer. A second notable finding was that the read aloud had a larger boost for elementary students than for middle school students.

Research findings generally support the read aloud of mathematics tests (Huynh, Meyer, & Gallent, 2004; Sireci, Scarpati, & Li, 2005 as examples). There is a disconnect, however, between what is considered best practice in classroom accommodations for dyslexics and what is done on large-scale assessments.

What teachers can do. It is important that students be given opportunities to access content through read-alouds in the classroom so that students continue to access content and vocabulary until they learn compensation techniques. Software solutions such as *Raz Kids* read and highlight text for elementary students as part of a reading homework program. Learning Ally (http://www.learningally.org/default.aspx?gclid=CNnxyrToscsCFUk6gQod2pkND) also provides many text books in audio format that can be downloaded onto a computer. Reading science, mathematics, and social studies texts, tests, and assignments to students is also necessary. Students can often use technology for these supports. As students get older they may need access to digital versions of classroom notes so that they can use software programs to "re-read" the notes when studying.

As dyslexic students begin to compensate, teachers (and parents) may need to listen to him or her read test items for themselves aloud to determine appropriate classroom actions. Teachers should also make the student their partner in determining best actions for instruction and assessment. If the child is skipping and misreading words, the read aloud is essential to measure how the child is able to think in the content. As children become more aware of how their dyslexia works, some dyslexics (but not all) may find they need to read and re-read questions *to themselves* aloud or silently in order to understand the material. It is important to remember that reading is often not the most efficient manner for dyslexics to gain information, one of the main purposes for reading. Students who use technology to support accessing information through the use of read alouds are also engaged in the English language arts standards.

Enlarged Text and eReaders

Researchers (O'Brien, Mansfield, & Legge, 2005) found that dyslexic children in Grades 2–4 required print sizes 32% larger than nondyslexics with the same reading ability to achieve their optimal reading speed. The reason for this is likely due to the vision processing issues experienced by many dyslexics. Visual attention span is impaired in dyslexics (Bosse, Tainturier, & Valdois, 2007), and during a typical reading task Jainta and Kapoula (2011) found that dyslexic children's eyes worked less well together during and after saccades compared to nondyslexics quasi-matched by age. Eye saccades are the quick movements eyes must make between fixed points or words. When reading texts, the reader's saccades go left to right, fixating word after word, and then bring the eyes to the next line of the text. Jainta and Kapoula noted dyslexics in their study fixated on words longer and had more regressions in saccades than nondyslexics consistent with other studies such as Biscaldi, Gezeck, and Stuhr (1998).

Dyslexics sometimes read on e-readers or tablets so that they can increase font size and length of text lines (Gasparini & Culen, 2012; Schneps et al., 2013a;

Schneps, Thomson, Chen, Sonnert,& Pomplun, 2013b). Schneps et al. (2013a) investigated this empirically with dyslexic high school students and found that those persons with poor visual attention span improved their ability to regulate their oculomotor functioning simply by using an e-reader that was held in their hand with no increases in font size. They also found if they increased the spacing between letters weaker readers comprehended the text comparably to stronger readers, but the oculomotor functioning was not improved. Most interesting, they found that having dyslexics read using an iPod improved both comprehension and oculomotor functioning with the percentage of inefficient regressions common in dyslexic processing being reduced.

What teachers can do. The research of Schneps et al. (2013a, 2013b) supports allowing dyslexics to take accommodated administrations of classroom and large scale assessments on tablets and computers in which font size and number of words per line can be controlled by the user. For assessments in paper-pencil format, for children in elementary school offering font sizes that are at minimum of 32% larger than what is standardized for the grade, shorter lines of text, and the opportunity to respond in a test booklet rather than an answer document is prudent to mitigate vision processing issues.

The same vision processing issues that make moving from a test booklet to an answer document challenging can also make copying information from the board correctly a challenge. It is not surprising to find words that were given to children on the board misspelled on paper. When your eyes work more slowly than your peers and you are working under time constraints, there is not sufficient time to double check each word. Giving students notes digitally or allowing them to record lectures can be helpful to ensuring they are capturing the content correctly. If students have not had access to a spell checker, it is advisable to not deduct points for misspellings.

Best Methods of Measuring Dyslexic Reasoning Skills

Eide and Eide (2012) and Silverman (2003) have postulated that dyslexic brains are optimized for reasoning tasks other than reading and writing, and this optimization interferes with language learning. Put another way, reasoning tasks that are only provided in two-dimensional, time sensitive, reading-based scenarios may miss the higher level reasoning skills in dyslexics. Bacon, Handley, and McDonald (2007) found that dyslexics tended to reason using spatial strategies whereas nondyslexics appeared to use predominantly verbal approaches to reasoning through logic tasks, even tasks with abstract content that authors believed should have been difficult to visualize.

Dyslexic students will often have a great deal of difficulty with test formats that require recall of specific facts like names, dates, places, terms, or of specific procedures (e.g., quadratic equation) because often times dyslexics have deficits

in working memory (B. Eide, February 2016, personal communication). These students will often miss easy questions; yet in a demonstration of conceptual understanding, they will excel. These are students who may struggle with the rote calculation of mathematical facts; but, they are able to conceptually demonstrate mathematical understanding through models. It is critical to remember dyslexic reasoning may be nonverbal, verbal, or a combination. The capabilities of a good portion of dyslexic individuals cannot be seen or shown in words; thus to measure what these individuals can do and to determine the quality of their reasoning skills requires authentic real world scenarios using portfolios of their work or project-based assessments (Brock Eide, October 2015, personal communication) as they get older. Allowing students to demonstrate conceptual understanding through models, drawing, or orally can assist teachers in measuring thinking. These are child who learn by doing and best show you what they can do using authentic demonstrations.

Conclusion

Oftentimes reading comprehension is a threshold skill in an assessment and once a child reads and writes fluently the assessment is really targeting higher level thinking skills. The ultimate intent of the Common Core standards expressed in this portrait (Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language) from the Common Core Standards Initiative (n.d) notes that Students Who are College and Career Ready

- are "self-directed learners, effectively seeking out and using resources to assist them, including teachers, peers, and print and digital reference materials."
- "They read purposefully and listen attentively to gain both general knowledge and discipline-specific expertise. They refine and share their knowledge through writing and speaking."
- "They employ technology thoughtfully to enhance their reading, writing, speaking, listening, and language use. They tailor their searches online to acquire useful information efficiently, and they integrate what they learn using technology with what they learn offline. They are familiar with the strengths and limitations of various technological tools and mediums and can select and use those best suited to their communication goals."

A careful review of the intended outcomes of the standards is that learners both read *and listen*, supply evidence when writing *and speaking*; however, large-scale assessments and classroom assessments largely measure and supply inferences about skills bounded by the printed text thus measuring 50% of the intended content in English language arts and require the use of verbal reasoning to accessing the content in other content areas. Thus, they can be biased estimates of achievement for persons with dyslexia. Our methods of testing often do not provide accurate information about the reasoning skill of many dyslexic individuals. Dyslexics often reason nonverbally. Assessments that

target verbal reasoning, as a result, may not provide teachers instructionally useful information about many students' abilities. With accommodations noted in this paper, often used in combinations, teachers will have better information about what dyslexics students know and can do, and as a result, can better determine what these students should do next in their learning.

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