Accounting for Oral Language Skills in Children With Dyslexia: A Systematic Review of the Literature

Natalie Kay Olsen Miller

Brigham Young University

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Accounting for Oral Language Skills in Children With Dyslexia:

A Systematic Review of the Literature

Natalie Kay Olsen Miller

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Katy Cabbage, Chair
Connie Summers
Douglas Petersen

Department of Communication Disorders
Brigham Young University

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ABSTRACT

Accounting for Oral Language Skills in Children With Dyslexia: A Systematic Review of the Literature

Natalie Kay Olsen Miller
Department of Communication Disorders, BYU
Master of Science

Purpose: In the present study, we conducted a systematic review to determine whether studies involving children with dyslexia include the assessment of oral language skills in their assessment batteries across various professional disciplines. Overlooking assessment of oral language in children with dyslexia may result in the misinterpretation of research findings and applications to children who present with both dyslexia and Developmental Language Disorder (DLD) or experience secondary oral language deficits.

Method: According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we searched the Elsevier Scopus database and obtained and analyzed 764 articles, up to 40 articles each year from 2000 to 2020, involving child participants with dyslexia. A coding scheme was created to analyze the diagnostic criteria and inclusion and exclusion criteria used for the classification of children with dyslexia within each study. We also investigated whether oral language was included in the methodology of the study, and, if so, what areas of oral language were assessed. We further analyzed whether the inclusion of oral language assessment varied according to the professional discipline of the journal (e.g., medicine, education, etc.).

Results: Out of 764 articles, 24.4% of articles account for oral language skills in criteria for children with dyslexia. The journal discipline of speech-language pathology considers oral language the most in their articles with 84% of articles either accounting for oral language in participant selection criteria or as a descriptive feature in children with dyslexia. Journal articles from the medical discipline are least likely (45% of all articles) to assess oral language. Phonological awareness is the most commonly reported area of oral language assessed, ranging from 10% to 18% of articles in each discipline.

Conclusion: Few studies investigate oral language skills in children with dyslexia beyond the phonological domain alone. This may result in misrepresentation of the varying oral language skills in children with dyslexia in research. To better understand the role of oral language in children with dyslexia, we recommend that researchers and professionals include oral language assessment when assessing children with dyslexia.

Keywords: dyslexia, children, oral language, assessment
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DESCRIPTION OF THESIS STRUCTURE AND CONTENT

This thesis, *Accounting for Oral Language Skills in Children With Dyslexia: A Systematic Review of the Literature,* is a systematic review written in a hybrid format which includes traditional thesis requirements and journal publication formats.

The preliminary pages of this thesis fulfill submission requirements to Brigham Young University. This thesis report’s length and style is written as a journal article that fulfills the required formatting to be submitted as a research report to education journals.

Appendix A consists of the literature review which was conducted before initiating this study. Appendix B includes the instructions given to research assistants on how to record qualitative information in Microsoft Excel when evaluating 764 articles for this systematic review. Appendix C contains oral language assessment descriptions obtained from research articles in this review and how they were categorized into four different oral language domains.
Introduction

Many children throughout the world are impacted by a specific learning disability known as dyslexia. Dyslexia has been defined in various ways; however, a popular definition utilized by the International Dyslexia Association, the National Institute of Child Health and Human Development, and state education codes includes:

Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (Ward-Lonergan & Duthie, 2018, p. 810)

This definition establishes that dyslexia is a phonological processing deficit with no other underlying cognitive disabilities. Catts et al. (2005) describes phonological awareness, a component of the phonological processing deficit in children with dyslexia, as “one’s sensitivity to, or explicit awareness of, the sound structure of language” (p. 1379). Catts et al. also details other deficits that impair children with dyslexia word-reading difficulties including phonological memory problems, nonword repetition difficulty, and “inefficiency in the formation of phonological representations” (p. 1379). Children with dyslexia experience specific word-reading difficulties which, as defined by Ward-Lonergan and Duthie (2018), ultimately can result in secondary oral language consequences beyond the phonological component of language including word learning difficulties and deficits in reading comprehension.
History of Dyslexia

Characteristic symptoms of dyslexia were first identified in 1870 and referred to as “word-blindness” or an “ocular deficit” (Kussmaul, 1877). The term “dyslexia” was coined by Rudolph Berlin, an ophthalmologist and academic, associating the term with the diagnoses of alexia and paralexia that imply dyslexia as a physical disease of the brain where reading ability is affected (Wagner, 1973). William Pringle Morgan (1896, as cited in Kirby, 2020) described dyslexia when describing a boy he worked with to be “‘bright and intelligent…in no way inferior to others of his age. His great difficulty has been…his inability to learn to read’” (pp. 476-477). By the 1920s, the view of dyslexia shifted from it being a disease or physical defect of the brain to a developmental disorder that now fell under the discipline of psychology (Rose, 1985). In the 1940s, reading difficulties in children were explained by failure of academic efforts to teach reading (Burt & Lewis, 1946). Once literacy became a greater educational focus in the 1960s, parents sought help for their children experiencing dyslexic symptoms of reading and spelling difficulties. The modern use of the term dyslexia, as a word reading deficit, began in the 1960s with more research attention beginning to take place during this time (Kirby, 2020).

Simple View of Reading

For many years, reading has been referred to solely as decoding, or one’s ability to articulate letter-sound relationships such as sounding out a word “d-o-g.” Gough and Tumner (1986) introduced the simple view of reading and how reading involves both decoding, which includes the phonological aspects of word reading, and linguistic comprehension that includes listening comprehension, an oral language skill. Decoding has been a major focus of reading instruction; however, one’s ability to decode words without comprehending the message does not necessarily result in attainment of knowledge. Gough and Tumner define linguistic
comprehension as one’s ability to interpret the meaning and message of the words and passages spoken or written such as understanding that “d-o-g” is a household pet or that a story is providing a message of loyalty. In regard to reading, oral language skills are necessary components to comprehension. Adlof and Hogan (2018) further clarified:

Reading comprehension is the product of accurate and efficient word reading and language comprehension. The language comprehension component…encompasses all of the linguistic knowledge and skills required for a listener to comprehend a text if it was read aloud, including vocabulary and semantic processing, syntax, inferencing, and discourse. (p. 763)

As a result, reading is not complete without considering both of its essential elements: (a) decoding, which includes the phonological aspects of word reading; (b) language comprehension, which includes fundamental oral language skills.

**Oral Language Skills and Reading**

Reading development can be viewed as an interaction between semantics, orthography, and phonology with additional connections of each of these elements to the oral language skills of grammar and discourse (Bishop & Snowling, 2004). Bishop and Snowling (2004) shared that some children with dyslexia with good language comprehension may use relatively strong “top-down semantic and syntactic skills” for deficient word reading skills (p. 877). Although this compensatory strategy may occur, there is still an overlap between reading skills and oral language skills. The American Speech-Language-Hearing Association (ASHA) details the relationship between reading and oral language skills:

(a) spoken language provides the foundation for the development of reading and writing;

(b) spoken and written language have a reciprocal relationship, such that each builds on
Spoken and written language are essential components to both language and literacy development. As a result, oral language is a necessary component of a comprehensive assessment for dyslexia.

**Oral Language Difficulties in Children With Dyslexia**

A large body of research has shown that many children with dyslexia experience oral language difficulties beyond the phonological domain of language (Adlof & Hogan, 2018; Alt et al., 2017; Bishop & Snowling, 2004; Catts et al., 2005; Scarborough, 1990; Snowling et al., 2020). Adlof and Hogan (2018) have shared that dyslexia has been described as a “language-based disorder…based primarily on deficits in the phonological domain” (p. 763). Thus, it is important to differentiate phonological processing deficits, a known challenge for individuals with dyslexia, and other oral language skills. Children transition from learning to decode to reading more complex material and learning from what they read around third or fourth grade (Duff et al., 2015). If children continue to experience deficits in learning to read beyond the early primary grades, deficient word reading skills may cause secondary consequences when learning more complex language that comes with literacy exposure. That is, someone with a reading disability like dyslexia may begin to lag behind their peers in oral language development because language learning primarily occurs through reading exposure in the later grades. Duff et al. (2015) describe the “Matthew effect” of vocabulary development and reading in children with
reading disabilities to further illustrate the impact of secondary consequences of oral language development for children with dyslexia. The Matthew effect in word reading refers to the phenomenon that children with good reading skills continue to exponentially improve their reading at a steady pace. Poor readers may also improve in reading, but they improve at a slower pace and the gap increasingly widens between good and poor readers, that is, “the rich get richer” (p. 853). Duff et al. found that a child’s initial reading level is positively related to his or her rate of growth in a reading skill. In this study, there was a large effect of vocabulary levels driven by “strong readers” that reveal the negative impact that can occur with vocabulary development of “weak readers” (p. 862). Children with dyslexia are considered weak readers and therefore as a secondary consequence of dyslexia, oral language may be negatively impacted as a result of the Matthew effect.

Catts et al. (2005) suggested that language difficulties may not just be due to secondary consequences to reading problems, indicating that, “a growing number of studies demonstrate that oral language difficulties are present in children at risk for dyslexia prior to school entry” (p. 1379). Children at risk for dyslexia are those who have a family history of dyslexia or a language delay (McBride-Chang et al., 2008). Scarborough (1990) found that children who were later diagnosed with dyslexia had poorer early language skills as early as 30 months old. Scarborough further noted that syntax and vocabulary are impaired in children with dyslexia when compared to typical developing peers. In a study by Adlof and Hogan (2018), early language skills were associated with having dyslexia from a review of 24 studies with preschool language skills of children with dyslexia. They also found that children with a family history of dyslexia, who later developed dyslexia, had more severe impairment in the phonological domain of language. They also had a severe impairment in broader language domains including vocabulary and grammar
when compared to their peers with and without a family history of dyslexia that did not develop dyslexia. Bishop and Snowling (2004) also found some older children with developmental dyslexia that demonstrate impairments in oral language skills that do not specifically involve reading or writing. Additionally, while children with dyslexia experiencing reading comprehension difficulties may be due to problems decoding text, they also could be as a result of “lower levels of vocabulary” or that their language comprehension skills are “not sufficient” to comprehend texts they can decode (Snowling et al., 2020, p. 678).

**Comorbidity of Dyslexia and Oral Language Disorders**

While oral language skills can be impaired during preliteracy stages or as a result of secondary consequences of dyslexia, there is also a common comorbidity of developmental language disorder (DLD), previously known as specific language impairment (SLI), in children with dyslexia (Catts et al., 2005). SLI, or DLD, is defined as, “a disorder of the development of oral language…[including] problems in semantics, syntax, and discourse” in the presence of normal nonverbal cognitive abilities (p. 1379). Some have debated whether or not these disorders are related or if they are “distinct disorders” (p. 1380). Catts et al. (2005) conducted a study to determine if there is an association between dyslexia and SLI. After looking at 527 school-age children from a longitudinal database, the study analyzed the percentage of children with SLI in kindergarten who had dyslexia in second, fourth, and eighth grades and the percentage of children with dyslexia who showed SLI in kindergarten. The study then looked at how phonological processing deficits impact both disorders and found a statistically significant, but limited, overlap between the disorders. They further concluded, however, that SLI alone was not associated with significant deficits in phonological processing and determined that SLI and dyslexia are distinct, but commonly co-occur. Additional research has further revealed the
prevalence of comorbidity between these distinct disorders. Adlof and Hogan (2018) found the disorders co-occurred from 17% to 71% depending on sampling differences and the time point of the diagnosis of dyslexia and SLI within 24 reviewed studies. In a study by Snowling et al. (2020), 260 children with a family risk of dyslexia were recruited at three years and six months old and were classified according to whether they had a preschool language impairment. The comorbidity of DLD was assessed once the participants with dyslexia were diagnosed at eight years old. The study concluded that the rate of comorbidity between the disorders was high; 48% of children diagnosed with DLD fulfilled the criteria for dyslexia at eight years old and 58% of those with dyslexia had DLD. This is a crucial consideration when assessing and treating children with dyslexia as they may not be evaluated thoroughly without including oral language assessments and they may not be receiving the services that they need that help to target both their reading and oral language skills.

Given the known correlation between oral language deficits and dyslexia along with language development and reading development, it is essential to have a comprehensive understanding of oral language abilities in children with dyslexia. Interestingly, as discovered in a meta-analysis done by Wagner et al. (2020) on the prevalence of dyslexia, it is not always apparent whether investigators studying children with dyslexia account for oral language skill in research conducted with these children as the assessment of oral language skills is not an aspect of dyslexia diagnosis. However, failing to account for oral language skills in research studies may lead to misrepresentation of findings for children with dyslexia due to the high comorbidity of confounding language deficits that may be unaccounted for in these children. For example, Alt et al. (2019) investigated word learning skills in a sample of second-grade children including two subgroups of children with dyslexia: (a) children with dyslexia with average to above-average
language skills, (b) children with dyslexia with DLD. Importantly, these groups of children performed differently on the word learning task. The children with dyslexia and DLD presented with phonological and semantic processing deficits whereas the children with dyslexia without DLD only presented with phonological processing deficits. This suggests the importance of accounting for oral language skills in children with dyslexia. In the current study, we investigate whether oral language skills are evaluated in research studies that include children with dyslexia. If oral language assessment is lacking, it is possible that researchers draw conclusions about children with dyslexia that may be confounded by the unknown contribution of oral language deficits in these children.

