

Research Article

Conceptions and Misconceptions: What Do School-Based Speech-Language Pathologists Think About Dyslexia?

Hannah Krimm,^a  Jena McDaniel,^b  and C. Melanie Schuele^b ^aDepartment of Communication Sciences and Special Education, University of Georgia, Athens ^bDepartment of Hearing and Speech Sciences, Vanderbilt University School of Medicine, Nashville, TN

ARTICLE INFO

Article History:

Received December 14, 2022

Revision received April 27, 2023

Accepted June 22, 2023

Editor-in-Chief: Kelly Farquharson

https://doi.org/10.1044/2023_LSHSS-22-00199

ABSTRACT

Purpose: The purpose of this exploratory study was to evaluate speech-language pathologists' (SLPs') conceptions and misconceptions about dyslexia.**Method:** Participants were 86 school-based SLPs. They completed an online survey on which they rated their agreement and disagreement with true and false statements related to the scientific evidence about the nature of dyslexia and interventions for dyslexia, as well as common misconceptions about dyslexia.**Results:** There was considerable variability among SLPs' agreement and disagreement with the statements. Critically, despite abundant contrary evidence in the literature, many SLPs believe that dyslexia involves a visual processing deficit.**Conclusions:** These findings suggest that many school-based SLPs hold misconceptions about dyslexia, especially those related to dyslexia being a visual disorder. The identified misconceptions may contribute to some SLPs' reluctance to incorporate reading and prereading skills into speech-language assessment and intervention. SLPs need greater knowledge of dyslexia to provide more effective evaluations and intervention services.

Misconceptions about neurodevelopment and neurodevelopmental disorders abound among the public and educators alike, including speech-language pathologists (SLPs). The problem of misconceptions is pervasive and persistent; recent findings indicate that many neuromyths are as popular today as they were a decade ago (Dekker et al., 2012; Torrijos-Muelas et al., 2021). Studies of neuromyths in education typically focus on a range of neuromyths across different aspects of brain function and define educators as a range of professionals involved in education (Torrijos-Muelas et al., 2021). Some of the most prevalent misconceptions relate to the signs and symptoms of dyslexia (Macdonald et al., 2017). The purpose of this exploratory study was to specifically examine school-based SLPs' beliefs about dyslexia.

Neuromyths in Education

There has been substantial interest in documenting belief in neuromyths. Macdonald et al. (2017) examined belief in neuromyths among a sample of almost 4,000 participants. Their sample included members of the public, neuroscience experts, and educators. "Educator" was broadly defined to include individuals working in early childhood education through higher education in a teaching role (special education and general education), administrative role (e.g., principals and deans), or related educational services (e.g., SLPs and counselors). On a survey, participants marked a series of statements as true or false dichotomously. Although educators marked fewer neuromyths as true than the public did, they marked more than half (56%) of the myths as true.

Similar findings have been reported in several studies that specifically have examined educators' understanding of dyslexia (Gini et al., 2021; Wadlington & Wadlington,

Correspondence to Hannah Krimm: Hannah.krimm@uga.edu. **Disclosure:** The authors have declared that no competing financial or non-financial interests existed at the time of publication.

2005; Washburn et al., 2011). Gini et al. (2021) reported high endorsement of neuromyths about dyslexia among the public and educators alike, with no statistically significant difference in endorsement of myths about dyslexia between individuals who had and had not worked with children with dyslexia. The belief in a visual basis for dyslexia seems particularly pervasive and persistent even though theories about a visual basis for dyslexia have long been disproven (see Vellutino et al., 2004, for a review). More than 90% of teachers in Washburn et al.'s (2011) sample agreed that "seeing letters and words backwards is a characteristic of dyslexia" (p. 174), and more than 70% of teachers in the sample agreed that "children with dyslexia can be helped by using colored lenses/colored overlays" (p. 174).

Causes and Characteristics of Dyslexia

A large body of literature demonstrates that dyslexia typically arises from a deficit in the phonological domain of language (Kovelman et al., 2012; Vellutino et al., 2004). Children with dyslexia routinely have deficits in phonological processing, which comprises phonological memory (i.e., ability to hold speech-based information in working memory), phonological retrieval (i.e., ability to retrieve speech-based information from long-term memory), and phonemic awareness (i.e., ability to segment, blend, and manipulate individual speech sounds). Poor performance on tasks that diagnostically tap any of these phonological processing skills may indicate dyslexia (Catts, 1989). Deficits in phonemic awareness precipitate difficulty with accurately and/or fluently decoding (i.e., reading) and encoding (i.e., spelling) written words (Melby-Lervåg et al., 2012; Snowling et al., 2020; Wagner & Torgesen, 1987).

Early identification and intervention for children with dyslexia can change their literacy trajectories. Phonemic awareness instruction in the early elementary years, especially when combined with systematic phonics instruction, has a substantial and lasting positive effect on reading acquisition (Ball & Blachman, 1988; Rehfeld et al., 2022). Dyslexia is less prevalent in the later grades among children who received explicit phonological awareness instruction in kindergarten compared to children who received no explicit phonological awareness instruction (Torgesen, 2000).

Dyslexia and Other Communication Disorders

Contrary to popular opinion, most definitions of dyslexia characterize it as difficulty with decoding and/or spelling that often is caused by difficulty with phonological processing (International Dyslexia Association, 2002;

National Institute of Neurological Disorders and Stroke, 2023). Researchers generally agree that dyslexia can and often does co-occur with oral language impairment¹ (hence, language impairment) and assert that both can be considered under the umbrella of developmental language disorders (Adlof & Hogan, 2018; Catts et al., 2005; McArthur et al., 2000; Werfel & Krimm, 2017). For example, McArthur et al. (2000) synthesized the results of several studies of children who previously had been diagnosed with dyslexia or language impairment. Participants completed a language and literacy assessment battery that included evaluation of reading accuracy (i.e., decoding) using the Neale Analysis of Reading Ability–Revised (NARA-R; Neale, 1988) and evaluation of oral language abilities using the Clinical Evaluation of Language Fundamentals–Revised (CELF-R; Semmel et al., 1987). McArthur et al. reported that more than half (55%) of the children who had been identified with dyslexia also met criteria for language impairment (CELF-R Total Language score < 85 in two studies, < 77 in one study) and that more than half (51%) of the children who had been identified with language impairment also met criteria for dyslexia (NARA-R scores at least 12–24 months below age expectations). These findings highlight the need for SLPs to be involved in identifying children with dyslexia, many of whom have co-occurring language impairment.

The Role of the SLP in Identification and Treatment of Dyslexia

Early language difficulties indicate risk for dyslexia (Catts, 1997), and many children with language impairment have poor phonological awareness (Zourou et al., 2010) that results in poor decoding skills (Catts et al., 2005). Up to 84% of children who receive speech-language services in schools have co-occurring characteristics of dyslexia (McArthur et al., 2000; Werfel & Krimm, 2017). However, considerable ambiguity surrounds the role of SLPs in identifying and treating children with dyslexia. This ambiguity likely arises from variability in SLPs' preparation regarding reading and writing, as well as conflicting policies surrounding professional responsibilities. For example, the American Speech-Language-Hearing Association (ASHA) explicitly includes reading and writing within the SLP's scope of practice (ASHA, 2000, 2001), but anecdotal reports indicate that some school districts expressly forbid SLPs from addressing written language.

¹We use the term *language impairment* throughout this article to align with the terminology used in the Individuals with Disabilities Education Act (IDEA) under which SLPs provide intervention services in schools. Children diagnosed with developmental language disorder, a relatively new diagnostic label, are included within children with language impairment.

Because of (a) the strong link between spoken and written language, (b) the importance of prompt intervention for mitigating risk for dyslexia, and (c) the increased risk of dyslexia among children with language impairment, there have been multiple calls for SLPs to serve as integral members of literacy teams (e.g., Ehren & Ehren, 2001; Staskowski & Zagaïski, 2003). For example, SLPs could (a) screen for dyslexia among children identified with or at risk for language impairment (Catts et al., 2001), (b) provide phonological awareness intervention for at-risk children (Schuele et al., 2008), (c) collaborate with classroom teachers to enhance early language and literacy learning experiences in the classroom (Girolametto et al., 2012; Hogan, 2018a, 2018b), and/or (d) advocate for children on their caseload to have the foundation of phonological awareness that underlies early word reading and spelling success (Hogan 2018b; Schuele & Young, 2017).

Despite the integral role school-based SLPs could play in identifying and remediating dyslexia, there is substantial variability in the extent to which they collaborate with literacy teams (ASHA, 2018; Loveall et al., 2022). Some SLPs believe that they can define dyslexia but cannot apply their knowledge to inform assessment and intervention (Loveall et al., 2022). Other SLPs believe that their role is more aligned with identification of children with dyslexia than in direct intervention for reading and writing skills (Loveall et al., 2022). Even though some SLPs believe they belong on identification teams, identification teams often include only the parent(s)/guardian(s), the child's general education teacher, a special education teacher, a district representative (e.g., principal), and an educational psychologist, none of whom typically conduct spoken language assessments (Al Dahhan et al., 2021; Ysseldyke, 2001).

There also is considerable variability in the extent to which SLPs incorporate reading, writing, and preliteracy skills into speech-language therapy. Some SLPs report incorporating reading and writing into language intervention daily, whereas others report never doing so (Loveall et al., 2022). Based on direct observation of intervention practices, Tambyraja et al. (2014) reported that SLPs spent an average of 1 min per session focused on preliteracy and literacy skills. However, many teachers recognize the alignment between SLPs' expertise and the foundational skills that underlie successful reading and writing and welcome collaboration with SLPs for written language intervention (Shaughnessy & Sanger, 2005; Watson et al., 2020).

The hesitation that some SLPs feel toward targeting reading and writing skills may stem from their self-reported lack of preparation for doing so (Blood et al., 2010; Farquharson et al., 2015; Watson et al., 2020). SLPs

who do routinely address written language in intervention report seeking additional training outside their graduate SLP program to gain the knowledge and skills to do so (Blood et al., 2010; Fallon & Katz, 2011), and many SLPs believe more graduate coursework should be dedicated to written language disorders (Watson et al., 2020). Based on their self-reported lack of preparation, it is possible that SLPs' insufficient understanding of the linguistic nature of dyslexia may deter them from collaborating with identification teams and integrating literacy intervention and speech-language intervention. It is critical to understand SLPs' conceptions and misconceptions about dyslexia to design preservice and in-service opportunities to better prepare SLPs to support children's written language and their spoken language. Thus, the purpose of this exploratory survey study was to examine SLPs' conceptions and misconceptions about dyslexia.

Method

The institutional review board at Vanderbilt University approved the methods for this study.

Participants

Participants were 86 SLPs with experience working in public schools (three male SLPs, 83 female SLPs). They were a subset of the 106 participants reported by McDaniel et al. (2023). The subset included only those who had previously or were currently working in schools. McDaniel et al. reported a subset of the survey findings that does not overlap with the current report. The mean age of participants was 37 years ($SD = 10$ years). Participant demographics approximated the makeup of the field (ASHA, 2021); 93% of participants reported being White, 3% reported being Black or African American, and 1% reported being Asian. No participants reported being Hispanic or Latino.

Participants reported a mean of 8 years of experience as school-based SLPs ($SD = 8$ years). Ninety-seven percent had earned a master's degree, and the remaining 3% had earned an advanced professional degree (e.g., PhD and clinical doctorate). Most reported holding a current Certificate of Clinical Competence in Speech-Language Pathology (87%). Among the nine participants who reported not holding a current Certificate of Clinical Competence, eight were completing their clinical fellowship. Most participants ($n = 70$) reported working in Tennessee. Other participants reported working in Arizona, California, Colorado, Delaware, Kentucky, Massachusetts, Mississippi, North Carolina, Pennsylvania, and Texas and for the Department of Defense Education Activity.

Materials

A survey was developed for this study; it was administered using the Research Electronic Data Capture Tool (REDCap) hosted at Vanderbilt University (Harris et al., 2009, 2019). The survey comprised 49 true and false statements about causes of disabilities, identification of disabilities, and evidence-based intervention for children with disabilities (see McDaniel et al., 2023). The survey statements were grouped by disability (e.g., dyslexia, autism spectrum disorder, and speech-language impairment). Thus, statements that related to each disability were presented sequentially. Responses to 14 survey statements related to dyslexia were analyzed for this report (see Table 1 in Results section). These statements were taken from the Dyslexia Knowledge Questionnaire (Peltier et al., 2020a). The statements map to three broad categories: (a) causes/characteristics of dyslexia, (b) instruction/intervention for children with dyslexia, and (c) special education services for children with dyslexia.

The Dyslexia Knowledge Questionnaire (Peltier et al., 2020a) was created to serve as a pretest, posttest, and follow-up assessment in an experimental study that evaluated the effect of reading a refutation text about dyslexia on knowledge of dyslexia among preservice teachers (Peltier et al., 2020c). The questionnaire includes 20 statements about dyslexia. Some statements are true, and others are false. Participants use a 6-point Likert-style scale to indicate the extent to which they believe *an expert* would agree or disagree with each statement. According to Peltier et al. (2020c), some statements had been used in previous studies, and others were written based on common misconceptions about dyslexia identified in the literature. Statements were reviewed by a dyslexia expert and revised based on the expert's recommendations. The questionnaire is publicly available at: <https://doi.org/10.17605/OSF.IO/8AYVX>.

Some modifications were made to the response requirements for the statements on the Dyslexia Knowledge

Table 1. Descriptive statistics for agreement ratings for each survey statement.

Survey statements	Mean agreement rating	Range of agreement ratings	Percentage of sample with positive agreement rating
True statements			
Students with dyslexia need explicit, systematic, direct instruction in phonemic awareness and phonics.	-31	-45 to 50	88
Difficulty with processing sounds in language is one of the major deficits found in dyslexia.	-15	-50 to 50	74
Parents with dyslexia are likely to have children with dyslexia.	-12	-50 to 50	72
Dyslexia is recognized as a type of specific learning disability that can receive special education services by the federal government.	-11	-50 to 50	65
False statements			
In some public schools, dyslexia is not recognized as a learning disability eligible for special education services.	-12	-50 to 50	62
Visual-perceptual deficiencies are components of the dyslexia diagnosis.	-05	-50 to 50	57
Seeing letters and words backward is a characteristic of dyslexia.	-00	-50 to 50	57
Students with dyslexia see words jumping around on the page.	-06	-50 to 50	36
Colored lenses and colored overlays are research-based accommodations to help students with dyslexia.	-12	-50 to 50	21
Students with dyslexia should be taught how to read using the whole-word method.	-15	-50 to 39	20
Dyslexia is primarily a visual-based reading disability.	-18	-50 to 50	20
Eye-tracking exercises are effective in remediating dyslexia.	-17	-50 to 50	13
Dyslexia should be diagnosed by an eye doctor.	-32	-50 to 33	16
Dyslexia identification has a clearly well-defined cutoff; students either have dyslexia or they don't.	-24	-50 to 45	15

Note. Statements were taken from the Dyslexia Knowledge Questionnaire (Peltier et al., 2020b). Statements were presented on the survey in a single random order (i.e., all participants responded to the same sequence of statements). Here, they are separated into true and false statements and then arranged from highest to lowest mean rating. Positive agreement ratings indicate agreement with a statement, and negative agreement ratings indicate disagreement with a statement. Accurate knowledge is illustrated by positive agreement ratings (i.e., agreement) on true statements and negative agreement ratings (i.e., disagreement) on false statements.

Questionnaire for this study. Rather than using a 6-point Likert-style scale to rate the extent to which they believe an expert would agree with each statement, participants were instructed to drag a slider on a visual analog scale to rate *their own agreement* with each statement. The slider was prepositioned in the middle of the scale, which included only two anchors: *strongly agree* to the far right and *strongly disagree* to the far left. Numerical values were assigned to participants' responses by an underlying metric in REDCap; participants did not see the numerical values assigned to their responses. A visual analogue scale was chosen over a Likert-style scale to preserve the continuous nature of the underlying variable (extent of agreement), which captures variance at a more fine-grained level than a categorical, Likert-style scale allows (Briggs & Closs, 1999; Pfenning et al., 1995). Best practices for electronic visual analogue scale administration were incorporated; for example, each statement appeared on the same screen as the corresponding scale, and scales were displayed horizontally (Byrom et al., 2022).

The Dyslexia Knowledge Questionnaire includes 20 statements, but participants in this study responded to only 14. Six statements were excluded because this survey was administered within a larger survey about SLPs' beliefs. Having all 20 items would have been too cumbersome. Statements that were not administered tap knowledge of specific neurological factors (e.g., "After effective reading intervention, the activation patterns in the brain of a student with dyslexia can change"; Peltier et al., 2020a, p. 2), which were judged to have less practical relevance than the included statements. For the statements included in this study with this sample, Cronbach's $\alpha = .79$.