**Current Challenges**

At present, there is significant inconsistency in dyslexia diagnosis and participant selection criteria among articles including participants with dyslexia (Lopes et al., 2020). In a systematic review investigating how dyslexia is characterized in research and practice, Lopes et al. (2020) evaluated the 800 most cited journal articles from 2000 to 2019 that included participants with dyslexia. Of the articles evaluated, nearly half reported that dyslexia diagnosis of participants was determined based on an outside diagnosis (e.g., self/parent report). As for testing conducted by the researchers, 75% of these articles included widely varying batteries of tests administered to participants, such as IQ tests including nonverbal and/or verbal IQ and reading assessments. Lopes and colleagues noted, however, that there was no evident consistency in the inclusionary and exclusionary criteria for dyslexia diagnosis within these studies. Additional descriptive information about participants with dyslexia (e.g., oral language skills) was not evaluated in Lopes and colleagues’ systematic review. Adlof and Hogan (2018) also noted that inconsistent inclusionary and exclusionary criteria for diagnosing children with
dyslexia have resulted in prevalence estimates of dyslexia ranging from 3% to 20% of the population. There is a variety of inclusion and exclusion criteria for participants with dyslexia without consideration for oral language skills. Adlof and Hogan stated, “current assessment frameworks that are used to determine whether a child meets diagnostic criteria for dyslexia and related special education services in the US public schools do not explicitly require that oral language skills beyond phonological awareness be assessed” (p. 769). At present, screenings for dyslexia mainly assess letter knowledge and decoding (Wagner et al., 2020). With the lack of consistency in dyslexia evaluation, it is unknown whether studies with participants with dyslexia are accounting for oral language skills in their evaluation criteria or not. The current study aims to evaluate whether oral language skills are accounted for in studies of children with dyslexia and if so, how it is accounted for.

Oral language skills are an essential consideration in assessing and treating children with dyslexia, yet it is not clear whether investigators conducting research with children with dyslexia consistently account for oral language skills in their participant samples. Failing to account for oral language may present an inherent confound for the interpretation and conclusions drawn about children with dyslexia in research. This study seeks to consider how and whether researchers from a variety of professional disciplines investigating children with dyslexia consider oral language skills when assessing their participant samples. By evaluating the most-cited articles in the research literature, we aimed to capture research that may be frequently viewed, referenced, and utilized by consumers and professionals. Thus, we asked the following research questions:

1. Out of the most-cited articles that include children with dyslexia from 2000 to 2020, do research articles account for oral language skills in these children?
2. Which journal disciplines are more likely to publish experimental studies that include oral language assessment for participants with dyslexia?

3. Out of the experimental studies that include oral language assessment of children with dyslexia, what areas of oral language (e.g., vocabulary, syntax, etc.) are most likely to be evaluated?

**Method**

**Data Sample**

In this study, we conducted a systematic review of 764 articles from current literature involving participants with dyslexia according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and consistent with previous research (Lopes et al., 2020). We first utilized the electronic database, Elsevier Scopus, to filter articles that contained child participants with dyslexia. Elsevier Scopus database includes over 27,000 peer-reviewed journals containing research from social, physical, health, and life sciences (Elsevier, 2022). Our search terms, “dyslexia, children” were used to screen each article included using the database search, “Search within: Abstract” and “Search Documents: dyslexia, children” with a date range for each specific year from 2000-2020 (i.e., if searching for articles in 2010, selected “Published from: 2010; To: 2010”). Utilizing the abstract in the search criteria narrowed the article search to articles specifically including participants with dyslexia in their study instead of presenting any article with dyslexia as a key term. The search criteria were further limited to articles with document types of “Reviews” and “Articles,” yielding 1,438 eligible articles. Each year was searched separately and sorted, “Cited by (highest).” The inclusionary criteria for articles selected required at least one participant sample of children (birth to 18 years old) described as having dyslexia in a descriptive or experimental study. The exclusionary criteria
included the following: (a) systematic reviews, meta-analyses, opinion articles, articles that did not include child participants described as having dyslexia at any point during the study; (b) articles not accessible in English; (c) studies with only adult participants; (d) duplicate entries. An example of an article excluded was one that was only published in German. See Figure 1 for a flowchart detailing the process for including and excluding articles within this review. Articles were obtained by trained research assistants between June to August 2021. With the inclusionary and exclusionary criteria, 674 articles were excluded from this review with 764 articles remaining (see Table 1 below). We aimed to include up to 40 articles from each year from 2000-2020 (consistent with Lopes et al., 2020). Some years yielded fewer than 40 articles as the result of exclusionary criteria being applied to article selection. When an article was excluded, the database was searched again to yield a replacement article. For years with fewer than 40 articles, the available articles for that year were exhausted and the search was discontinued.
Table 1

*Number of Articles Collected, Coded, and Analyzed per Year From 2000-2020 According to Inclusionary and Exclusionary Criteria*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>26</td>
</tr>
<tr>
<td>2001</td>
<td>27</td>
</tr>
<tr>
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<td>2006</td>
<td>39</td>
</tr>
<tr>
<td>2007</td>
<td>37</td>
</tr>
<tr>
<td>2008-2010</td>
<td>40</td>
</tr>
<tr>
<td>2011</td>
<td>39</td>
</tr>
<tr>
<td>2012</td>
<td>40</td>
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<td>2014-2018</td>
<td>40</td>
</tr>
<tr>
<td>2019</td>
<td>39</td>
</tr>
<tr>
<td>2020</td>
<td>40</td>
</tr>
</tbody>
</table>
Figure 1

Flowchart Diagram for the Process of Including and Excluding Articles in the Study

Note. Used with permission from Trumbo (2022)
Coding

Once each article was chosen, a coding scheme was created to analyze the inclusionary and exclusionary criteria and/or descriptive assessments used for the classification of children with dyslexia within each study. Research assistants (RA) underwent training to ensure fidelity to the coding scheme. All coders were required to reach 90% accuracy when coding five sample articles compared to the coding of the same five articles completed by an expert coder to pass the training. The RAs received specific feedback from the expert coder and if the RAs did not initially reach 90% accuracy, they received an additional two articles to code before working on the project. All RAs met the training criteria. RAs were provided written and verbal instructions along with additional documents providing examples and answers to their questions in relation to the interpretation of the coding scheme. RAs were allowed to meet one-on-one with an expert coder to ask questions. Periodic fidelity evaluations were completed throughout coding to ensure all coders were maintaining fidelity to the training protocol. Twenty percent of the articles from each year were coded a second time by a second reviewer again to ensure reliability.

For each article, specific elements were identified and coded into a Microsoft Excel spreadsheet including the following: (a) title of the article, (b) article publication year, (c) primary language of the participants, (d) age of participants, (e) number of participants, (f) journal and field of study where the article was published, (g) inclusionary/exclusionary criteria used for dyslexia participant determination, (h) oral language assessments used (see Appendix B). For the journal and field of study where the article was published, each journal title from each article was coded into six disciplines: (a) medicine, (b) psychology, (c) education, (d) speech-language pathology, (e) dyslexic-specific, (f) interdisciplinary. For more information on how each journal was categorized, see the study by Trumbo (2022). We also reported whether or
not assessments of word reading, non-word reading, oral language, and/or IQ was included in the methodology of the study. We looked at the scores for both the controls and the children with dyslexia and the cutoff criteria utilized for participant inclusion and exclusion, or diagnosis, which are not included in this study. We analyzed several domains of oral language within these articles including vocabulary, phonological awareness, morphosyntax, overall oral language comprehension (e.g., a full language battery), and narrative language. Table 2 below provides an example of the components of oral language in participant inclusionary/exclusionary criteria that were coded.

**Table 2**

*Example of Components of Oral Language Coded in Participant Inclusionary/Exclusionary Criteria in Studies With Dyslexia Participants*

<table>
<thead>
<tr>
<th>Study</th>
<th>Language (Y/N)</th>
<th>Language Assessments Used</th>
<th>Mean Language Score(s)</th>
<th>Criteria Used for Assessment of Language Skills</th>
<th>Language Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Control Group(s)</td>
<td>Dyslexic Group(s)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Y</td>
<td>CELF-4</td>
<td>114.5</td>
<td>96.6</td>
<td>&gt; 78</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>CTOPP</td>
<td>106.8</td>
<td>79.1</td>
<td>NR</td>
</tr>
<tr>
<td>3</td>
<td>N</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

*Note.* NR = Not Reported

**Data Analysis**

Quantitative measures were obtained regarding the number and percentage of total articles that included oral language assessment as part of the inclusionary and exclusionary criteria for participants with dyslexia or if it was used descriptively for participants with
dyslexia. Additionally, further analysis was completed to determine which journal disciplines were more likely to account for oral language assessment for participants with dyslexia. Additional qualitative information was obtained regarding which oral language assessments were used and what aspects of oral language were evaluated for each study whether that be vocabulary, phonological processing, morphosyntax, oral language comprehension, and/or narrative language (see Appendix C).

Inter-rater reliability is currently being calculated and will be reported in a related study that will be published at a later date.

**Results**

**Descriptive Data**

The current study evaluated research studies from a variety of professional disciplines involved in studying children with dyslexia. A total of 764 articles met inclusionary criteria for the systematic review. Trumbo (2022) categorized the articles according to the following professional disciplines: (a) medicine (e.g., medical journals, neuroscience journals; \( n = 343 \)), (b) psychology \( (n = 117) \), (c) speech-language pathology \( (n = 25) \), (d) education \( (n = 95) \), (e) dyslexia-specific research (e.g., *Annals of Dyslexia*; \( n = 90 \)), (f) interdisciplinary (e.g., psychology + medicine; \( n = 89 \)). Five articles were outliers and unable to be categorized into the six major categories (e.g., music, computer science, and environmental science) and were excluded from further analysis resulting in a total of 759 articles that were retained for systematic review. See Figure 2 for a chart detailing the frequency from each professional discipline.
Diagnostic and Participant Selection Criteria for Children With Dyslexia Across All Disciplines

Word reading, non-word reading, oral language, and IQ were analyzed across all disciplines as to whether they were reported in dyslexic participant inclusionary and exclusionary criteria or dyslexia diagnosis, reported but not included as participant selection criteria for children with dyslexia, or not reported (see Figure 3). Word reading was reported diagnostically in 66.8% of the articles, reported but not diagnostically in 14.4% of articles, and not reported in 18.8% of articles. Non-word reading was reported diagnostically in 35.9% of the articles, reported but not diagnostically in 15.6% of articles, and not reported in 48.6% of articles. Oral language was reported in dyslexic participant inclusionary and exclusionary criteria in 22.4% of the articles, reported but not included as part of dyslexic participant criteria in 30.4% of articles, and not reported in 47.3% of articles. IQ was reported diagnostically in 70.8% of the articles, reported but not diagnostically in 11.4% of article, and not reported in 17.8% of articles.
Figure 3

Percentage of Articles From all Disciplines That Accounted for Word Reading, Non-Word Reading, Oral Language, or IQ in Dyslexia Diagnosis or Dyslexic Participant

Selection Criteria

<table>
<thead>
<tr>
<th>Not reported</th>
<th>Reported, not diagnostic</th>
<th>Reported, diagnostic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Reading</td>
<td>Non-word Reading</td>
<td>Language</td>
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Diagnostic and Participant Selection Criteria for Children With Dyslexia Within Each Discipline

Word reading, non-word reading, oral language, and IQ were analyzed within each discipline as to whether they were reported in dyslexic participant inclusionary and exclusionary criteria or dyslexia diagnosis (see Figure 4). Overall, word reading and IQ assessments had the highest percentage of usage for dyslexia diagnosis across the disciplines. Word reading was reported in 65.3% of medicine discipline articles, 74.4% of psychology discipline articles, 76% of speech-language pathology discipline articles, 63.2% of education discipline articles, 65.6% of dyslexic specific discipline articles, and 66.3% of interdisciplinary discipline articles. IQ was reported in 77.3% of medicine discipline articles, 65% of psychology discipline articles, 68% of speech-language pathology discipline articles, 65.3% of education discipline articles, 63.3% in dyslexic specific discipline articles, and 70.3% of interdisciplinary discipline articles.
Non-word reading and oral language assessment had the least percentage of articles across all disciplines that reported these assessments in dyslexic inclusionary or exclusionary criteria or dyslexia diagnosis. Non-word reading was reported in 39.1% of medicine discipline articles, 35% of psychology discipline articles, 52% of speech-language pathology discipline articles, 24.2% of education discipline articles, 30% of dyslexic specific discipline articles, and 39.3% of interdisciplinary discipline articles. Oral language was reported in 19% of medicine discipline articles, 28.2% of psychology discipline articles, 40% of speech-language pathology discipline articles, 22.1% of education discipline articles, 24.4% of dyslexic specific discipline articles, and 20.2% of interdisciplinary discipline articles.

Word reading, non-word reading, language, and IQ were analyzed within each discipline as to whether they were reported but not used diagnostically or not included as part of dyslexic participant inclusionary and exclusionary criteria (see Figure 5). Oral language assessments had the lowest percentage of articles that reported them. Oral language was reported, but not included as dyslexic participant selection criteria in 26.5% of articles in the medicine discipline, 30.8% of articles in the psychology discipline, 44% of articles in the speech-language pathology discipline, 33.7% of articles in the education discipline, 34.4% of articles in the dyslexic specific discipline, and 34.8% of articles in the interdisciplinary discipline. The remaining assessment domains, word reading, non-word reading, and IQ, were all reported, but not diagnostically, in approximately 21% of articles from each discipline.
Oral Language Across Disciplines

The percentage of oral language assessments within each discipline used as part of the participant inclusionary and exclusionary criteria for children with dyslexia or included in studies as descriptive features were compared (see Figure 6). For inclusionary and exclusionary criteria for participants with dyslexia, articles from the medicine discipline included oral language assessments in 19% of its articles, psychology in 28.2% of its articles, speech-language pathology in 40% of its articles, education in 22.1% of its articles, dyslexic specific in 24.4% of its articles, and interdisciplinary in 20.2% of its articles. For oral language assessments included in studies as descriptive features, articles from the medicine discipline included oral language assessments in 26.5% of its articles, psychology included them in 30.8% of its articles, speech-
language pathology in 44% of its articles, education in 33.7% of its articles, dyslexic specific in 34.4% of its articles, and interdisciplinary in 34.8% of its articles. When the percentage of articles that assessed oral language in their participant selection criteria and the percentage of articles that assessed it as a descriptive feature were combined, the medicine discipline included oral language assessments in 45.5% of its articles, psychology in 59% of its articles, speech-language pathology in 84% of its articles, education in 55.8% of its articles, dyslexic specific in 58.8% of its articles, and interdisciplinary in 55% of its articles.