Procedure

Participants were recruited from (a) registrants ($n = 338$) for an annual state-wide professional development conference focused on the needs of school-based SLPs (held online during data collection due to the COVID-19 pandemic) and (b) a listserv that included over 1,700 professionals who previously attended professional development sponsored by the Vanderbilt University Medical Center. All conference registrants were invited to participate via e-mail prior to the conference. During the conference, registrants were encouraged to participate in the survey study (e.g., the opportunity was announced at the outset of the conference sessions via the chat feature). Following the conference, listserv SLPs were invited via e-mail to complete the survey. Some conference registrants also received the invitation via the listserv; participants only completed the study once. Interested individuals from the conference and/or listserv e-mailed the

research team to gain access to the survey. This step was required to ensure that (a) data were de-identified and (b) no individual completed the survey more than once. Participants were compensated nominally for survey completion.

Variables and Analysis Plan

Variables

The variables presented here were created for this study. Agreement ratings were calculated from raw data for each participant for each statement. A dyslexia knowledge score was calculated for each participant based on their agreement ratings.

Agreement Ratings

Responses were assigned a value from 0 (*strongly disagree*, end of the visual scale) to 100 (*strongly agree*, end of the visual scale) by an underlying metric in the REDCap software (i.e., participants did not see the numbers). For interpretability, an agreement rating was created for each participant on each statement. Agreement ratings were created by subtracting 50 from each underlying value, thus creating values centered on 0 and ranging from -50 to $+50$. Values on the *disagree* portion of the scale (0–49) were converted to values of -50 to -1 . Values on the *agree* portion of the scale (51–100) were converted to values of 1 – 50 . Values of 50 were converted to 0. Negative agreement ratings correspond to disagreement with a statement, and positive agreement ratings correspond to agreement with a statement.²

Dyslexia Knowledge Score

A dyslexia knowledge score was calculated for each participant. This approach to scoring responses on the Dyslexia Knowledge Questionnaire (Peltier et al., 2020a) was devised for this study and was not used by Peltier et al. (2020c). To calculate the dyslexia knowledge score, agreement ratings for false statements were converted to their negative. Thus, if an individual had an agreement rating of -50 (*strongly disagree*) for a false statement, a value of $+50$ on this statement contributed toward their dyslexia knowledge score. Likewise, if an individual had an agreement rating of $+50$ (*strongly agree*) for the same false statement, a value of -50 on this statement contributed toward their dyslexia knowledge score. Thus, after transposition, positive scores for false statements indicated accurate knowledge of dyslexia. For the true statements, no transposition was necessary. Second, each participant's values for all statements were averaged to compute a

²The data in the study of McDaniel et al. (2023) were reported using the underlying scale of 0–100. The data were converted to the -50 to 50 scale for clarity in this report.

dyslexia knowledge score for each participant. Dyslexia knowledge scores could range from -50 to $+50$; $+50$ represents strong knowledge of dyslexia indicated by correct agreement with true statements and correct disagreement with false statements.

Analysis Plan

This was an exploratory study designed to be a first step toward understanding SLPs' knowledge of dyslexia. Therefore, the data were examined for overall patterns and distributions. Three analyses were completed. Descriptive statistics were calculated for the dyslexia knowledge score (i.e., group mean, standard deviation, and histograms). Descriptive statistics were calculated for each statement (i.e., group mean, range of agreement rating across participants, and percentage of participants who agreed with the statement). Pearson correlations were computed for the relation between (a) agreement scores for statements about causes/characteristics of dyslexia and statements about instruction/intervention for children with dyslexia and (b) agreement scores for statements about receipt of special education services for children with dyslexia.

Results

Dyslexia Knowledge Score

Dyslexia knowledge scores reflect the extent to which participants correctly agreed with true statements and correctly disagreed with false statements. Dyslexia knowledge scores could range from -50 (misinformed) to 50 (well informed). The mean dyslexia knowledge score for the sample was 12.64 ($SD = 12.44$), and the median dyslexia knowledge score was 10.64 . Dyslexia knowledge

scores ranged from -18.43 to 41.36 . Figure 1 illustrates the distribution of knowledge scores across the sample.

Agreement Ratings

Table 1 shows the mean agreement rating, range of agreement ratings, and percentage of the sample that provided a positive agreement rating for each statement. The mean agreement rating for the four true statements about dyslexia was 17.2 ($SD = 9.6$). The mean agreement rating for the 10 false statements about dyslexia was -10.9 ($SD = 13.4$). Individual SLP ratings covered the entire scale range (i.e., -50 to $+50$) for all but four statements.

Causes and Characteristics of Dyslexia

Figure 2 illustrates the distributions of the agreement ratings for the five statements about the causes and characteristics of dyslexia. The frequencies of participant responses were grouped into 10 equal-sized bins of agreement ratings, plus a bin for agreement ratings of 0. The distributions of responses about causes and characteristics of dyslexia proceeded in the ideal direction for three statements. Responses clustered on the right half of the histogram, indicating tendency toward agreement, for the true statement: "Difficulty processing sounds in language is one of the major deficits found in dyslexia" (a on the figure). Responses clustered on the left half of the histogram, indicating tendency toward disagreement, for the false statement: "Dyslexia is primarily a visual-based disorder" (c on the figure) and for the false statement: "Students with dyslexia see words jumping around on the page" (e on the figure). However, responses clustered on the right half of the histogram for two false statements: "Visual Perceptual deficiencies are components of the dyslexia diagnosis" and "Seeing letters and words backwards is a characteristic of dyslexia" (b and d on the figure, respectively).

Figure 1. Distribution of participants' dyslexia knowledge scores. The range of possible dyslexia knowledge scores was -50 to 50 . Dyslexia knowledge scores closer to 50 reflect a well-informed participant, and dyslexia knowledge scores closer to -50 reflect a misinformed participant. No participants had knowledge scores of 0.

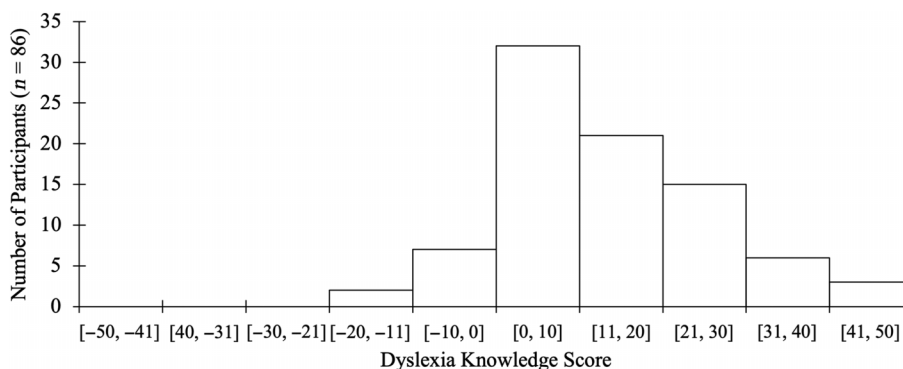
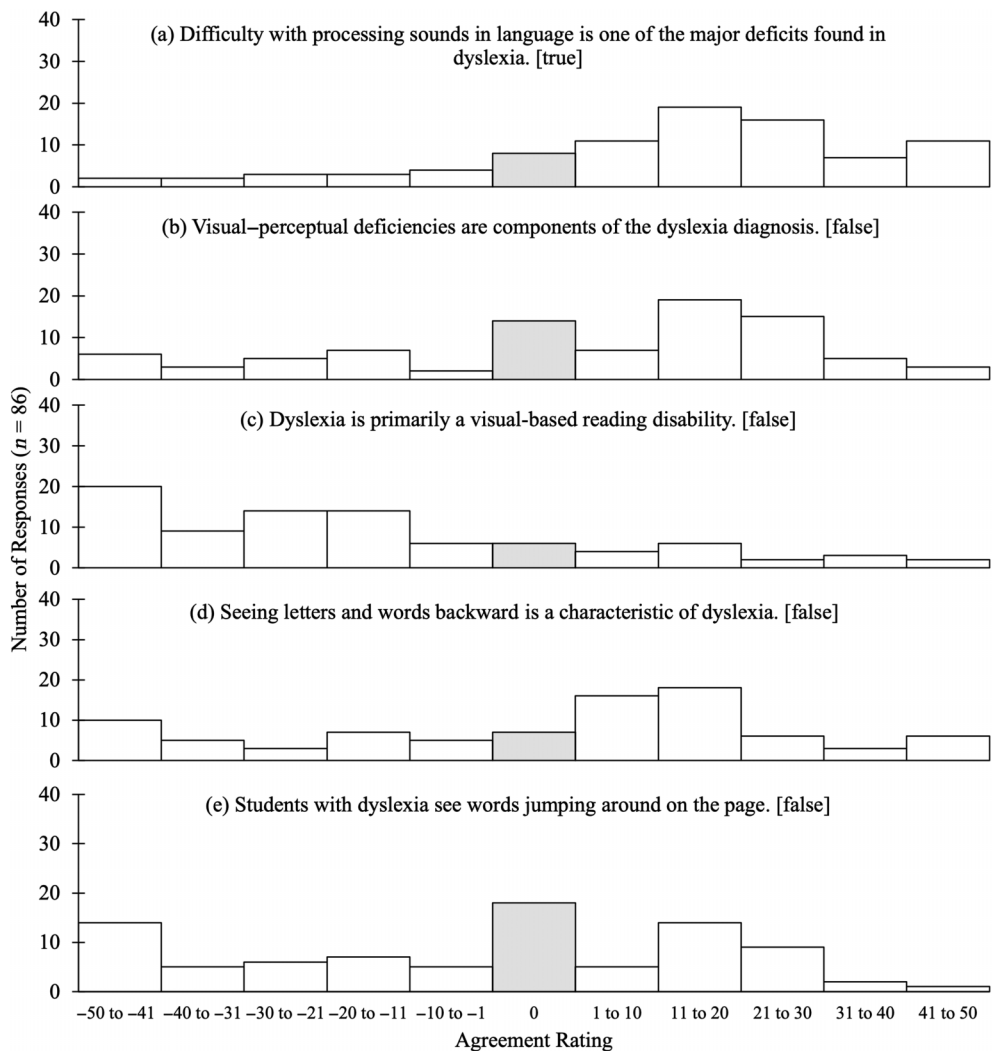