Figure 5

*Percentage of Articles From Each Discipline That Accounted for Word Reading, Non-Word Reading, Oral Language, or IQ in Children With Dyslexia, but not in Dyslexic Participant Selection Criteria or Dyslexia Diagnosis*
A chi-square test of independence was conducted between professional discipline and whether language was assessed, diagnostically or descriptively, in the research study. All expected cell frequencies were greater than five. There was a statistically significant association between professional discipline and whether language was assessed, $\chi^2(10) = 23.001, p = 0.011$. The association was small (Cohen, 1988), Cramer’s $V = .123$. Researchers from speech-language pathology were most likely to include assessment of oral language skills in children with dyslexia. Researchers from the medical discipline were least likely to include assessment of oral language skills. All other disciplines were more likely to not include oral language assessment for children with dyslexia.

**Oral Language Assessment Variations Across Disciplines**

We next examined what domains of oral language were assessed when researchers reported the assessment of oral language skills (see Figure 7). For the articles that included oral language in participant inclusionary and exclusionary criteria for children with dyslexia, we
examined the assessments used and categorized the language domain that was assessed. All language assessments were categorized into one of the following domains: (a) vocabulary, (b) phonological awareness, (c) grammar/syntax, (d) a full language battery. No assessments were unable to be categorized. Phonological awareness was the most commonly reported oral language skill assessed in children with dyslexia. Researchers from the medicine discipline included phonological awareness in 10.8% of its articles, psychology in 18.8% of its articles, speech-language pathology in 16% of its articles, education in 10.5% of its articles, dyslexic specific in 14.4% of its articles, and interdisciplinary in 18% of its articles. For the oral language domain of vocabulary, the percentage of articles from each discipline include 3.2% in the medicine discipline articles, 6.8% of the psychology discipline articles, 4% of speech-language pathology discipline articles, 6.3% of education discipline articles, 2.2% of dyslexic specific discipline articles, and 3.4% of interdisciplinary discipline articles. The oral language domain of grammar/syntax had the lowest percentages of articles that included it in participant inclusionary and exclusionary criteria for children with dyslexia with 6% of articles in the medicine discipline, 3.4% of articles in the psychology discipline, 0% of articles in the speech-language pathology discipline, 3.2% of articles in the education discipline, 2.2% of articles in the dyslexic specific discipline, and 0% of articles in the interdisciplinary discipline. For the full language battery, the speech-language pathology domain had the highest percentage of articles including it in dyslexic participant inclusionary and exclusionary criteria at 20% of their articles. The medicine domain included it in 1.5% of its articles, psychology in 3.4% of its articles, education in 4.2% of its articles, dyslexic specific in 2.2% of its articles, and interdisciplinary in 2.2% of its articles.
A chi-square test of independence was conducted between professional discipline and each of the language domains (vocabulary, phonological awareness, syntax/grammar, and full language battery). The only statistically significant association between professional disciplined and language domain was whether a full language battery was administered, $\chi^2(5) = 29.422, p < 0.001$. Post hoc analysis involved pairwise comparisons using the z-test of two proportions with a Bonferroni correction. The proportion of articles from speech-language pathology that administered a full language battery was significantly higher than those from the medical, education, dyslexia-specific, or multidisciplinary journals, $p < 0.05$. The number of articles that utilized a full language battery was not significantly different between the speech-language pathology and psychology disciplines, $p > 0.05$. 

Figure 7

*Percentage of Oral Language Domains That Were Accounted for When Assessing Children With Dyslexia*
Discussion

Purpose of Study

We aimed to determine whether the most-cited research studies from the years 2000 to 2020, involving children with dyslexia, assessed oral language skills in their participants with dyslexia along with what domains of oral language were assessed. Accounting for oral language in children with dyslexia is essential when reporting results of studies including participants with dyslexia, assessing dyslexia, and treating dyslexia as oral language difficulties often co-occur in children with dyslexia. Additionally, there is a high comorbidity of dyslexia and DLD. Oral language also plays an integral role in the development of reading. Throughout the current study, we were looking to answer the following questions:

1. Out of the most-cited articles that include children with dyslexia from 2000 to 2020, do research articles account for oral language skills in these children?

2. Which journal disciplines are more likely to publish experimental studies that include oral language assessment for participants with dyslexia?

3. Out of the experimental studies that include oral language assessment of children with dyslexia, what areas of oral language (e.g., vocabulary, syntax, etc.) are most likely to be evaluated?

Research Question 1

According to the results, out of the most-cited articles with participants with dyslexia from 2000 to 2020, under one quarter of all of articles (22.4% of articles) reported oral language assessments as a part of their participant selection process for children with dyslexia. While 30.4% of articles mentioned or reported oral language descriptively within their studies, they did not use it to include or exclude participants. Thus, just over half of the reviewed articles
mentioned oral language skills in their inclusionary and exclusionary criteria or descriptive data for participants with dyslexia. Almost half of the articles (47.3% of articles) did not report oral language skills within their studies with participants with dyslexia. Consistent with Adlof and Hogan (2018), our results indicate that it is not uncommon for studies of children with dyslexia to omit an analysis of oral language difficulties, such as the co-occurrence of DLD, in children with dyslexia. By contrast, the majority of these articles assessed word reading (66.8%) and IQ (70.8%) when diagnosing dyslexia or including participants with dyslexia in their studies which is consistent with Lopes et al. (2020) and Wagner et al. (2020).

Assuming that the most-cited articles are most frequently viewed and applied by professionals working with children with dyslexia, not accounting for the co-occurrence of oral language difficulties or DLD with children with dyslexia may lead to misinterpretation of the results of such studies. Adlof and Hogan (2018) argue, “the conclusions drawn about one disorder may be confounded on the unknown presence of the other disorder in the participation sample” (p. 770) As a result, if oral language is not accounted for in research participants with dyslexia, it is difficult to determine whether difficulties arise from dyslexia alone or co-occurring deficits in oral language. This ultimately may negatively impact or limit the treatment effectiveness of these professionals treating the needs of children with dyslexia.

**Research Question 2**

The main journal disciplines that included oral language assessment in their studies with participants with dyslexia were researchers publishing in the speech-language pathology discipline with 84% of its articles either assessing or mentioning oral language in relation to the participants with dyslexia. Researchers publishing in the psychology discipline have the next highest percentage of articles including oral language assessment in 59% of its articles.
Researchers publishing in the dyslexic specific discipline similarly assessed oral language skills in 58.8% of its articles. Researchers publishing in the medicine, education, and interdisciplinary discipline had the lowest percentage of articles that either mentioned or included oral language assessments in participants with dyslexia with the medicine discipline including oral language the least in 45.5% of its articles. The medicine discipline is the most represented discipline of most-cited article publications (45%) which is consistent with the results from Lopes et al. (2020) where a majority (67%) of the journals in their systematic review was of the medical discipline (i.e., neuroscience and medical science). One possible explanation for the large representation of the medical discipline may be due to the fact that dyslexia was originally viewed as a medical disorder such as a disease or physical defect of the brain for 50 years until it was viewed as a developmental disorder (Kirby, 2020). It is important to note that although the treatment of children with dyslexia consists of mainly educational approaches and not medical approaches, medical journals are the largest resource for dyslexic research (Elliott, 2020; Trumbo, 2022). As research articles from medical disciplines proportionately produce the most literature on dyslexia, it is possible this could be the reason for the common lack of consideration for oral language difficulties in children with dyslexia.

The results indicate that speech-language pathology journals are more likely to publish experimental studies that include oral language assessment in their studies with participants with dyslexia. With speech-language pathology journals addressing oral language the most when assessing children with dyslexia, they are leading out in the importance of considering these skills to support academic growth in children with dyslexia. As encouraged by Adlof and Hogan (2018), it is important for SLPs to advocate to make it common practice to consider oral language skills when researching, assessing, and treating children with dyslexia.
Research Question 3

Out of 22.4% of articles that accounted for oral language assessment in children with dyslexia, phonological awareness was the language domain with the highest percentage of articles from each discipline that accounted for it in their inclusionary and exclusionary criteria for participants with dyslexia. Each discipline accounted for phonological awareness ranging from 10% to 18% of all their articles. Interestingly, the use of a full language battery, such as the Clinical Evaluation of Language Fundamentals – Fourth Edition (Semel et al., 2003), had the next highest percentage of oral language assessment accounted for, but predominantly within the speech-language pathology discipline. Twenty percent of the speech-language pathology articles that accounted for oral language skills in their dyslexic participant inclusionary and exclusionary criteria used a full language battery. The other disciplines utilized a full language battery in under 5% of their articles. For the oral language domain of vocabulary, each journal discipline accounted for it in their participants with dyslexia in 2.2% to 6.8% of their articles. The oral language domain of grammar/syntax had the least percentage of articles accounting for it in their participants with dyslexia ranging from 1.5% to 4.2% of their articles.

These results display that the most accounted for oral language domain in inclusionary and exclusionary criteria for children with dyslexia was phonological awareness. Vocabulary, grammar/syntax, and full language batteries had significantly low percentages of articles that accounted for these oral language domains. These results are consistent with the findings from Adlof and Hogan (2018) as many studies did not account for comorbidity of dyslexia and DLD and did not investigate oral language skills beyond the phonological domain of language. Additionally, oral narrative language skills, a “bridge” between oral and written language (Spencer & Petersen, 2018), were also not accounted for in any articles that included participants
with dyslexia. While phonological awareness is a domain of oral language, it does not encompass all oral language skills (Adlof & Hogan, 2018). If researchers are only accounting for phonological awareness as their oral language assessment, then essential components of oral language such as vocabulary, grammar/syntax, and expressive and receptive language are disregarded. As a result, the skills of children with dyslexia and possible language difficulties are misrepresented and misinterpreted, therefore negatively impacting research study results or treatment of these children.

**Clinical Implications**

Oral language skills are essential skills to be considered beyond the phonological domain of language in studies that are applied in the field of dyslexia research and for those that intend to support children with dyslexia in every aspect of their academic development. Those evaluating children with dyslexia should consider assessing nonphonological skills including tests of expressive and receptive language, vocabulary, grammar development, and oral narrative language to help identify their needs. Additionally, comparing listening comprehension with reading comprehension in children with dyslexia helps to not only diagnose these children, but also to understand which fundamental skills in academic development are lacking (Bishop & Snowling, 2004). Skills assessed in children with dyslexia are then followed by treatment of their impairments. If children are only assessed for word reading without consideration of oral language deficits, then these children may not receive proper treatment of their weaknesses across all domains of language or receive additional necessary treatment to support oral language growth.
Current Assessment and Treatment of Dyslexia According to Federal Legislation

Currently, dyslexia is considered a type of specific learning disability (SLD). SLD is one of the 13 categories of eligibility for special education services in public schools according to the Individuals with Disabilities Education Improvement Act (IDEA) reauthorized in 2004 (Ward-Lonergan & Duthie, 2018). Ward-Lonergan and Duthie (2018) noted that IDEA “does not specify how dyslexia is defined or how services should be provided for students with dyslexia in public schools. As a result, special education services provided to children with dyslexia vary greatly across states” (p. 811). As a result, resources vary significantly nationwide for children with dyslexia.

While children with dyslexia may work with reading specialists and teachers, some children with dyslexia may present with oral language impairments and would benefit from treatment from speech-language pathologist (SLP) professionals, who specialize in treating oral language skills. SLPs can also play an important role in treating reading deficits in children with dyslexia. According to ASHA (2001), SLPs have a major responsibility and role to play in supporting both spoken and written language development in students. ASHA has also shared how SLPs can play a role in reading and writing impairment identification, assessment, and intervention including those with dyslexia. ASHA outlines the roles and responsibilities for SLPs regarding treatment of written language disorders:

Appropriate roles and responsibilities for SLPs include, but are not limited to (a) preventing written language problems by fostering language acquisition and emergent literacy; (b) identifying children at risk for reading and writing problems; (c) assessing reading and writing; (d) providing intervention and documenting outcomes for reading and writing; and (e) assuming other roles, such as providing assistance to general
education teachers, parents, and students; advocating for effective literacy practices; and advancing the knowledge base. (para. 4)

SLPs play an essential role when treating children with dyslexia. Children with dyslexia experience challenges beyond just decoding, the phonological component of language. These children may either experience co-occurring disorders with written language and oral language deficits or may be negatively impacted by secondary consequences of oral language development due to limited access to language through word reading. SLPs can provide a valuable contribution to identifying, assessing, and treating children with dyslexia with both their expressive and written language needs. While SLPs can play an important role in dyslexia treatment, they also can collaborate with other professionals in the development of written language. A current problem, however, is that special education providers may not be aware of children with dyslexia’s language needs other than phonological awareness treatment (Adlof & Hogan, 2018). Understanding more of the importance of oral language treatment in addition to advocating the scope of practice of SLPs will contribute to the treatment and growth of children with dyslexia.

Limitations

We note several limitations to our study. First, as our systematic review was coded and calculated by research assistants, there is always a possibility for data entry errors. In order to address this limitation, we performed fidelity checks and retraining, and accounted for inter-rater reliability for a randomized 20% of our articles that were coded again. Second, the inter-rater reliability has not been calculated at this time. This percentage will be calculated before the publication of this review. Lastly, this review only included one search database, Elsevier Scopus. The use of this database was intentional due to its large database of articles from 27,000
peer-reviewed journals containing research from social, physical, health, and life sciences (Elsevier, 2022), its ability to search for most-cited articles, and its use in the systematic review by Lopes et al. (2020). We chose to look at the most-cited articles to evaluate the articles that consumers are utilizing the most. Due to the use of one database, this may have contributed to our inability to obtain 40 most-cited articles from every year from 2000 to 2020 that met the inclusionary and exclusionary criteria for this review. Future research that looks at multiple search databases may be able to provide more articles that more fully answer the questions from our study.

**Conclusion**

By conducting a systematic review of the 40 most-cited articles from the years 2000 to 2020 that included child participants with dyslexia, we were able to determine the frequency of articles accounting for oral language assessments in their inclusionary and exclusionary criteria in children with dyslexia. According to our results, only 22.4% of all 759 articles accounted for oral language skills in participant selection criteria of children with dyslexia. The journal discipline of speech-language pathology considered oral language the most in their articles with 84% of articles either accounting for oral language in dyslexic participant selection criteria or as a descriptive feature in children with dyslexia. The medicine discipline, accounting for almost half of the articles within the study, considered oral language in children with dyslexia the least with 45.5% of its articles. Lastly, out of all of the language domains assessed, phonological awareness had the greatest percentage of articles, ranging from 10% to 18% of articles, using it as their oral language assessment. As a result, oral language skills beyond the phonological domain are not being accounted for in children with dyslexia which can result in misrepresentation of children with dyslexia in research, assessment, and treatment. Researchers
should consider assessing oral language skills in children with dyslexia to obtain a greater understanding of their needs and to represent these children and their needs more fully in research that are to be applied by professionals treating children with dyslexia.
References


https://doi.org/10.1044/2018_LSHSS-DYSLC
APPENDIX A

Annotated Bibliography


[https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0049](https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0049)

Objective: This article is a tutorial discussing the language basis of dyslexia in the context of Development Language Disorder (DLD) and bringing to attention broader language skills of children with dyslexia beyond phonological skills. This article first details the history behind dyslexia and expresses the lack of consensus on diagnostic criteria. It shares that the definitions of dyslexia, however, agree on primary inclusionary criteria of difficulties in word reading, decoding, and spelling with the difficulties being “unexpected” when considering IQ and proper instruction. Because the inclusionary and exclusionary criteria vary, the estimated prevalence rates range from 3% to 20% of the population. It shares that dyslexia has been described as a language-based disorder, however there is less clarity about the extent to which other aspects of language development like vocabulary, syntax, and discourse are affected in individuals with dyslexia. After presenting the history of dyslexia, it presents the simple view of reading sharing the importance of reading comprehension in reading. “Reading comprehension is the product of accurate and efficient word reading and language comprehension. The language comprehension component...encompasses all of the linguistic knowledge and skills required for a listener to comprehend a text if it was read aloud, including vocabulary and semantic processing, syntax, inferencing, and discourse” (p. 763). It also shared that children with dyslexia also have weaknesses in other aspects of language
including vocabulary, morphology, syntax, and discourse, in addition to phonological
deficits before the onset of formal reading instruction. The article also details the
progression of diagnosing dyslexia including first, an IQ achievement discrepancy
approach only diagnosing children with high IQ with dyslexia to ending IQ discrepancy
diagnoses and diagnosing dyslexia using an IQ cutoff to rule out low cognitive abilities.
This allows for children with language deficits to be identified as dyslexic. The article
then shares the relationship of DLD and dyslexia and the history behind it looking at the
three different hypotheses for dyslexia and DLD. It shares of the parallels between the
definitions of dyslexia and DLD, the comorbidity of the disorders, and the eventual
conclusion of the distinction of the disorders. While McArthur found that 55% of
children with dyslexia in his study could be classified as having DLD and 51% of
children with DLD could be classified as having dyslexia, Catts found that 17%-36% of
children with kindergarten DLD also met criteria for dyslexia in grades two to eight.
Catts was a population-based sample which found that the majority of children with DLD
did not have dyslexia and the majority of children with dyslexia did not have DLD. Catts
also concluded that phonological deficits were more closely associated with dyslexia than
with DLD and that the evidence best supports the distinct disorders hypothesis. The
 disorders can co-occur ranging from 17%-71% (likely due to sampling differences and
time point of the diagnosis of dyslexia and language impairment). This article continues
to share about language abilities in children with dyslexia. It shares how some studies
also suggest that children with dyslexia without DLD may still present with relatively
weak language skills compared with typically developing peers including poorer
vocabulary, sentence repetition, syntactic comprehension, and word learning abilities.
This article seeks to review studies with a family history of dyslexia to examine preschool language skills in children with dyslexia and to eliminate clinical bias.

Method: This study specifically reviewed 24 studies with preschool language skills of children with dyslexia found in Appendix B of Snowling and Melby-Lervag's (2016) meta-analysis. In these studies, children with and without a family history of dyslexia were recruited and tested on cognitive-linguistic tasks before formal reading instruction and then tested again in the early school grades to determine who had dyslexia or not. This study wanted to look at which early skills were associated with having dyslexia and which were associated with having a family history of dyslexia.

Results: 1) Children with a family history of dyslexia showed early and persistent deficits in phonology compared with their peers with no family history, but not all of them developed dyslexia. 2) Children with a family history of dyslexia who developed dyslexia were more severely impaired in the phonological domain of language and in broader language domains (vocabulary, grammar) compared with their peers with and without a family history who did not develop dyslexia. 3) In comparison with numerous tasks used to obtain details of the skills in the phonological domain of language, relatively few tasks were used to measure broader language skills in most individual studies, however across studies receptive vocabulary was the most commonly studied nonphonological language task. 4) No studies considered whether and/or what proportion of children who had dyslexia also had comorbid DLD and only two studies assessed broader language skills at the time of dyslexia diagnosis. Both of the studies provided evidence that those with a family history of dyslexia had poorer broader language skills.
than their peers with a family history who did not go on to have dyslexia. However, some of these children would also qualify as having a DLD.

Conclusion: Dyslexia and DLD are distinct but often co-occurring disorders. Although diagnostic criteria varies for both disorders, it is likely that at least half of the children identified with reading disabilities in schools or clinics will have co-occurring DLD. This article argues that although many Speech-Language Pathologists (SLPs) are aware that children on their caseloads may have reading difficulties, they and special education providers may not be fully aware that children with dyslexia often have language needs outside the phonological domain. Additionally, current assessment frameworks that are used to determine whether a child meets diagnostic criteria for dyslexia and related special education services in the United States (U.S.) public schools do not explicitly require that oral skills beyond phonological awareness be assessed. SLPs should advocate for assessment of language skills across multiple domains during the evaluation process and to monitor the skills over time. Assessing multiple domains of language include assessment of phonology, orthography, morphology, semantics, syntax, and discourse processing and investigation of both receptive and expressive tasks. The study also expressed that intervention should target a child’s strengths and weaknesses across all domains of language because they all impact reading comprehension. Collaborating between multiple service providers including classroom teachers, SLPs, reading specialists, and other special educators can ensure that these domains are effectively addressed for all students. Lastly, those who have dyslexia, regardless of language abilities at the time of diagnosis are at risk for slower language acquisition and slower growth of world knowledge across their lifetime, as a result of reduced reading
experience as a result of the Matthew effect. The best way to prevent the Matthew effect
if to provide high-quality, evidence-based reading intervention as early as possible.
Compensatory techniques include listening to audiobooks of the school textbooks and
others. One more note: studies more frequently ignore the co-occurrence of dyslexia and
DLD than account for it in analyses. As a result, the conclusions drawn about one
disorder may be confounded on the unknown presence of the other disorder in the
participation sample.

Relevance to current study: Everything about this article is relevant to the current
study. It talks about the importance of considering language skills in children with
dyslexia for assessment and for treatment. It also expresses some very important
argument points that are main points in this current study including the importance of
advocating for the treatment of children with dyslexia with multiple service providers
including SLPs, the importance of including language assessments in assessment
frameworks for diagnostic criteria for dyslexia as to consider all of the children’s
strengths and weaknesses across all domains of language because they all impact reading
comprehension, and the importance of considering co-occurrence of dyslexia and DLD in
research analysis as to not confound the results of studies. Each of these points are
important factors as to why language should be considered in the assessment process of
diagnosing dyslexia.

deficits in children with dyslexia. Journal of Speech, Language, and Hearing Research,
60(4), 1012–1028. https://doi.org/10.1044/2016_JSLHR-L-16-0036
Objective: This study seeks to investigate spoken word learning in children with dyslexia to determine strengths and weaknesses of these children during the configuration stage of word learning. Word learning is a dynamic process of three overlapping stages: triggering (recognizing a word is new and needs to be learned), configuration (forming lexical and semantic representations and a link between them), and engagement (dynamic stage of learning where representations formed during configuration interact with and affect the existing lexicon). The study wants to look at this to understand deficits in dyslexia. The nature of deficits underlying dyslexia has been shown to extend beyond phonological deficits to procedural learning and to visuospatial deficits. These deficits potentially can affect children’s word learning. Obtaining this knowledge can provide more research base for evidence-based treatments.

Methods: This study used stringent selection criteria for the dyslexic sample to ensure that participants did not also have oral language impairment. This study claims that studies of children with dyslexia frequently include (or do not explicitly exclude) children with oral language deficits which could affect the interpretation of study results. This study shares that dyslexia commonly co-occurs with language impairment, a disorder associated with poor word learning.

Participants in this study were ages two to nine, in second grade, and who completed tasks as part of a larger study of word learning and working memory. There were 116 monolingual English-speaking children with typical development in reading (TD) (73 girls, 43 boys) and 68 monolingual English-speaking children with dyslexia (41 girls, 27 boys). These participants were recruited from Arizona, Massachusetts, and Nebraska through school districts. They had to have no neuropsychiatric disorders,
intellectual disability, autism, or significant exposure to languages other than English. They needed to pass a bilateral hearing screening, near vision acuity screening, and color vision screening. They had to achieve 75 or higher on the Kaufman Assessment Battery for Children-Second Edition which measure non-verbal intelligence. “Gifted” children were excluded that has a standard score of 125 or higher on the K-ABC-2. To exclude children with oral language disorders, all children had to achieve a standard score equivalent of 88 or higher on the core language measures of the Clinical Evaluation of Language Fundamentals-Fourth Edition. To qualify for the TD group, children had to have a grade level standard score of 96 or higher on the Test of Word Reading Efficiency-Second Edition and score above the 31st percentile on the GFTA-2. The dyslexia group had to receive a standard score of 88 or below (≤ 20th percentile) on the Test of Word Reading Efficiency-Second Edition and above the 31st percentile on the GFTA-2. Descriptive data was also obtained for maternal education, parental rating of child’s attention, nonword repetition, expressive vocab, and reading comprehension.

Participants participated in computer-based work learning games that are part of the Comprehensive Assessment Battery for Children-Word Learning and also one with Working Memory. The games were presented in random order within and across sessions and a child never played more than one set of work learning games per day. A trained research assistant (RA) monitored the child’s progress and advanced games when necessary. All data collection was automated by the computer, except for the Naming task which was scored offline from audio recordings.

Results: Looking more at phonology, regarding word length manipulation, the dyslexia group was significantly less accurate than the TD but only for longer, four-
syllable words. For phonological similarity manipulation, the dyslexic group was significantly less accurate than the TD group but only for phonologically similar words. For visual similarity, the dyslexic group was significantly less accurate than the TD group. The dyslexic group was also significantly less accurate than the TD group with phonological similarity manipulation, location manipulation, and visual similarity manipulation. For visuospatial tasks, there was a significant main effect for group for location manipulation with the dyslexia group being more accurate than the TD group. Additionally, the dyslexia group was significantly less accurate than the TD group, but only for referents that were visually dissimilar. Looking at all the results and how children with dyslexia were as accurate as peers with TD across all four sets of games and their manipulation indicates that there is not a fundamental deficit in paired-associate learning. The results of the differences between groups for the Mispronunciation Detection and Naming Tasks provide evidence for phonological deficits in children with dyslexia (this is not surprising due to consistency of findings). The findings do, however, highlight that phonological deficits are not limited to phonological-orthographic linking. The results of the findings suggest that children with dyslexia did not have particular difficulty processing phonologically similar sounds in the study but that they struggled with tasks that asked them to assess the phonology of a newly learned word. Shorter words were easier for children with dyslexia to learn than longer words. Children with dyslexia had difficulty making visual difference decisions when the items to be learned were visually dissimilar.

Conclusion: Children with dyslexia have spoken word learning deficits in the configuration stage of work learning that can be attributed primarily to phonological
deficits as evidenced by the difficulties with tasks that required children to create and store detailed phonological representations. Visual processing deficits, particularly when visual similarity is manipulated, likely play a role as well. Children with dyslexia showed a word learning advantage when the location of the referent was manipulated and the task demand was visuospatial.

Relevance to current study: Word learning deficits, deficits usually associated with language impairments, are found in children with dyslexia that do not have co-occurring language impairment. This study shares that a language impairment like word learning is present in individuals with dyslexia even without co-occurring language impairment. This study provides valuable information that language is impacted, such as in work learning deficits, in children with dyslexia. This supports my thesis because it looks at other aspects of language skills that may be impaired in individuals with dyslexia. This study also supports my thesis by demonstrating how a study can assess language to exclude any co-occurring impairment like a language impairment to strengthen the results of a study specifically intended for dyslexic treatment. This study also argues the importance of using assessments to exclude co-occurring impairments that can confound the results. This is an important example and argument for my own study.