Figure 2. Distribution of agreement ratings for survey statements about causes and characteristics of dyslexia. Ratings greater than 0 indicate agree, and ratings less than 0 indicate disagree. Ratings of 0 are noted in gray.



Instruction and Intervention for Children With Dyslexia

Three survey statements relate to instruction and intervention for children with dyslexia. See Figure 3. The majority (88%) of participants correctly agreed that students with dyslexia need explicit, systematic, direct instruction in phonemic awareness and phonics. However, an unsettling proportion of participants agreed that “Students with dyslexia should be taught how to read using the whole-word method” (20%) and that “Colored lenses and colored overlays are research-based accommodations for children with dyslexia” (21%).

Mapping Causes and Characteristics to Instruction and Intervention

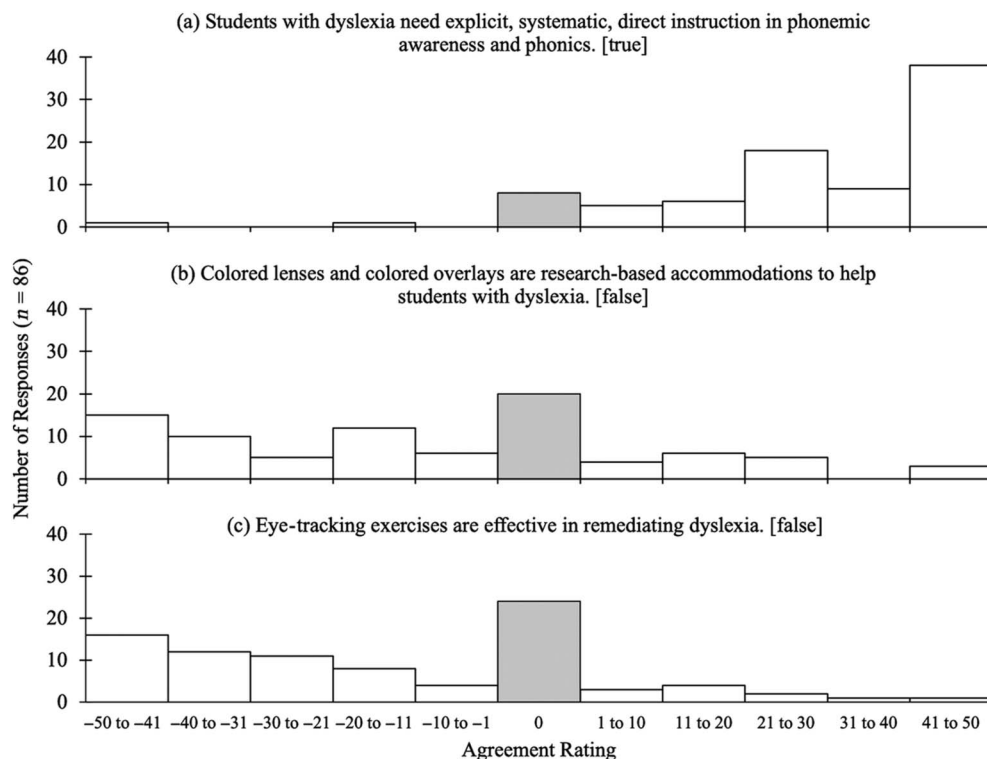
Table 2 displays the correlations between agreement ratings for statements about causes and characteristics of

dyslexia with agreement ratings for statements about instruction and intervention for children with dyslexia. These correlations proceed in the expected direction. SLPs who more strongly agreed with statements about dyslexia involving a visual processing deficit were also likely to more strongly agree with statements that endorsed using visual-perceptual interventions for dyslexia. Similarly, SLPs who more strongly agreed with statements about the linguistic basis of dyslexia were more likely to disagree more strongly with statements about visual-perceptual interventions.

Eligibility for Special Education

Participants’ agreement with the two statements about access to special education services were expected to be directly opposed (i.e., we considered the statements to

Figure 3. Distribution of agreement ratings for survey statements about instruction and intervention for children with dyslexia. Ratings greater than 0 indicate agree, and ratings less than 0 indicate disagree. Ratings of 0 are noted in gray.



be mutually exclusive). However, there was only a moderate statistically significant negative correlation ($r = -.44$, $p < .05$) between the two statements about access to special education services. Figure 4 illustrates the distribution of responses to these two statements. About half of the participants agreed with the true statement: “Dyslexia is recognized as a type of specific learning disability that can receive special education services by the federal government” (i.e., data points in Quadrants I and II, above the x -axis). However, of the participants who agreed with the prior true statement, about half also agreed with the false statement: “In some public schools, dyslexia is not recognized as a learning disability eligible for special education services” (i.e., data points mapped in Quadrants I

and IV, to the right of the y -axis). In other words, 33% of the total sample agreed with *both* statements about eligibility for special education services (i.e., data points in Quadrant I). A well-informed participant’s data points would map to Quadrant II, highlighted in the figure with a gray box; only 22% of participants’ responses mapped to Quadrant II.

Discussion

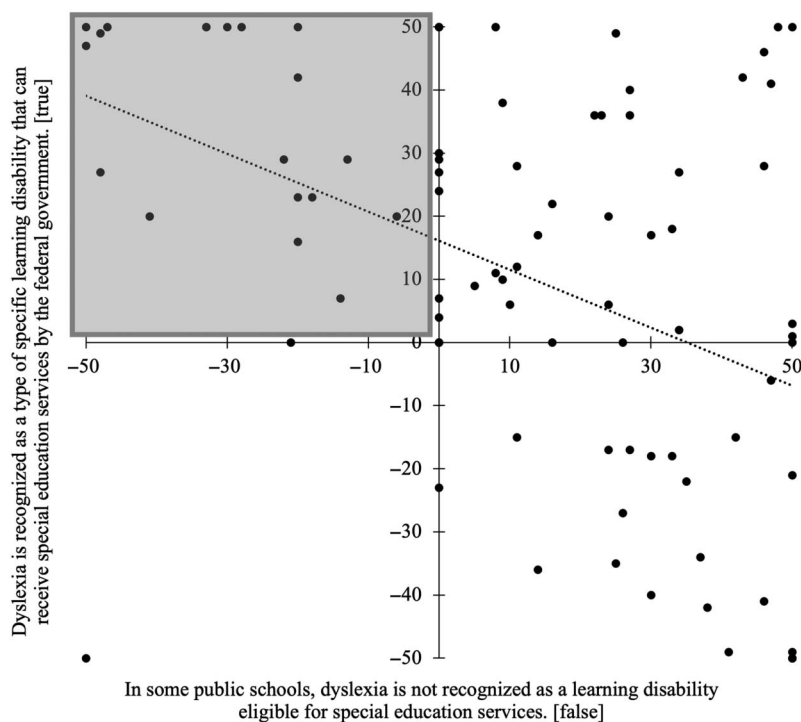
The majority of SLPs in this sample agreed with true statements about dyslexia. However, average agreement ratings for true statements were relatively low, and

Table 2. Correlations between agreement ratings for survey statements about causes of dyslexia and interventions for children with dyslexia.