Summary: SLPs play a critical and direct role in the development of literacy for children and adolescents with communication disorders. SLPs also collaborate with others with
expertise in the development of written language. Spoken language provides foundation for the development of reading and writing, spoken and written language have a reciprocal relationship (they build on each other to result in general language and literacy competence), children with spoken language problems frequently have difficulty learning to read and write and children with reading and writing problems frequently have difficulty with spoken language, instruction in spoken language can result in growth in written language, and instruction in written language can result in growth in spoken language. Learning to read and write can involve any of the components of language-phonology, morphology, syntax, semantics, pragmatics.

Appropriate roles and responsibilities for SLPs include, but are not limited to (a) preventing written language problems by fostering language acquisition and emergent literacy; (b) identifying children at risk for reading and writing problems; (c) assessing reading and writing; (d) providing intervention and documenting outcomes for reading and writing; and (e) assuming other roles, such as providing assistance to general education teachers, parents, and students; advocating for effective literacy practices; and advancing the knowledge base. (2001, para. 4)

Relevance to current study: There is a necessity for intervention for language disorders that target written and spoken language needs. SLPs are qualified to prevent, identify, assess, and treat children with reading disorders/written language disorders. These support the current study in identifying the importance and relevance of spoken language assessment/treatment with those with reading disorders.
Objective: Specific language impairment (SLI) and developmental dyslexia (specific reading disability, SRD) are common developmental disorders with prevalence of 3%-10% of children. While for many years research has followed these disorders on separate paths, other research has considered both of the disorders as a continuum rather than distinct disorders and consider it a language learning impairment encompassing reading and/or oral language impairments. The goal of this article is to examine the relationship between dyslexia and SLI and whether or not to abandon the distinction between the disorders or to retain differentiation. The study shares that although there are close behavioral similarities between SLI and dyslexia, it is helpful to retain a distinction between literacy deficits and difficulties with production and comprehension of oral language. Some children considered as “poor-comprehenders” have difficulty with semantics, syntax, and discourse that affect literacy acquisition. Additionally, while the disorders may appear similar at the behavioral level, they may have different causal origins such as different underlying cognitive impairments. Manifestation of a cognitive deficit could vary according to compare behavior across conditions, measuring skills without reading or speaking language, children with low IQ, specific language being learned, and many other conditions. Additionally, there is a need to “distinguish between current cognitive deficits that explain a behavioral deficit (proximal causes) and those that operated in the past to lead to a current behavioral deficit (distal causes)” (p. 860). Additionally, the study seeks to look at the neurobiological level (abnormalities of brain
structure and function) and the etiological level (genetic/environmental factors) of these disorders.

Summary: Diagnostic Issues – It is important to establish whether a child with language or literacy problems has problems with phonological processing and problems with nonphonological language skills but contemporary definitions of dyslexia and SLI tend to obscure the distinction. Discrepancy definition is that a specific deficit occurs in the absence of poor general cognitive ability. The DSM-IV and ICD-10 diagnostic criteria is that a person must show poor performance on a psychometric test of language or literacy and have a mismatch with a test of IQ. The issues with this diagnostic criteria is that that types of reading and IQ used to diagnose are not specified. SLI uses a mismatch between nonverbal intelligence and language skills and dyslexia should use a mismatch of verbal IQ than nonverbal IQ. However, verbal IQ may decline as a consequence of poor reading. Phonological skills rather than general cognitive abilities predict reading attainment. Researchers select children whose reading or language ability fall below age level who have nonverbal IQ within broadly normal limits however, this can encompass a heterogeneous group of children who may not necessarily have a specific learning disability. This study suggests a cognitive marker approach to diagnosis where individuals are identified on the basis of underlying cognitive deficits rather than observed behavior on psychometric tests. Instead of having IQ as the baseline again which reading is assessed, compare reading comprehension with listening comprehension to assess language versus reading. Additionally, while there are discrete categories for SLI such as expressive versus receptive language impairments and dyslexia such as phonological dyslexia versus surface dyslexia, this study views that individual
differences in reading and language disorders are better conceptualized in terms of a multidimensional model with continuous variation of skills.

Observed Behavior – Multiple studies conclude that the vast majority of children with reading impairment may also have some degree of oral language deficit. The study also expresses that similarities of dyslexia to SLI could be consequences of limited exposure to written language materials which could impact vocabulary develops. The Matthew effect therefore is hypothesized for poor readers. This is shown in a study that semantic deficits were present more in reading disabled fifth-grade children then second-grade children. Language deficits have also been present in preliterate children with continuities between oral and written language difficulties as at-risk families present with slow development in preschool years. The model of illusory recovery by Scarborough and Dobrich support this by presenting a model that shows a delay in oral language acquisition around three to four years followed by a period of “illusory recovery” as normal development starts to plateau. There is also a deficit in mastery of literacy skills. This model regards language impairment and dyslexia as different manifestations of the same underlying disorder that age determines whether oral or written language problems are more apparent. There have also been high rates of literacy problems in children who present with SLI. From literature, both short-term and long-term consequences of language impairment can occur with literacy problems. Oral language problems are strongly linked to poor reading comprehension. Overt problems with SSD do not lead to literacy problems unless they are severe and persistent or accompanied by other language difficulties. In a study with an SLI group, there was a substantial drop in reading accuracy relative to age between eight and 15. In early development, there were problems
of reading comprehension, the later years indicated word recognition and decoding deficits which could be a result of phonological analysis and memory difficulties and slow growth of sight vocabulary as sentence contexts boost reading of new words. One instance where the presence of additional language difficulties did not significantly affect children’s literacy outcome included children with speech difficulties with deficits on phonological awareness tasks at six and seven years with literacy problems at seven years. Therefore, a child’s phonological processing skills at the beginnings of reading development (around five years) will determine a child’s ability to learn to read and spell. As a result, language skills are stronger predictors of reading outcomes than speech skills. This article concludes that if one uses the definition of dyslexia that requires a child to have poor reading ability in the context of broadly normal nonverbal IQ, then a high proportion of these cases will have impairments in oral language. While many children with dyslexia have oral language problems, a high proportion of them would not meet criteria for SLI because their oral problems are neither severe nor persistent. Those with SLI have additional difficulties affecting other domains of oral language.

Etiology - Dyslexia and SLI tend to run in families. In a case-control study, 26% of first-degree relatives of affected children had both language and reading impairment, 7% had language impairments only, and 9% had reading impairments only. However, due to lack of IQ consideration, it is unclear how many relatives met discrepancy-based criteria for dyslexia. Studies for genetic etiologies for both dyslexia and SLI are not conclusive because family members share many environmental influences as well as genes. Studies have found lower heritability for reading disability, but are more heritable with severe reading disability. Additionally, poor readers with low nonword repetition
scores had significantly higher heritability than poor readers who scored in the normal range on nonword repetition. Heritability is also highest with people with phonological deficits with average IQ. Neither visual processing in dyslexia nor auditory processing in SLI was significantly heritable. Regarding molecular genetics, there is no reported overlap between linkage sites for the two disorders. For environmental factors, it has been proven difficult to identify any environmental agent or experience that is a necessary and sufficient cause of SLI. The principal environmental influences for reading include educational experiences and home environment. This evidence is correlational.

Neurobiology - The majority of children with specific language and literacy problems do not have detectable neurological abnormality. There is often inconsistency in findings from one study to the next. In a study, found that three neurobiological features that differed in specific reading disability (SRD) and SLI include normalized cerebral volume, surface area of left Heschl’s gyrus, and planum temporale asymmetry. When using functional imaging, a study shared that there was consistency that people with dyslexia showed less activity than controls in the left hemisphere temporoparietal cortex. A study also shared that children with SLI at resting levels of brain activation present with abnormal function of the left temporoparietal region. There is a broad agreement that both SLI and dyslexia are associated with abnormalities of early neurobiological development rather than lesions acquired early in life. However, neurobiological studies of brain structure have little consensus on which regions are affected.

Cognitive Processes - Literacy development is as much of a problem in children with SLI as it is in dyslexia. This study explains a theoretical framework that details that
a child develops a system of mappings between printed words (orthography), spoken words (phonology) and word meanings (semantics). This is a connectionist approach where each domain is treated as connected instead of separate. While this model focuses on decoding single words, it is oversimplified and it is so important to consider reading comprehension that is beyond decoding single words. Research has focused on phonological deficits and not as much on semantic impairments as there is little evidence that orthographic impairments are the primary source of literacy problems in either SLI or dyslexia. When looking at the framework, specific weakness in the mapping from orthography to phonology, as seen in poor nonword reading, is the most common pattern of reading deficit observed in dyslexia. However, children with surface dyslexia are worse at reading irregular words than nonwords. Phonological processing deficits are the key deficit in developmental dyslexia and are also common in SLI which suggests continuity between the two disorders. These deficits include phonological awareness; however, it does not necessarily mean that they have the same underlying cognitive deficit, but that literacy skills are poor in both. Regarding low-level auditory processing, no studies have been replicated that support auditory temporal processing deficits in dyslexia and SLI or that there is a strong correlation between nonword reading and auditory temporal processing. As a result, auditory temporal deficit is not sufficient enough to account for language impairment. Then with phonological memory, this study suggests that phonological memory may be a beneficial skill to consider when evaluating phonological origins of literacy problems in dyslexia and SLI. Additionally, semantic representations can be impacted. A group of children known as poor comprehenders do not attract clinical concern but these children and children with dyslexia both have
deficits in verbal working memory and naming difficulties but the nature of the problem is different in the two disorders.

Cognitive Processes: Beyond the Triangle Model - While the triangle model is restricted to single-word reading, children with SLI have oral language deficits that affect processing at the level of the sentence or the paragraph. The study shares that at the level of single words, knowledge of grammatical morphology influences spelling ability. With this difficulty, a child who is unable to understand complex oral language will likely have poor reading comprehension. Context is important to reading unfamiliar irregular words. Syntactic deficits are also a hallmark of SLI. Regarding language difficulties in dyslexia, the study expresses that, “Where semantic or syntactic deficits are found in children with reading disability, they are commonly regarded as secondary consequences of phonological impairment” (p. 876). Additionally, frequency of syntactic deficits in dyslexia is influenced by the way dyslexia is defined. However, these deficits are likely to be a source of difference between SLI and dyslexia.

Toward a Model of the Cognitive Relationships Between Developmental Dyslexia and SLI - While there has been dissociation between phonological dyslexia (impaired mapping between orthography and phonology) and specific deficits in reading comprehension (impaired mapping between orthography and semantics), pure dissociations are rare in development.

Learning to Read: The Role of Nonphonological Language Skills - Reading is a division of labor between the phonological pathway and the semantic pathway. Phonological skills are unique predictors of reading and spelling in the first few school years. Some children with dyslexia that have good language comprehension can use a
top-down semantic and syntactic skills to help their ineffective decoding skills or to rely on contextual cues to support the decoding processes. Then with children with SLI, those whose oral language difficulties were resolved had less severe literacy problems. With children with dyslexia, while reading can be compensated, spelling deficits are more impactful and lasting. Reading development can change with age. Reading difficulties of children with resolved and persistent SLI changed from primarily affecting reading comprehension at age eight to also affecting reading accuracy at age 15. With all this information, while cognitive deficits that carry the risk of reading difficult are similar in both disorders, that does not mean that they are the same disorder.

Conclusion: SLI and developmental dyslexia present with many similarities. At the cognitive level, children with SLI usually have the same core phonologic impairments that are regarded as characteristic of developmental dyslexia. Additionally, some older children with developmental dyslexia demonstrate impairments in oral language tasks that do not involve reading or writing. However, with all of the information in this review, a unidimensional model of reading disability is inadequate to capture the relationship between dyslexia and SLI. Deficits on the phonological dimension are heritable. This study seeks to encourage a quadrant model when looking at these disorders as there is overlap among the disorders but also distinction between the disorders. This quadrant would include, dyslexics, SLI, poor comprehenders, and no disorder. This study also argues that while semantics can be impacted in these disorders, syntactic and discourse skills can also impact negatively learning to read and write and on reading comprehension.
If we were to treat as dyslexic any children with poor reading accuracy or comprehension in the context of normal performance (nonverbal) IQ, then we would be likely to select children with a mixture of poor comprehension, classic SLI, and classic dyslexia. If we identify children who have poor reading accuracy in relation to verbal IQ, we are likely to capture a higher proportion of cases of children with classic dyslexia who have relatively pure phonological difficulties. (2004, p. 879)

This is according to the procedure adopted. Then when looking at nonphonological skills in these children, tests of vocabulary development and grammatical sensitivity would be useful. Looking at diagnosis in a different way is helpful such as comparing listening comprehension with reading comprehension. Then when treating these disorders such as with phonologically based intervention, they can improve phonological reading skills but fail to result in fluent word recognition. The study shares that “Programs that neglect verbal skills beyond phonology run the risk of leaving untreated fundamental skills that are important for both decoding and reading comprehension” (p. 880).

Relevance to current study: This article provides such powerful information regarding the similarities and distinctions between developmental dyslexia and SLI. It shares that while phonological deficits are very similar in both disorders, the underlying cognitive processes for each disorder distinguish the disorder. Additionally, this study suggests a triangle model looking at reading development as a connection between semantics, orthography, and phonology. It also looks at how each of these elements can also impact grammar and discourse affecting the context of new words, etc. It emphasizes that although these disorders are distinct, they have some overlap and deficits like
language deficits secondary to reading or reading comprehension deficits secondary to language. The article emphasizes the importance of the definition of dyslexia defined and how children are assessed to establish their deficits appropriately for them to get the treatment they need. These findings and suggestions are very applicable to the current study emphasizing the importance of considering language not only in diagnosis, but also for secondary deficits of dyslexia.