Survey statement	1	2	3
1. Difficulty with processing sounds in language is one of the major deficits found in dyslexia. [true]	—		
2. Students with dyslexia need explicit, systematic, direct instruction in phonemic awareness and phonics. [true]	.44*	—	
3. Dyslexia is primarily a visual-based reading disability. [false]	-.41*	-.47*	—
4. Colored lenses and colored overlays are research-based accommodations to help students with dyslexia. [false]	-.30*	-.23*	.41*

* $p < .05$.

Figure 4. Distribution of responses regarding dyslexia and special education services. Quadrants are labeled counterclockwise from the top right corner. Accurate knowledge on both statements would result in a participant's data falling within Quadrant II, highlighted with the gray box.



many SLPs also agreed with false statements about dyslexia. When examined more precisely, the data suggest only moderate understanding about dyslexia among the majority of SLPs. Collectively, SLPs may be acquiring knowledge of dyslexia, but many individual SLPs may not yet be confident enough in their knowledge to seek collaboration on literacy teams, advocate for evidence-based practices in schools, and incorporate literacy and preliteracy skills into speech-language therapy.

Causes and Characteristics of Dyslexia

The majority of SLPs were aware that phonological processing difficulties, not visual deficits, are the primary cause of dyslexia. This awareness, however, has not replaced beliefs about a visual deficit as a causal mechanism; the majority of SLPs in the sample agreed that although visual-perceptual deficits are not a *primary* cause of dyslexia, they are a *component* of the dyslexia diagnosis. Additionally, the majority of SLPs agreed that seeing letters and words backward is a characteristic of dyslexia. Our findings are consistent with Washburn et al.'s (2011) findings among teachers and the lay population. Taken together, these findings suggest a persistent and pervasive misconception about visual deficits in dyslexia that needs to be corrected.

There are several potential challenges presented by the persistent belief that visual deficits cause dyslexia and that children with dyslexia experience visual symptoms. First, persistent belief that children with dyslexia see letters or words backward likely affects which children are referred for evaluation. Not only are letter reversals not characteristic of dyslexia, they are common among children who are acquiring reading and writing skills typically (Treiman et al., 2014). If a primary “red flag” that parents and teachers look for is, in fact, not a red flag at all, many children who present with actual red flags (e.g., phonemic awareness deficits and other spoken language difficulties but not letter reversals) may be overlooked for referral. SLPs need to ensure that parents and educators are aware that early language difficulties often precede identification of dyslexia (Catts, 1997).

Once a child is referred for evaluation for dyslexia, the persistent belief in visual-perceptual deficits may waste valuable assessment time. Although guidelines about what should be included in a dyslexia evaluation vary across settings, a comprehensive evaluation should include multiple measures to evaluate the child's strengths and weaknesses across linguistic domains (Adlof & Hogan, 2018). In alignment with previous recommendations (e.g., Adlof & Hogan, 2018), we recommend that children with

suspected dyslexia be evaluated using at least (a) a measure of phonological processing, (b) a measure of pseudo-word reading, (c) a measure of reading fluency, and (d) a measure of spelling. However, because dyslexia and language impairment often co-occur, best practice would involve including spoken language measures suitable for assisting in the identification of language impairment in dyslexia evaluations (Adlof & Hogan, 2018). SLPs need to be aware of the high rate of co-occurrence and communicate with the special education team to ensure that spoken language skills are assessed appropriately. Doing so will ensure that children with co-occurring language impairment and dyslexia can be identified as such and provided with intervention that meets each child's needs, rather than with intervention that addresses only decoding difficulties.

In addition to a comprehensive evaluation of language skills, it also may be necessary for children with suspected dyslexia to be evaluated for other commonly co-occurring disorders such as attention-deficit/hyperactivity disorder, anxiety, and depression (Germanò et al., 2010; Mugnaini et al., 2009). Thus, a comprehensive evaluation for a child with dyslexia is likely to last several hours and involve multiple professionals. Spending time evaluating visual processing wastes time given that such deficits neither contribute to reading skills nor differentiate between children with and without dyslexia (Vellutino et al., 1991).

Finally, the persistent belief in visual processing deficits as a component of dyslexia may contribute to SLPs' concerns over whether they are qualified to diagnose or contribute to the diagnosis of dyslexia. Although there is considerable confusion around this issue and SLPs' role in diagnosing dyslexia may vary across states and clinical settings, SLPs are qualified to administer and interpret measures of phonological processing, reading, writing, and spoken language to diagnose dyslexia. ASHA (2001) specifically includes assessing and supporting written language as one of SLPs' roles and responsibilities. Countering the belief in a visual deficit in children with dyslexia while highlighting the linguistic nature of the disorder may support SLPs in advocating for their role on literacy teams.

Instruction and Intervention for Children With Dyslexia

The erroneous belief in a visual deficit in children with dyslexia also likely contributes to the continued popularity of sham therapies such as colored lenses, special fonts, and behavioral optometry (i.e., visual exercises; Hempenstall, 2020). The pattern of correlations in our data suggests that endorsement of visual interventions tends to occur alongside agreement with a visual basis for

dyslexia. Indeed, ideally interventions *are* chosen according to the known or hypothesized origin of a disorder. However, a wealth of research shows that accommodations such as colored lenses and special fonts and interventions such as vision exercises are ineffective for treating dyslexia (Hempenstall, 2020). The resources spent procuring these products and services would be better spent securing access to effective instruction, intervention, and accommodations (e.g., audiobooks). Thus, it is important for professionals to encourage pursuit of evidence-based interventions that are likely to result in meaningful change.

Rather than seeking visual solutions to a linguistic problem, educators should provide early phonological awareness intervention for children with and at risk for dyslexia. Phonological awareness is a malleable skill that is improved with intervention (Al Otaiba et al., 2009), and improving phonological awareness is associated with improved reading outcomes (Torgesen, 2002). Because SLPs tend to outperform other educators on explicit phonological awareness tasks (Krimm, 2019; Spencer et al., 2008), delivering such intervention and partnering with classroom teachers to improve Tier 1 phonological awareness instruction are means by which SLPs can begin to integrate themselves within literacy teams (Catts, 1991; Girolametto et al., 2012).

Eligibility for Special Education for Children With Dyslexia

Data from this study suggest that there may be substantial confusion among SLPs over the use of the term *dyslexia* in special education. It is important for SLPs to intimately understand eligibility requirements across special education disability categories because SLPs sometimes are the only member of the Individualized Education Program team with specialized diagnostic training (e.g., when a child's only disability is speech and/or language impairment). About half of the SLPs in our sample believed that public schools do not recognize that dyslexia is a learning disability eligible for special education services, whereas about half knew that dyslexia is a type of specific learning disability (SLD) included within the SLD definition in the Individuals with Disabilities Education Act (IDEA; 20 U.S.C.§1401, 1975). Despite the expected negative correlation between the ratings for these two survey statements, almost a quarter of the participants agreed with *both* statements. A well-informed participant would have considered these statements to be mutually exclusive.

It is possible that the apparent confusion over eligibility for special education services reflects a limitation of the measure used, specifically the wording of the false statement: "In some public schools, dyslexia is not

recognized as a learning disability eligible for special education services.” The purpose of this statement was to capture the extent to which participants believed schools can legally deny services to children with dyslexia. However, the statement could be interpreted as asking about what does happen in schools, rather than what should happen. Indeed, many school personnel are under the impression that they may not use the term *dyslexia* even though it is specifically named in IDEA as an example of SLD (IDEA 20 U.S.C.§1401, 1975). It is possible that these data reflect a more general lack of knowledge about special education law that has been observed (e.g., Schuele & Young, 2017). It may be important to evaluate and address knowledge of special education law among SLPs in the future.

Consequences of Misconceptions About Dyslexia

Although many SLPs correctly agreed with true statements about dyslexia and correctly disagreed with false statements about dyslexia, the relative strength of their agreement/disagreement is concerning. Ratings for true and false statements tended to converge toward the middle of the scale. These ratings suggest that SLPs who have accurate knowledge of dyslexia may lack confidence in their knowledge. Importantly, a lack of confidence may prevent an SLP from promoting evidence-based practice. For example, an SLP who knows that dyslexia results from a phonological processing deficit but who doubts their own understanding may not correct a parent or colleague whose comments suggest the belief that dyslexia results from a visual deficit.