Objective: This study seeks to determine whether specific language impairment (SLI) and dyslexia or distinct developmental disorders or not. The study shares that there has been interest in the relationship between developmental disorders of oral and written language. “Dyslexia is a specific learning disability characterized by difficulties with accurate and/or fluent word recognition and spelling” (p. 1379). A phonological processing deficit underlies word-reading difficulties in many children with dyslexia including phonological awareness, “one’s sensitivity to, or explicit awareness of, the sound structure of language” (p. 1379), phonological memory problems, nonword repetition difficulty, and inefficiency in the formation of phonological representations. SLI is a disorder of the development of oral language with deficits in semantics, syntax, morphosyntax, and discourse in the presence of normal nonverbal cognitive abilities. However, children with dyslexia have shown early deficits in semantics and syntax and children with SLI have shown phonological processing deficits, phonological memory problems and problems with recognizing printed words. For dyslexia, “some of these oral
language difficulties could be the result of reading problems themselves...However, a growing number of studies demonstrate that oral language difficulties are present in children at risk for dyslexia prior to school entry” (p. 1379). This study wants to look at if there is an association between the disorders and in what way. It considers three models: 1) Dyslexia and SLI are different manifestations of the same underlying cognitive deficit with a phonological processing deficit being responsible for both disorders (large overlap between disorders). With a severe deficit, children will show problems in word reading and oral language (SLI) and with a less severe deficit and children will demonstrate problems in word reading and show limited or no problems in oral language (dyslexia); 2) Dyslexia and SLI are partially similar but distinct disorders (considerable overlap) with both disorders having an equal severity of a phonological deficit. SLI would instead involve an additional cognitive deficit or deficits operating independently of the phonological processing deficit; 3) Dyslexia and SLI are distinct developmental disorders with different cognitive deficits and behavioral manifestations and relate due to comorbidity.

Study 1

Method: There were 527 school-age children recruited from a population-based sample of children participating in a longitudinal study of language and reading development. This longitudinal database included measurements of oral language (and IQ) in kindergarten, second, fourth, and eighth grades. The study analyzed the percentage of children with SLI in kindergarten who had dyslexia in second, fourth, and eighth grades and the percentage of the children with dyslexia who showed SLI in kindergarten. In kindergarten, language abilities were assessed by five subtests of TOLD-2:P and a
narrative story task. Full Scale IQ and nonverbal IQ were assessed using the Block Design and Picture Completion subtests of the Wechsler Preschool and Primary Scale of Intelligence—Revised, WISC-III, and PPVT-R, with non-verbal IQ assessed in kindergarten, second, and eighth grades and FSIQ estimated in second, fourth, and eighth grades. Word recognition was assessed using the Word Identification and Word Attack subtests of the Woodcock Reading Mastery Tests-Revised in second, fourth, and eighth grades. Criteria for SLI were used in the original epidemiologic study, and it was if a child’s performance on at least two of five language composite z-scores fell below –1.25 SD (language impairment criteria) and if they also demonstrated normal or above-normal nonverbal IQ (>1 SD) and normal sensory and socioemotional development. Criteria for dyslexia included a low-achievement definition with a performance of at least 1 SD below the mean on the composite measure of word recognition and scored above a cutoff value (-1 SD) in their measured intelligence. They also used the dyslexic criteria IQ-achievement discrepancy definition where the participants were identified as having dyslexia if their actual word recognition score was more than 1 SD below their predicted word recognition score.

Results: There was a limited but statistically significant overlap between dyslexia and SLI. About one third of children with SLI in kindergarten met the most liberal criteria for dyslexia in later grades. The more conservative and widely used criteria involving reference to IQ determined that 17% to 29% of children with SLI in kindergarten met IQ-referenced definitions of dyslexia in the school grades. A higher rate was found with nonverbal IQ because children with SLI generally have lower verbal than nonverbal IQs. Approximately 15% to 20% of children identified with dyslexia (in
second, fourth, and eighth grades) met the criteria for SLI in kindergarten. The results showed a limited overlap between SLI and dyslexia, however it warns of the importance of not disregarding oral language deficits in children with reading disabilities.

Study 2

Method: This study seeks to look at how children with dyslexia and/or dyslexia can be characterized by the same deficits in phonological processing. Participants were a subsample of those identified with SLI and/or dyslexia in Study 1. Four groups were selected: 1) N = 43, SLI only who were all children with SLI in kindergarten who had normal reading achievement in fourth grade (word recognition composite score about the 40th percentile); 2) N = 18, SLI/dyslexia who were all participants with SLI in kindergarten and who also met regression-based FSIQ-discrepancy and low achievement criteria; 3) N = 21 dyslexia only who were all children with dyslexia in fourth grade (same criteria as group two) who had normal language in kindergarten; 4) N = 165, all children who had normal language in kindergarten and normal reading achievement in fourth grade (same criteria as above). Each participant was assessed for phonological awareness. For children in kindergarten, second, and fourth grades they participated in a syllable/phoneme deletion task. For children in eighth grade, they participated in a more complex phoneme deletion task. Each participant was also assessed for phonological memory. This was assessed by a nonword-repetition task in second and eighth grades.

Results: A phonological processing deficit could be more closely associated with dyslexia than SLI. Children with dyslexia, and children with dyslexia/SLI performed poorly on measures of phonological awareness and nonword repetition across grade. Children with SLI only did not show significant deficits on measures of phonological
processing when compared to the children with dyslexia, but they did have lower scores than the normal subgroup on all measures of phonological processing. There was a weak association between SLI and problems in nonword repetition. An explanation for the discrepancy of the findings concerning the link between SLI and a deficit in phonological processing can be explained on the basis of comorbidity between SLI and dyslexia. Comorbidity could be a reason for poor performance in nonword repetition with children with SLI, but when compared with children without a language impairment, the group still differed significantly in nonword repetition. Therefore, this could be due to other factors other than comorbidity. The results also show that some children may have problems in phonological processing and not in semantics and syntax (dyslexia only) and others may show the reverse pattern (SLI only).

Conclusion: The results are in line with Model 3 that SLI and dyslexia are distinct but comorbid disorders. The results from Study 1 showed a statistically significant, but limited, overlap between SLI and dyslexia. The results from Study 2 support Model 3 by showing that while dyslexia was associated with significant deficits in phonological processing, SLI alone generally was not. The results also indicate that about twice as many children had both disorders than would be predicted given the base rate of either disorder. The study also shared that children who demonstrate a deficit in reading comprehension despite normal or near-normal word recognition ability are referred to as poor comprehenders. The study suggests that while children meet the criteria for SLI prior to school entrance but do not have a phonological processing deficit, that these children could have SLI. Poor comprehender would be referred to children with a history
of SLI (and those without) who have specific problems in reading comprehension during the school years.

Relevance to current study: This study shares a significant amount of valuable information that reveals the comorbidity of SLI and dyslexia. It supports that SLI and dyslexia are distinct developmental disorders. The study also provides evidence that phonological processing and word reading deficits are characteristics of dyslexia while deficits in semantics, syntax, and/or discourse processing are characteristics of SLI. While children with SLI experience more phonological processing deficits and nonword reading difficulties than typical developing peers and children with dyslexia, these are not essential characteristics of the disorder. As a result, a comorbidity between SLI and dyslexia is present and prevalent.


Objective: The Matthew effect describes the process in which advantages and disadvantages accumulate: the rich get richer and the poor get poorer. In terms of reading, this would mean that a child’s initial reading level would be positively related to his/her rate of growth in a reading skill. A relative Matthew effect is a pattern where growth rates differ across skill levels even while absolute skill levels increase for all. This study specifically looks at one prediction of the Matthew effect that reading skill and word reading skill could be related to the rate of vocabulary growth. Vocabulary skill is strongly related to a variety of academic, vocational, and social outcomes. This article states that reading development could potentially have a significant effect on a child’s
exposure to novel words. For older children and adults, learning new words occurs through exposure to written texts. The study predicts that word learning through reading will affect vocabulary as measured on both oral and written tasks. The transition from becoming proficient in reading (learning to read) to advancing to more complex print material (reading to learn) occurs around the third or fourth grade for many students. This study investigates the prediction of the Matthew effect with vocabulary development and reading during the middle grades and high school predicting that better readers during this time will have a greater likelihood of confronting novel, low-frequency words than will weak readers which will affect the rate of vocabulary growth. This study also wants to determine if the relationship is a two-sided Matthew effect (strong readers show increasing gains relative to average readers as weak readers show decreasing gains relative to average readers) or a one-sided Matthew effect (strong readers could show increasing gains relative to average readers whereas weak readers have gains similar in size to those of average readers).

Method: Data analyzed drawn from a sample of 604 participants in kindergarten in the 1993-1994 school year who originally took part in an epidemiologic study of language impairment. In the initial sample, a stratified cluster sample was used with stratification by residential setting and cluster sampling according to school. All students who failed the initial screening were given a diagnostic battery of language and cognitive measures. Those who consented in this original study became participants in a longitudinal study. There are 485 participants included in this study who completed the longitudinal study and whose vocabulary scores were available. This study looked at the scores in fourth grade and in tenth grade. Children with poor language in this study
received proportionally less weight in the analyses than did children who showed typical language. All tasks were administered as part of a larger longitudinal study, and they were standardized with examiners given detailed training and monitoring by a data-collection manager. Vocabulary measures from kindergarten and older grades for both expressive and receptive were analyzed (picture ID tests and definition-generation tasks. For reading, word reading and nonword reading tests were used. Developmental ability scores were computed using a Rasch model of item response theory (IRT). Weighted scores were used in the analyses to correct for high rate of language and/or cognitive impairment. A composite score was derived for vocabulary for each participant which was used to plot vocabulary growth curves. The study also looked at multilevel modeling and individual differences in vocabulary growth.

Results: The mean of the composite developmental ability scores for vocabulary showed an increase in vocabulary knowledge at each time interval, beginning in kindergarten. Between the fourth and tenth grades, the change was more linear. Vocabulary ability upon school entry at kindergarten was correlated with vocabulary ability and fourth, eighth, and tenth grades with statistical significance. It showed that vocabulary ability at the onset of reading is associated with subsequent vocabulary ability and it is likely that there are factors influencing vocabulary growth in children. The rate of growth in vocabulary between fourth and tenth grades was significantly associated with the children’s fourth-grade reading level. Higher word reading ability in fourth grade is associated with greater rates of vocabulary growth. The association of the fourth-grade reading ability and subsequent vocabulary growth varied somewhat depending on the reading level resulting in a one-sided Matthew effect.
Conclusion: Results strongly support an association between word-reading ability and the rate of subsequent vocabulary growth as measures by an oral language task. Word-reading ability in the fourth grade alone is unlikely to explain the results. The measure of fourth grade reading ability is an indicator variable that is associated with reading-related activities of the children between fourth and tenth grades. Reading would be expected to affect vocabulary growth after children are exposed to a large number of novel words through reading, beginning at about the third or fourth grade. Regarding the one-sided Matthew effect, the strong readers made greater vocabulary gains relative to the average and weak readers but the weak readers were not getting poorer due to their weak reading. Reasons for this include that the gap in reading volume between strong and average readers is greater than the gap in reading volume between average and weak readers. There can include other factors like intervention, different methods of word learning, etc. The data from this current study, however, was collected from a population-based sample, meaning that these findings apply to both readers who are typically developing and language impaired. Current study provides strong support from existence of Matthew effect between word-reading skill and vocabulary. The magnitude of the effect on absolute vocabulary levels was found to be large (driven by strong readers), an encouraging finding for those concerned about the outcomes for weak readers.

Relevance to current study: This study determines that there is a relationship between reading and vocabulary growth. This can impact future academic growth in children and determine their future success in learning new words. This article also reveals that this takes place beginning in third and fourth grade and that a one-sided Matthew effect occurs for the strong readers while the weak readers remain weak, or
average. These results show the impact of reading on language in children which supports the argument in the current study.


Summary: For a long time, many have maintained that the ability to decode is at the core of reading ability. Decoding can be considered “sounding out” words, or spelling-sound correspondence. Decoding, however, is not word recognition. Word recognition involves the use of letter-sound correspondence rules, or an orthographic cipher. Reading is not decoding. There is a simple view of reading, supported by research, that reading is the product of decoding and linguistic comprehension (listening comprehension, oral language). Reading disability, then can result in an inability to decode (dyslexia), inability to comprehend (hyperlexia), or both. In the current usage, dyslexia is defined by exclusion as a dyslexic is an individual who has failed to learn to read despite normal intelligence and sensory function, adequate opportunity for learning, and an absence of severe neurological and physical disability, emotional or social problems, or socioeconomic disadvantage. However, the common denominator for dyslexia is inability to decode as a result of a lack of phonemic awareness. Hyperlexia is a skill in decoding with an average or inferior comprehension. Perfection in decoding will make you read exactly as well as you can listen. Then with garden variety reading disability, the good decoder tends to be a good comprehender and the poor decoder a poor one (simple view of reading). Dyslexia and hyperlexia are exceptions to the rule. Both decoding and comprehension are essential to reading.

Conclusion: Reading skill is the product of decoding and comprehension.
Relevance to current study: The simple view of reading shows the importance of considering both aspects of reading: decoding and linguistic comprehension. While dyslexia is considered the exception to the rule with initial deficits in decoding, this does not prevent the simple view of reading to occur or to co-occur which will impact reading in children. Oral language is an essential part of reading which is relevant to the argument of the current study.