The seemingly inescapable belief in a visual component to dyslexia, combined with a lack of conviction about the phonological basis of dyslexia, may also explain SLPs’ apparent reluctance to address literacy and preliterate skills in speech-language intervention. Clarifying that dyslexia is a linguistically based disorder that often co-occurs with language impairment (\pm speech impairment) may be an important starting point for encouraging SLPs to identify children at risk for dyslexia. Similarly, clarifying the powerful protective effect of early elementary phonological awareness instruction on later elementary reading achievement may nudge SLPs toward including phonological awareness in speech-language intervention and/or participating as interventionists in Tier 2 phonological awareness interventions.

Factors That Contribute to Misconceptions About Dyslexia

Overall, our data suggest that most SLPs have moderate understanding of dyslexia. Due to the exploratory

nature of the study, sufficient information about participants’ educational background to draw conclusions about factors that may have contributed to higher dyslexia knowledge scores was not collected. In a similar study, Peltier et al. (2020c) found that the number of reading courses completed by preservice teachers was not related to their dyslexia knowledge. Fallon and Katz (2011) reported that SLPs who (a) had specific training in supporting written language, (b) believed that they had the necessary expertise to serve children in written language, and (c) believed that doing so should be within SLPs’ scope of practice were more likely to address written language skills in speech-language intervention as compared to SLPs who did not believe that supporting written language is within the SLPs’ scope of practice. These variables also may correlate with higher dyslexia knowledge scores. Future work can systematically evaluate the factors that contribute to misconceptions.

Replacing Misconceptions About Dyslexia

There are several consequences of misconceptions about dyslexia that range from minor to severe outlined above. At best, children with dyslexia sometimes learn to read well enough and/or learn to compensate for weak reading skills well enough to progress through school but do not reach their full potential. At worst, children with dyslexia remain unidentified and never receive evidence-based instruction or effective intervention.

Because reading and writing are critical for academic success, it is imperative that educators’ misconceptions about dyslexia are adjusted to reflect current scientific understanding. Steps can be taken by SLPs, SLP graduate programs, and school districts to improve SLPs’ knowledge of dyslexia. Several resources and suggestions are provided below. The authors have no financial or non-financial association with the recommended resources and acknowledge that other high-quality resources exist that are not mentioned here.

There are many avenues for practicing SLPs who feel uncomfortable with their knowledge of written language and, specifically, dyslexia to achieve this knowledge. SLPs are encouraged to seek scientifically sound information about dyslexia independently. A starting point may be to read Peltier et al.’s (2020b) refutation text, which can be found here, <https://doi.org/10.17605/OSF.IO/FBYHT>, and/or to form a professional learning community based on *Speech to Print: Language Essentials for Teachers* (Moats, 2020), which details the connections between spoken and written language while providing in-depth information about the structures and functions of written English. SLPs who wish to seek additional coursework to prepare them to evaluate and treat children with dyslexia can

access a list of programs accredited by the International Dyslexia Association here: <https://dyslexiaida.org/accredited-teaching-training-programs/>. Many programs are tailored to the needs of working educators and offer online classes and flexible scheduling. Other programs can be completed with intensive training over a few weeks, usually with the addition of a longer practicum experience.

Graduate programs can address misconceptions about dyslexia in preservice SLPs by examining and possibly revising teaching practices and/or curricular requirements. In classroom teaching, instructors can employ refutation texts and refutation lectures to revise students' misconceptions about dyslexia. Refutation texts are an effective approach to conceptual change. They include (a) a statement of the misconception, (b) an explicit refutation of the misconception, (c) a replacement conception, and (d) a description of scientific support for the replacement conception (Tippett, 2010). Historically, refutation texts have been used in science education to replace misconceptions about controversial concepts such as climate change and evolution (Heddy & Sinatra, 2013; Lombardi et al., 2016). Peltier et al. (2020b) wrote a refutation text to address teachers' misconceptions about dyslexia. An excerpt of the text reads (brackets added to guide our readers):

Many people think dyslexia is a visual or perceptual difficulty [statement of misconception]. . . . But that is not what has been shown by research [explicit refutation]. In actuality, dyslexia is primarily a language-based reading disability, not a visual-based disability [replacement conception]. . . . Research shows that, in students with dyslexia, the part of the brain that processes. . . sounds and connects those sounds to letters is underactivated as compared with typically developing readers [description of support]. (p. 1)

Peltier et al. (2020c) found statistically significant improvement in preservice general education and special education teachers' knowledge of dyslexia associated with reading this refutation text ($\eta^2 = .33$). Refutation texts also may be useful for replacing SLPs' misconceptions about dyslexia, and investigation into their use with SLPs is currently underway.

Additionally, preparing preservice SLPs to adequately address dyslexia may require graduate programs to reconsider their curricular design. Many graduate programs offer a single course on each of several disorders for which SLPs must have basic competence in assessment and intervention. This "one course per disorder" model could be reconsidered according to factors including (a)

adult learning principles, (b) prevalence and impact of each disorder on communication, and (c) the amount of scientific evidence that must be considered in the evaluation and treatment of each. Because language is affected in many developmental disorders (e.g., autism and hearing impairment), some programs do require multiple courses related to child language. However, the extent to which written language is covered in these courses varies considerably by program.

One solution is to add coursework that focuses specifically on written language disorders, though doing is likely to be a cumbersome undertaking that perpetuates the separation of spoken and written language. Integrating written language disorders into existing coursework, however, often is impractical given the amount of time students have each semester. Alternatively, programs could move away from the "one course per disorder" model and introduce specializations according to students' intended future careers. This change can be accomplished by combining several courses into broader courses that focus on establishing basic competence, thus freeing time for more in-depth study in students' areas of interest.

School districts can contribute to improving knowledge of dyslexia among practicing SLPs in several ways. A first step would be to include SLPs in training provided to classroom teachers about dyslexia. Additionally, school districts can elect to abandon the "one and done" model of professional development, in which educators receive a day or two of intense instruction without follow-up, in favor of ongoing partnerships with expert entities (e.g., Brownell et al., 2017). Establishing ongoing partnerships likely will build districts' capacity and institutional memory for high-quality instruction. Although ongoing inter-professional development presents many logistical challenges, we believe these challenges can be overcome at a low cost relative to the amount of benefit that may be seen in children's reading outcomes.

Limitations

The data for this study were obtained from a small convenience sample drawn from participants from a conference hosted annually at the second and third authors' institution. The sample was prone to selection bias because interested participants had to take multiple steps (e.g., e-mail the study team) to enroll. The link was not included in the recruitment e-mail to (a) maintain participants' anonymity and (b) to prevent the same participant from completing the survey multiple times. Given these factors, it is likely that the study sample included participants with (a) particular interest in research and/or (b) particular interest in language and literacy. Thus, the generalizability of the findings reported herein is limited.

Additionally, the questions analyzed in this study were drawn from an experimental measure (Peltier et al., 2020a). To our knowledge, item analysis has not yet been completed nor have reliability and validity been verified.

Conclusions and Future Directions

This study adds to the knowledge base by exploring conceptions and misconceptions about dyslexia in a sample of school SLPs. Our findings suggest that many school-based SLPs hold misconceptions about dyslexia. One of the most prominent misconceptions was that dyslexia is, at least in part, a visual disorder. SLPs' misconceptions about dyslexia may contribute to their general reluctance to address reading and writing skills. Given that children with language impairment are at high risk for dyslexia, SLPs need to better understand the scientific evidence about causes, identification, and remediation for children with dyslexia.

Data Availability Statement

The data sets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

Acknowledgments

This research was supported by a Vanderbilt University Medical Center CTSA Program Award (5UL1TR002243-03) and the National Center for Advancing Translational Sciences (UL1TR000445) awarded to the Vanderbilt Center for Clinical and Translational Research. The authors thank the participants for making this study possible. They also thank Hannah Malamud and Annabelle Clarke for assisting with data collection.