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Objective: This article seeks to provide a historical perspective of defining dyslexia beginning from 1870 to address the dyslexia debate. The article urges commentators, critiques, and researchers to broaden, rather than diminish, dyslexia support once a history perspective and scientific perspective have been distinguished. This debate argues that dyslexia may not be a clearly defined scientific condition, but instead is a title that provides funding or an invention of concerned parents. The five major aspects of the dyslexia debate include that dyslexia: 1) has no clear definition, and cannot be differentiated from other reading difficulties; 2) is a product of over-anxious parents, seeking to explain and justify their children’s learning difficulties; 3) is a ‘middle-class’ myth, more common in pupils from wealthier backgrounds for social rather than scientific reasons; 4) is over-diagnosed, especially by educational psychologists unfamiliar with the term and/or seeking to appease over-anxious parents; and 5) is frequently associated with high intelligence, despite there being no scientific basis for this claim.
Summary of History: With these dyslexia debate claims, researchers seek to respond to these claims. Frank Ramus share that “phonological deficits play a causal role in certain types of reading disability, but not in all of them” (p. 473) therefore there is a separation between poor readers and those with dyslexia. The article shares how “although imperfect, dyslexia helps to define and distinguish reading problems, aligns deficits with effective interventions, motivates parents and legislators to action and protects children from being falsely labelled as stupid or lazy” (p. 473). This study argues that the most influential current description of dyslexia is from UK’s 2009 Rose Review, “a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling. Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory and verbal processing speed. Dyslexia occurs across the range of intellectual abilities” (p. 474). The study used this as a starting point for the history of dyslexia. They drew on the collection of the UK Dyslexia Archive (UKDA) founded in 2016 and based at St. John’s College, Oxford. The comprehensive history includes: Period of modern dyslexia began in 1960s as it attracts most academic attention. Characteristic symptoms of dyslexia were first identified in 1870s. From 1870 to 1960, there was little scholarly attention. In 1870, dyslexia first identified and discussed as “word-blindness”. In 1877, reading and spelling difficulties characteristic of dyslexia today first identified by Adolph Kussmaul, a German Professor of Medicine. The disorder was originally thought to be an ocular deficit. Dyslexia was coined by Rudolph Berlin, an ophthalmologist and academic, associating this term with other diagnoses like alexia and paralexia implying a physical disease of the brain where reading ability was affected. In 1890s, British physicians like James Hinshelwood, an
ophthalmologist, and William Pringle Morgan, a general practitioner, have studies more closely aligned with dyslexia defined today. Morgan provided famous description of dyslexia sharing about a boy that was, “a bright and intelligent boy, quick at games, and in no way inferior to others of his age. His great difficulty has been – and is now – his inability to learn to read.’ ‘This inability is so remarkable, and so pronounced,’ ‘that I have no doubt it is due to some congenital defect” (p. 477). As a result, he differentiated between word-blindness and dyslexia and shared that he understands how the term could be misleading because others may not have a clear conception of what Kussmaul meant by it. After the 1870 Education Act, learning difficulties like word blindness were identified at a much broader scale. Then by 1920s, Samuel Orton, an American neuropathologist shared that the roots of reading disability could be located in the angular gyrus and that it is a lack of cerebral dominance. The hypothesis was incorrect; however, it shifted the view of dyslexia as a developmental disorder and into the discipline of psychology. The view changed that it was a problem of how children were thinking rather than a disease or physical defect of the brain. In the 1940s, Cyril Burt, an educational psychologist that worked for a governmental body, claimed that reading difficulties implied a failure in our efforts to teach reading to “duller and more backward pupils” (p. 478). In 1942, Millfield, the independent school in Somerset became the first school of Britain to address dyslexia specifically. With the 1944 Education Act, schooling was made compulsory until 15-years-of-age and the eleven-plus examination created a two-tier educational system that expanded until 1960s before diminishing. As literacy became increasingly necessary in the 1960s for individuals and economic productivity of the state, more dyslexic difficulties were being encountered and parents
sought for help. A conference was then held in 1962 at Barts Hospital, London organized by Alfred White Franklin, a pediatrician, with psychology attendees and decided that dyslexia required more research attention. The Word Blind Center for Dyslexic Children (WBC) was formed with parent resources and Local Educational Authorities funding. Then in 1972, the WBC set the stage for other organizations such as the British Dyslexia Association and Dyslexia Institute whose work embedded dyslexia into British legislation and education. Modern dyslexia then began and critiques of dyslexia were already in place.

Conclusion: Because of this history of concerned parents, middle-classes, and high-performing children, dyslexia has been recognized more. It is even recognized by the Special Educational Needs and Disability Code of Conduct, as well as legislation such as the 2010 UK Equality Act. Regarding its ambiguous definition, it is a disorder with nonvisible cognitive impairments and is considered a “hidden disability” such as depression. There is need for more research to understand it like research for depression has come to surface. Instead of impeding its research, dyslexia research needs to come to light. The history provides a social history including early scientific beliefs and societal reception of the discrepant diagnostic model. This is where parents and other advocates have urged the need for dyslexic research. There has been blurring of social and scientific critiques of dyslexia. The critiques are based on particular aspects of dyslexia’s history and not universal. As a result, dyslexia support in state education should be broadened instead of diminished.

Relevance to current study: This study provides a detailed summary of the history of dyslexia and the major critiques that have been made towards dyslexia and the
relevance of its diagnosis and research. This provides important background information to the discovery of dyslexia and what elements of its definition and diagnosis have been addressed or not. It also provides controversies that are already present in this field of research and how it encourages novel arguments for future research in dyslexia. This study seeks to offer a novel argument to look at dyslexia in a more wholistic view of both reading and oral language evaluation.


Summary: This article looks at the diseases of the nervous system and disturbances of speech. One thing that this article notes is that the characteristics of those with dyslexia include reading and spelling difficulties.

Relevance to current study: For the longest time, dyslexia was seen as an ocular deficit. Kussmaul was the first to note characteristics other than visual deficits such as reading and spelling difficulties. This applies to this current study because it contributes to the history of dyslexia. This article shows that dyslexia continues to be researched and to be more and more complex.


Objective: There is no consensus about the definition, origin, and diagnosis of dyslexia and the term is often used very differently by researchers and practitioners. Research findings have been employed by clinicians in ways that are misleading and potentially
counterproductive. This study seeks to examine participant samples included in studies of dyslexia over 20 years of research. Dyslexia is described as involving reading (decoding) and spelling problems. There is a gulf between understandings of the construct of dyslexia in research literature and formal definitions put forward by practitioner and advocacy groups. The U.S. notion of dyslexia as an ‘unexpected’ problem seeks to differentiate between dyslexic and other poor readers using an IQ-discrepancy model of specific learning disabilities. However, “socially disadvantaged children with reading disabilities are likely to experience particularly acute problems with general knowledge, comprehension, and vocabulary, often attributable to reduced access to the life opportunities that could compensate for their lack of access to the written word” (p. 588).

Dyslexia researchers draw upon a pool of poor readers as participants for the study and then use the findings to support dyslexic subgroups. Criteria for making the distinction between all struggling decoders or a subset that can be differentiated from other poor readers are rarely explicit as well. Dyslexics and poor readers seem to be taken as synonymous. The objective of this study therefore is: (a) To identify selection criteria in studies of dyslexia, and to assess the degree of homogeneity of the criteria used for the selection of samples; (b) To compare the selection criteria for samples of struggling readers (other than ‘dyslexics’) with selection criteria for samples of identified dyslexics; (c) To identify the contexts from within which samples of dyslexics were collected; (d) To identify the professional characteristics of groups involved in the diagnosis of participants for studies on dyslexia; (e) To review the characteristics of the scientific journals that publish studies on dyslexia.
Method: This study included 800 journal articles involving dyslexia that were analyzed. The journals included samples of ‘dyslexics only’, samples that contrasted ‘dyslexics’ and ‘normal readers’, or other subjects. An analytical grid was used to examine features of each journal article: (a) Title of the article; (b) Article publication year; (c) Journal in which the article was published; (d) Number of identified dyslexic participants in the sample; (e) Contexts of sample collection; (f) Criteria for sample selection; (g) Test battery for sample selection; (h) The professional categories of groups involved in the diagnosis of participants for studies on dyslexia. The Elsevier SCOPUS database was used to search the articles using the keywords Dyslexia or Dyslexics. The 40 most cited articles each year from 2000 through 2018 were used.

Results: Criteria to select dyslexic participants are stricter than criteria used to select normal readers. The battery of tests typically included cognitive (usually IQ) and reading tests. There were 315 articles (39%) that required a formal diagnosis of dyslexia for their participants. Eight hundred articles (100%) included dyslexic participants; 738 articles (92%) included normal readers. Seven articles (0.9%) included struggling readers. Out of the articles that used a battery of tests as criterion for the participants, 596 articles (75%) used it to determine dyslexic participants, 487 articles (66%) used it determined normal readers, and four articles (57%) used it to determine struggling readers. Twenty articles (3%) used school records of learning problems as criteria for dyslexia and 14 articles (2%) used it as criteria for normal readers. IQ was used as criteria for 498 articles (62%) for dyslexic participants, 370 (50%) for normal readers, and five (71%) for struggling readers. No information was reported for 18 articles (2%) for dyslexic participants, 76 articles (10%) for normal readers, and two articles (29%) for
struggling readers. Regarding exclusionary criteria found in studies, sensory deficits and comorbidities are the most common exclusionary criteria (sensory deficits had 28% articles for dyslexic exclusionary criteria and comorbidity had 35% for dyslexic exclusionary criteria). Other exclusionary criteria included lack of educational opportunities, IQ, and English not as a first language. Results for professionals selecting/diagnosing participants for studies on dyslexia included 66% of studies using researchers to identify whether participants were dyslexic or not, 23% of articles had an unspecified professional in clinical or community context diagnose, 8% used a psychologist to diagnose, 30% used other professionals to diagnose, and 6% had no information. The journals that published these studies on dyslexia included neuroscience journals (43% of articles), followed by psychology journals (24%), medical sciences journals (14%), interdisciplinary journals (19%) and education journals (5%). For sample size, almost 50% of the studies (n = 398); contained 1–50 participants; 25% (n = 202) had 50–100 participants; 21% (n = 165) had more than 100 participants; and 3% (n = 22) had more than 1,000 participants.

Conclusion: There is significant inconsistency in the selection of participants for studies of dyslexia. Many researchers term dyslexia as any poor reader. There is a lack of control over identification procedures and persistence in the use of IQ-Achievement discrepancy method. Explicit criteria for a research sample of designated dyslexics are uncertain. Clinicians use findings from dyslexia studies to justify diagnostic differentiation, however these results indicate that with these studies there is a lack of criteria consistency, professional qualification for dyslexia diagnosis, and articles and resources from appropriate professionals (education).
Relevance to current study: This article is the foundation of the methods of the current study. This study searched 40 most cited articles from each year from 2000 to 2019 and looked at the inclusionary and exclusionary criteria for each study, the journal publications, and dyslexic criteria of each study. The current study uses the methods of this study to evaluate how dyslexia is defined and whether or not oral language assessment is considered in each study. Lopes et al. mentioned the importance of identifying these discrepancies so diagnosis of dyslexia and use of the findings from dyslexia article can be used appropriately clinically. This study seeks to evaluate oral language consideration in dyslexia assessment in each study for the same reason: to ensure appropriate application of dyslexia study findings in clinical practice.


Objective: At the time, children with dyslexia/reading disability were not identified until they have tried and failed to learn to read in school. By doing this, these children reached the criteria of a severe reading problem that is not attributed to sensory, intellectual, emotional, socioeconomic handicaps, or any other impediments that impact learning to read. The study shared that kindergarteners and pre-kindergarteners who later show low reading achievement present with weakness in receptive vocabulary, syntax comprehension, syntax production, phonological production, syntactic awareness, and phonemic awareness. This study seeks to look at the role of language-processing deficits in the etiology of dyslexia to use these measures as a way to measure children before they try to learn to read. Specifically, it seeks to evaluate syntactic, lexical, and phonological skills in children experiencing early language development.
Method: There were three groups of 30-month-old children (N = 52): 20 from dyslexic families who became disabled readers, 12 from dyslexic families who became normal readers, and 20 normal children who resembled the dyslexic group closely in IQ, socioeconomic status, and sex. The Reading Cluster of the Woodcock-Johnson Psychoeducational Battery and the Wechsler Intelligence Scale for Children-Revised were administered to most of the participants at the end of grade two with the exception of 12 children whose scores were estimated from school-administered nationally standardized tests of reading achievement and scholastic aptitude. A cutoff of 1.5 SD below the mean indicated reading disabled. While six evaluations of preschool development were conducted between the ages of two and five years, language proficiency at 30 months was analyzed for this study. The children were assessed in their home and were assessed on the language tests of vocabulary, naming vocabulary, and speech discrimination using the Peabody Picture Vocabulary Test (PPVT), Boston Naming Test (BNT), and Phoneme Discrimination Series. Language samples were also obtained from videorecorded mother-child play sessions. Two measures of productive syntax were coded for each child from 100 successive intelligible child utterances excluding imitations, self-repetitions, and routines. Mean length of utterance (MLU) was computed along with grammatical complexity using the Index of Productive Syntax. The child’s consonant pronunciation error rate of their first 100 identifiable words determined the child’s phonological production ability. Lexical diversity was assessed according to the number of different words the child used among their first 250 identifiable words. Then at 60 months (age before entering kindergarten), the subjects were evaluated on the BNT and Sounds and Letters Test to assess their precursor to reading achievement.
Results: The results established that early language skill of the dyslexic group were poorer than those of the other two groups which did not differ from each other. There was no significant difference between the dyslexic and normal groups in lexical diversity after variance and when IQ, syntax factors, and lexical diversity were controlled, the consonant error rate accounted for no significant additional variance in outcomes. However, the syntax score significantly differentiated the groups even with IQ, consonant errors, and lexical diversity controlled. Regarding the family incidence of reading disability, no large or significant differences were observed between the subgroup with mothers with dyslexia and the subgroup with mothers with typical reading ability at grade two, IQ, and language scores at 30 months. This presents results that dyslexia is a genetically transmitted disorder and not as a result of environmental factors. Regarding language and readiness skills in the later preschool years, at 36 months the Phoneme Discrimination Series (PDS) failed again to differentiate the children who became disabled readers from the children who became normal readers; however, language test scores obtained six months earlier were strongly correlated with PDS scores at 36 months and consonant pronunciation was the only language-production measure related to subsequent phoneme discrimination ability. Both of the vocabulary test scores at 42 months were significantly lower for the reading-disabled group. BNT and PPVT scores were related not only to vocabulary test scores obtained one year earlier, but also to earlier syntactic and phonological production abilities. The children who became disabled readers also did more poorly as five-year-old children. The Sounds and Letters Test revealed substantial differences in favor of the children who became normal readers. As a result, letter identification, phonemic awareness, and knowledge about letter-sound-
correspondences skills were weaker for the dyslexic group. Early syntactic and phonological production abilities were strongly predictive of outcome reading status. A significant effect was still obtained for the syntax factor score, but not for the consonant error rate. The results therefore suggest that the relation of early syntactic deficits to reading disabilities was not mediated by problems with language and preliteracy in the late preschool years.