References

- Adlof, S. M., & Hogan, T. P. (2018). Understanding dyslexia in the context of developmental language disorders. *Language, Speech, and Hearing Services in Schools, 49*(4), 762–773. https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0049
- Al Dahhan, N. Z., Mesite, L., Feller, M. J., & Christodoulou, J. A. (2021). Identifying reading disabilities: A survey of practitioners. *Learning Disability Quarterly, 44*(4), 235–247. <https://doi.org/10.1177/0731948721998707>
- Al Otaiba, S., Puranik, C. S., Ziolkowski, R. A., & Montgomery, T. M. (2009). Effectiveness of early phonological awareness interventions for students with speech or language impairments. *The Journal of Special Education, 43*(2), 107–128. <https://doi.org/10.1177/0022466908314869>
- American Speech-Language-Hearing Association. (2000). *Guidelines for the roles and responsibilities of the school-based speech-language pathologist* [Guidelines]. <https://www.asha.org/policy/pi2010-00317/>
- American Speech-Language-Hearing Association. (2001). *Roles and responsibilities of speech-language pathologists with respect to reading and writing in children and adolescents* [Position statement]. <https://www.asha.org/policy/PS2001-00104/>
- American Speech-Language-Hearing Association. (2018). *2018 schools survey. Survey summary report: Numbers and types of responses, SLPs*. <https://www.asha.org/siteassets/surveys/2018-schools-survey-summary-report.pdf>
- American Speech-Language-Hearing Association. (2021). *2020 member affiliate profile*. <https://www.asha.org/siteassets/surveys/2002-2022-member-and-affiliate-profile-trends.pdf>
- Ball, E. W., & Blachman, B. A. (1988). Phoneme segmentation training: Effect on reading readiness. *Annals of Dyslexia, 38*(1), 208–225. <https://doi.org/10.1007/BF02648257>
- Blood, G. W., Mamett, C., Gordon, R., & Blood, I. (2010). Written language disorders: Speech-language pathologists' training, knowledge, and confidence. *Language, Speech, and Hearing Services in Schools, 41*(4), 416–428. [https://doi.org/10.1044/0161-1461\(2009/09-0032\)](https://doi.org/10.1044/0161-1461(2009/09-0032))
- Briggs, M., & Closs, J. S. (1999). A descriptive study of the use of visual analogue scales and verbal rating scales for the assessment of postoperative pain in orthopedic patients. *Journal of Pain and Symptom Management, 18*(6), 438–446. [https://doi.org/10.1016/S0885-3924\(99\)00092-5](https://doi.org/10.1016/S0885-3924(99)00092-5)
- Brownell, M., Kiely, M. T., Haager, D., Boardman, A., Corbett, N., Algina, J., Dingle, M. P., & Urbach, J. (2017). Literacy learning cohorts. *Exceptional Children, 83*(2), 143–164. <https://doi.org/10.1177/0014402916671517>
- Byrom, B., Elash, C. A., Eremenco, S., Bodart, S., Muehlhausen, W., Platko, J. V., Watson C., & Howry C. (2022). Measurement comparability of electronic and paper administration of visual analogue scales: A review of published studies. *Therapeutic Innovation & Regulatory Science, 56*(3), 394–404. <https://doi.org/10.1007/s43441-022-00376-2>
- Catts, H. W. (1989). Defining dyslexia as a developmental language disorder. *Annals of Dyslexia, 39*(1), 50–64. <https://doi.org/10.1007/BF02656900>
- Catts, H. W. (1991). Early identification of dyslexia: Evidence from a follow-up study of speech-language impaired children. *Annals of Dyslexia, 41*(1), 163–177. <https://doi.org/10.1007/BF02648084>
- Catts, H. W. (1997). The early identification of language-based reading disabilities. *Language, Speech, and Hearing Services in Schools, 28*(1), 86–89. <https://doi.org/10.1044/0161-1461.2801.86>
- Catts, H. W., Adlof, S., & Hogan, T. P., Weismer, S. E. (2005). Are specific language impairment and dyslexia distinct disorders? *Journal of Speech, Language, and Hearing Research, 48*(6), 1378–1396. [https://doi.org/10.1044/1092-4388\(2005/096\)](https://doi.org/10.1044/1092-4388(2005/096))
- Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools, 32*(1), 38–50. [https://doi.org/10.1044/0161-1461\(2001/004\)](https://doi.org/10.1044/0161-1461(2001/004))
- Dekker, S., Lee, N. C., Howard-Jones, P., & Jolles, J. (2012). Neuromyths in education: Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology, 3*, Article 429. <https://doi.org/10.3389/fpsyg.2012.00429>
- Ehren, B. J., & Ehren, T. C. (2001). New or expanded literacy roles for speech-language pathologists: Making it happen in the schools. *Seminars in Speech and Language, 22*(3), 233–244. <https://doi.org/10.1055/s-2001-16146>
- Fallon, K. A., & Katz, L. A. (2011). Providing written language services in the schools: The time is now. *Language, Speech,*

- and Hearing Services in Schools, 42(1), 3–17. [https://doi.org/10.1044/0161-1461\(2010/09-0068\)](https://doi.org/10.1044/0161-1461(2010/09-0068))
- Farquharson, K., Tambyraja, S. R., Logan, J., Justice, L. M., & Schmitt, M. B. (2015). Using hierarchical linear modeling to examine how individual SLPs differentially contribute to children's language and literacy gains in public schools. *American Journal of Speech-Language Pathology*, 24(3), 504–516. https://doi.org/10.1044/2015_AJSLP-14-0055
- Germanò, E., Gagliano, A., & Curatolo, P. (2010). Comorbidity of ADHD and dyslexia. *Developmental Neuropsychology*, 35(5), 475–493. <https://doi.org/10.1080/87565641.2010.494748>
- Gini, S., Knowland, V., Thomas, M. S. C., & Van Herwegen, J. (2021). Neuromyths about neurodevelopmental disorders: Misconceptions by educators and the general public. *Mind, Brain, and Education*, 15(4), 289–298. <https://doi.org/10.1111/mbe.12303>
- Girolametto, L., Weitzman, E., & Greenberg, J. (2012). Facilitating emergent literacy: Efficacy of a model that partners speech-language pathologists and educators. *American Journal of Speech-Language Pathology*, 21(1), 47–63. [https://doi.org/10.1044/1058-0360\(2011/11-0002\)](https://doi.org/10.1044/1058-0360(2011/11-0002))
- Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., Duda, S. N., & REDCap Consortium. (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, 95, Article 103208. <https://doi.org/10.1016/j.jbi.2019.103208>
- Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, 42(2), 377–381. <https://doi.org/10.1016/j.jbi.2008.08.010>
- Heddy, B. C., & Sinatra, G. M. (2013). Transforming misconceptions: Using transformative experience to promote positive affect and conceptual change in students learning about biological evolution. *Science Education*, 97(5), 723–744. <https://doi.org/10.1002/sce.21072>
- Hempenstall, K. (2020). Behavioral optometry and Irlen lenses to resolve reading problems. *Perspectives on Language and Literacy*, 46(1), 17–20.
- Hogan, T. (2018a). Five ways speech-language pathologists can positively impact children with dyslexia. *Language, Speech, and Hearing Services in Schools*, 49(4), 902–905. https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0102
- Hogan, T. (2018b). What speech-language pathologists need to know about dyslexia. *Language, Speech, and Hearing Services in Schools*, 49(4), 759–761. https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0098
- Individuals with Disabilities Education Act, 20 U.S.C. § 1401. (1975). <https://www.loc.gov/item/uscode1958-004019005/>
- International Dyslexia Association. (2002). *Definition of dyslexia*. Retrieved April 26, 2023, from <https://dyslexiaida.org/definition-of-dyslexia/>
- Kovelman, I., Norton, E., Christdoulou, J. A., Gaab, N., Lieberman, D. A., Triantafyllou, C., Wolf, M., Whitfield-Gabrieli, S., & Gabrieli, J. D. E. (2012). Brain basis of phonological awareness for spoken language in children and its disruption in dyslexia. *Cerebral Cortex*, 22(4), 754–764. <https://doi.org/10.1093/cercor/bhr094>
- Krimm, H. (2019). *An exploration of educator linguistic knowledge and expertise* [Doctoral dissertation, Vanderbilt University]. Electronic Theses and Dissertations. <https://etd.library.vanderbilt.edu/etd-03202019-154557>
- Lombardi, D., Danielson, R. W., & Young, N. (2016). A plausible connection: Models examining the relations between evaluation, plausibility, and the refutation text effect. *Learning and Instruction*, 44, 74–86. <https://doi.org/10.1016/j.learninstruc.2016.03.003>
- Loveall, S. J., Pitt, A. R., Rolfe, K. G., & Mann, J. (2022). Speech-language pathologist reading survey: Scope of practice, training, caseloads, and confidence. *Language, Speech, and Hearing Services in Schools*, 53(3), 837–859. https://doi.org/10.1044/2022_LSHSS-21-00135
- Macdonald, K., Germine, L., Anderson, A., Christodoulou, J., & McGrath, L. M. (2017). Dispelling the myth: Training in education or neuroscience decreases but does not eliminate beliefs in neuromyths. *Frontiers in Psychology*, 8, Article 1314. <https://doi.org/10.3389/fpsyg.2017.01314>
- McArthur, G., Hogben, J., Edwards, V., Heath, S., & Mengler, E. (2000). On the “specifics” of specific reading disability and specific language impairment. *The Journal of Child Psychology and Psychiatry*, 41(7), 869–874. <https://doi.org/10.1111/1469-7610.00674>
- McDaniel, J., Krimm, H., & Schuele, C. M. (2023). Speech-language pathologists' endorsement of speech, language, and literacy myths reveals persistent research-practice gap. *Language, Speech, and Hearing Services in Schools*, 54(2), 550–568. https://doi.org/10.1044/2022_LSHSS-22-00087
- Melby-Lervåg, M., Lyster, S.-A. H., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. *Psychological Bulletin*, 138(2), 322–352. <https://doi.org/10.1037/a0026744>
- Moats, L. C. (2020). *Speech to print: Language essentials for teachers* (3rd ed.). Brookes.
- Mugnaini, D., Lassi, S., La Malfa, G., & Albertini, G. (2009). Internalizing correlates of dyslexia. *World Journal of Pediatrics*, 5(4), 255–264. <https://doi.org/10.1007/s12519-009-0049-7>
- National Institute of Neurological Disorders and Stroke. (2023). *Dyslexia*. Retrieved April 26, 2023, from <https://www.ninds.nih.gov/>
- Neale, M. D. (1988). *Neale Analysis of Reading Ability—Revised: Manual*. Australian Council for Educational Research.
- Peltier, T. K., Heddy, B. C., & Peltier, C. (2020a). *Dyslexia knowledge questionnaire*. <https://doi.org/10.17605/OSF.IO/8AYVX>
- Peltier, T. K., Heddy, B. C., & Peltier, C. (2020b). *Refutation text*. <https://doi.org/10.17605/OSF.IO/FBYHT>
- Peltier, T. K., Heddy, B. C., & Peltier, C. (2020c). Using conceptual change theory to help preservice teachers understand dyslexia. *Annals of Dyslexia*, 70(1), 62–78. <https://doi.org/10.1007/s11881-020-00192-z>
- Pfennings, L., Cohen, L., & van der Ploeg, H. (1995). Preconditions for sensitivity in measuring change: Visual analogue scales compared to rating scales in a Likert format. *Psychological Reports*, 77(2), 475–480. <https://doi.org/10.2466/pr0.1995.77.2.475>
- Rehfeld, D. M., Kilpatrick, M., O'Guinn, N., & Renbarger, R. (2022). A meta-analysis of phonemic awareness instruction provided to children suspected of having a reading disability. *Language, Speech, and Hearing Services in Schools*, 53(4), 1177–1201. https://doi.org/10.1044/2022_LSHSS-21-00160
- Schuele, C. M., Justice, L. M., Cabell, S. Q., Knighton, K., Kingery, B., & Lee, M. W. (2008). Field-based evaluation of two-tiered instruction for enhancing kindergarten phonological awareness. *Early Education and Development*, 19(5), 726–752. <https://doi.org/10.1080/10409280802375299>
- Schuele, C. M., & Young, K. (2017). On the cusp of middle school... with minimal reading and writing skills. *Perspectives*

- of the ASHA Special Interest Groups, 2(1), 138–150. <https://doi.org/10.1044/persp2.SIG1.138>
- Semmel, E., Wiig, E. H., & Secord, W.** (1987). *Clinical evaluation of language fundamentals—revised*. The Psychological Association.
- Shaughnessy, A., & Sanger, D.** (2005). Kindergarten teachers' perceptions of language and literacy development, speech-language pathologists, and language interventions. *Communication Disorders Quarterly*, 26(2), 67–84. <https://doi.org/10.1177/15257401050260020601>
- Snowling, M. J., Hulme, C., & Nation, K.** (2020). Defining and understanding dyslexia: Past, present, and future. *Oxford Review of Education*, 46(4), 501–513. <https://doi.org/10.1080/03054985.2020.1765756>
- Spencer, E. J., Schuele, C. M., Guillot, K. M., & Lee, M. W.** (2008). Phonemic awareness skill of speech-language pathologists and other educators. *Language, Speech, and Hearing Services in Schools*, 39(4), 512–520. [https://doi.org/10.1044/0161-1461\(2008/07-0080\)](https://doi.org/10.1044/0161-1461(2008/07-0080))
- Staskowski, M., & Zagaiski, K.** (2003). Reaching for the stars: SLPs shine on literacy teams. *Seminars in Speech and Language*, 24(3), 199–213. <https://doi.org/10.1055/s-2003-42825>
- Tambyraja, S. R., Schmitt, M. B., Justice, L. M., Logan, J. A., & Schwarz, S.** (2014). Integration of literacy into speech-language therapy: A descriptive analysis of treatment practices. *Journal of Communication Disorders*, 47, 34–46. <https://doi.org/10.1016/j.jcomdis.2014.01.004>
- Tippett, C. D.** (2010). Refutation text in science education: A review of two decades of research. *International Journal of Science and Mathematics Education*, 8(6), 951–970. <https://doi.org/10.1007/s10763-010-9203-x>
- Torgesen, J. K.** (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research and Practice*, 15(1), 55–64. https://doi.org/10.1207/SLDRP1501_6
- Torgesen, J. K.** (2002). The prevention of reading difficulties. *Journal of School Psychology*, 40(1), 7–26. [https://doi.org/10.1016/S0022-4405\(01\)00092-9](https://doi.org/10.1016/S0022-4405(01)00092-9)
- Torrijos-Muelas, M., González-Villora, S., & Bodoque-Osma, A. R.** (2021). The persistence of neuromyths in the educational settings: A systematic review. *Frontiers in Psychology*, 11, Article 591923. <https://doi.org/10.3389/fpsyg.2020.591923>
- Treiman, R., Gordon, J., Boada, R., Peterson, R. L., & Pennington, B. F.** (2014). Statistical learning, letter reversals, and reading. *Scientific Studies of Reading*, 18(6), 383–394. <https://doi.org/10.1080/10888438.2013.873937>
- Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D.** (2004). Specific reading disability (dyslexia): What have we learned in the past four decades? *The Journal of Child Psychology and Psychiatry*, 45(1), 2–40. <https://doi.org/10.1046/j.0021-9630.2003.00305.x>
- Vellutino, F. R., Scanlon, D. M., Small, S. G., & Tanzman, M. S.** (1991). The linguistic basis of reading ability: Converting written to oral language. *Text*, 11, 99–133.
- Wadlington, E. M., & Wadlington, P. L.** (2005). What educators really believe about dyslexia. *Reading Improvement*, 42(1), 16–33.
- Wagner, R. K., & Torgesen, J. K.** (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, 101(2), 192–212. <https://doi.org/10.1037/0033-2909.101.2.192>
- Washburn, E. K., Joshi, R. M., & Binks-Cantrell, E. S.** (2011). Teacher knowledge of basic language concepts and dyslexia. *Dyslexia*, 17(2), 165–183. <https://doi.org/10.1002/dys.426>
- Watson, M., O'Keefe, C., Wallace, A., & Terrell, P.** (2020). A survey of reading teachers: Collaboration with speech-language pathologists. *Perspectives of the ASHA Special Interest Groups*, 5(1), 304–313. https://doi.org/10.1044/2019_PERSP-19-00006
- Werfel, K. L., & Krimm, H.** (2017). A preliminary comparison of reading subtypes in a clinical sample of children with specific language impairment. *Journal of Speech, Language, and Hearing Research*, 60(9), 2680–2686. https://doi.org/10.1044/2017_JSLHR-L-17-0059
- Ysseldyke, J.** (2001). Reflections on a research career: Generalizations from 25 years of research on assessment and instructional decision making. *Exceptional Children*, 67(3), 295–309. <https://doi.org/10.1177/001440290106700301>
- Zourou, F., Ecalle, J., Magnan, A., & Sanchez, M.** (2010). The fragile nature of phonological awareness in children with specific language impairment: Evidence from literacy development. *Child Language Teaching and Therapy*, 26(3), 347–358. <https://doi.org/10.1177/0265659010369288>