Conclusion: Preliteracy weaknesses were a precursor of subsequent reading disability at 60 months. Children’s preliteracy deficits are accompanied by oral language difficulties that are also related to subsequent progress in reading. This is demonstrated by the present sample of five-year-old children who had poor letter-sound knowledge and who later became poor readers who also presented with deficiencies in object-naming and phonemic awareness skills. In the present study, syntactic differences among two-year-old children corresponded most closely with children’s eventual outcomes, but phonological production was also substantially impaired in children who were later identified as poor readers. There was no evidence of early receptive phonological impairment. There was also little evidence for very early problems in vocabulary development among the children who later developed reading disabilities. Vocabulary deficits were associated with reading problems but not until the children were 42 months old. Lexical diversity during natural conversation was not strongly related to any concurrent or subsequent measures in the study. The BNT and PPVT test results indicate that syntactic and phonological production deficits can be a precursor to reading disabilities at an early age whereas vocabulary could be a consequences of earlier structural language deficiencies. Precursors of dyslexia indicate that a child may
experience problems with preliteracy skills during the late preschool period, exhibit vocabulary deficiencies, poor rhyme recitation skills, and phonemic awareness deficits from the age of three or four, and produce shorter, syntactically simpler sentences and less accurate pronunciations of words than other two-year-old children. The study also explains that phonological processing abilities at the time of formal instruction in decoding begins may play an important role in the acquisition of reading. Their findings conclude that phonological processing is the aspect of language skill most closely related to outcomes of disabled readers with only secondary contributions, if any, for more general language deficiencies. The study also concludes that dyslexia is a genetically transmitted trait because child-rearing patterns cannot be so broad as to affect all aspects of a child’s future development. Potentially important differences between children who do and do not become disabled readers are evident by the third year of life.

Relevance to current study: This study specifically looks at language abilities and reading abilities and what skills would be precursors to identifying a child with dyslexia. The study concludes that the aspect of language that impacts reading disability the most is phonological processing. While deficits in syntax and phonological production may be a precursor to reading disabilities, other deficits in vocabulary and lexical diversity may be consequences of earlier structural language deficiencies. This study reveals the application of language in the diagnosis and consequences of dyslexia in children. This article shares the importance of considering language when diagnosing and working with children with dyslexia.


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Objective: This article shares that oral language is the foundation of learning to read and that children with a history of oral language difficulties are at a high risk of reading problems. This study acknowledges that many children have both decoding and reading comprehension problems. There are individual differences in phonological and broader oral language skills. Reading comprehension is the product of decoding and linguistic comprehension. A 2D model for these disorders look at how dyslexia is associated with poor phonological skills and DLD/SLI is associated with reading comprehension. As a result, DLD can co-occur with poor phonology (dyslexia) or with proficient phonological skills (poor comprehenders). Dyslexia and DLD are separate disorder but comorbidity between them is common. This study seeks to evaluate the reading comprehension outcomes of high-risk (family history of dyslexia, with preschool language impairment, recruited at three and a half years old) at the ages of eight and nine and to compare the groups of DLD, dyslexia, and DLD and dyslexia.

Method: There were 260 children that were three and a half years old classified using a two-stage process to determine if they were at family risk of dyslexia and whether they had a preschool language impairment. There were 71 children recruited as controls and 234 children included in the present analysis. To establish kids with dyslexia, at eight years they scored –1.5 SD compared to the typical developing group in reading and spelling (TD). Fifty children were dyslexic with 184 normal readers. DLD was defined by a z score of 85 or below on three tests: expressive vocabulary, test for reception of grammar, and recalling sentences from the CELF-4. Sixty-seven children were classified
as DLD with 167 having normal language. There was a result of three groups at eight years old: 21 children with dyslexia, 38 for DLD, and 29 for dyslexia and DLD. At age nine, there were 20 children with dyslexia, 38 with DLD, 23 with dyslexia and DLD, and 64 TD controls. All children participated in language tests including receptive grammar, expressive grammar, morphological inflection, and vocabulary and reading tests including word reading, nonword reading skill, and reading comprehension.

Results: There was an overall group difference at eight years and at nine years. The pattern of performance of the groups was similar except for those whose language difficulties resolved by five and a half years old who did not show a deficit and whose scores were not very different from the previous year. The DLD group performed significantly better than the dyslexic group at eight years in nonword reading and the group with dyslexia and the comorbid group performed at the same level as each other both times. For reading comprehension, the DLD group did not perform as well when compared to the group with dyslexia, and the performance of the comorbid group was only marginally worse than the DLD group. Relative to TD controls, the group with dyslexia show mild deficits in vocabulary at age eight and nine but the skills are within normal range with their score much smaller than the two DLD groups. The reading comprehension impairment in the comorbid group had a larger deficit than the other two groups at both time points and at nine years, the deficits approximated that of the additive combination of deficits in dyslexia,

Conclusion: In this study, the rate of comorbidity between DLD and dyslexia is high in this at-risk sample of about 48% of children diagnosed with DLD also fulfilling the criteria for dyslexia and 58% of those with dyslexia had DLD. All three groups have
reading comprehension difficulties, but for different reasons, though they are mild in the group with dyslexia and more severe in the two DLD groups. The findings align well with predictions from the simple view of reading in that reading comprehension is the product of decoding and language comprehension ability and deficits in either skill will inevitably lead to reading comprehension difficulties. For children with dyslexia, reading comprehension difficulties are likely a reflection of problems in decoding text (however, about one third of the sample had lower levels of vocabulary which could compromise comprehension). For children with DLD, their reading comprehension difficulties reflect the fact that their language comprehension abilities are not sufficient for them to comprehend the texts that they can decode. The comorbid group showed the most severe reading comprehension problems given their dual deficit in decoding and language skills. The findings underline the dissociation between dyslexia and DLD. Dyslexia and DLD do not differ in severity but are separate conditions possibly with different etiologies. Finally, from the 161 children recruited at age three and a half for being at family risk for dyslexia or for having a preschool language impairment, 55% had clinically significant reading or language problems at age eight. A family history of reading problems or preschool language problems place children at risk of later reading and language difficulties.

Relevance to current study: This study reveals the large comorbidity of DLD and dyslexia and the impaired reading comprehension for each of these disorders. Additionally, the comorbid group had a larger deficit of reading comprehension. This study shares the inevitable nature of reading comprehension impacted in these disorders and that other factors like vocabulary can be impacted. This study is relevant to the
current study because it emphasizes the language deficits that occur in children with dyslexia and with comorbid dyslexia and DLD. Although reading comprehension may be impacted for different reasons, this language difficulty still occurs and it becomes more severe with age (as shown from the participants at age nine). As a result, this study shares the importance of considering the effects of oral language with each of these groups and how to best treat these children.


**Objective:** Replicate and extend a new approach for determining the prevalence of dyslexia due to the current elusive method of determining the prevalence of dyslexia. The current approach contributes to the under identification or overidentification that may be occurring in school districts, states, or nations. The current method may also be elusive due to varied cut points on a continuous distribution of the population, distinct operational definitions that yield different prevalence estimates, and unreliability in commonly used identification procedures.

**Method:** This is a model-based meta-analysis to calculate an average weighed correlation between listening and reading comprehension. There was an initial search using the databases ProQuest, ERIC, Google Scholar, and PubMed using the search terms, “standardized measure(s)”, “norm referenced”, “reading” with search combinations with decoding, listening comprehension, reading comprehension, and phono*. When this search did not provide specific assessments meeting the search requirements, then this study used Google search using the search string *standardized*
measures of reading. The study found the Southwest Educational Development Laboratory (SEDL) reading assessment database, Reading Rockets website, and Wrightslaw reading assessment list to then reveal 91 assessments. The inclusionary criteria of these assessments were (a) norm referenced; (b) nationally representative norming sample; (c) in English; (d) included subtests for measuring listening comprehension, reading comprehension, vocabulary, decoding, and phonological awareness; (e) correlation matrix of subtests and subtest reliability available; and (f) included data from multiple ages or grades. The inclusionary criteria yielded nine assessments: The Kaufman Test of Educational Achievement (KTEA-III), the Woodcock Johnson-IV, the Iowa Test of Basic Skills (ITBS), the Wechsler Individual Achievement Test-III, The Woodcock Reading Mastery Test-III, the Early Reading Diagnostic Test (ERDA), the Oral and Written Language Scales-II (OWLS-II), the Brigance Comprehensive Inventory of Basic Skills-II (CIBS-II), and the Standford Achievement Test-10 (SAT-10).

Results: The study looked at the correlations between reading comprehension and listening comprehension in each of the nine tests for each grade that the test assesses. As a result, the correlations were substantial with a median correlation of .61. The reliabilities were adequate with median reliabilities of .78 for listening comprehension and .87 for reading comprehension. They converted grade to age to analyze all the studies together to maximize the sensitivity of the analysis and to determine whether grade or age supported the correlation between listening and reading comprehension. After performing additional procedures, the sample size was not a significant predictor of the effect size as indicated by the age effect remaining at the value of .003 but the significance level
increasing to \( p = .001 \) following the procedures. From a scatterplot, there are 2 main results: 1) among poor readers, more readers are expected than unexpected readers (reading comprehension worse than listening comprehension); 2) individuals whose reading comprehension is lower than their listening comprehension occur throughout the reading spectrum. They are not confined to the poor-reader segment. With only one exception, fewer than half of the poor readers were unexpected. More discrepant individuals were found above rather than below the poor-reader cutoffs examined for seven out of nine comparisons completed.

Conclusion: 1) Samples of poor readers will contain more expected poor readers (reading and oral language levels similar) than unexpected poor readers (readers with dyslexia). 2) Individuals whose level of performance in reading is substantially lower than their level of performance in oral language occur largely through the distribution of reading. These results provide implications for sample selection in scientific studies of dyslexia that individuals whose reading is poor relative to their level of oral language should be considered dyslexic instead of individuals whose reading is poor relative to peer age or grade. Additionally, for screening dyslexia, the results indicate that individuals with dyslexia will likely be missed instead of correctly identified if letter knowledge and reading are the only assessments used. The majority of individuals identified as dyslexic will likely be expected rather than unexpected poor readers. The study argues that, “science should inform public policy and practice rather than using public policy and practice to inform science” (p. 362). It also argues that “specific learning disabilities including dyslexia can occur throughout the range of cognitive and
language abilities, which includes both lower than average and higher than average levels of functioning” (p. 362).

Relevance to current study: This article references the most widely used definition of dyslexia established by the International Dyslexia Association, the National Center for Learning Disabilities, and the National Institute for Child Health and Human Development:

Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (Wagner et al., 2020, p. 354)

This definition states that reading deficits are unexpected in relation to other cognitive abilities. This definition also states that secondary consequences include problems in reading comprehension and the growth of vocabulary which are key elements of language skills. The results from this study declare the need for scientific studies of dyslexia to consider assessing individuals whose reading is poor relative to their level of oral language instead of whose reading is poor relative to their age or grade. It also shares the importance of assessing more than just letter knowledge and reading when screening for dyslexia. The current study emphasizes the need for assessment of oral language in children with dyslexia. This study provides another reason for the need of oral language
assessment in order to appropriately and efficiently diagnose children with dyslexia as unexpected poor readers instead of missing individuals with dyslexia by assessing them as expected poor readers.


Summary: International Dyslexia Association, National Institute of Child Health and Human Development, many researchers and educators, and state education codes use this definition of dyslexia:

Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (2018, p. 810)

This study shares that dyslexia is a language-learning disability that negatively affects an individual’s written language skills (reading, spelling, written expression). Another type of reading disability describes “specific comprehension deficit” characterized by accurate word recognition but poor language comprehension with weaknesses in morphology, syntax, and semantics. A third type of reading disability is a “mixed
decoding/comprehension deficit”. Regarding these deficits, parents, professionals, and researchers advocate for awareness, early identification, and increased access to appropriate services in the public schools for children with dyslexia in recent years. This study seeks to raise awareness of the need of legal protection for students with dyslexia to prevent negative impact on academic achievement and psychosocial and socioeconomic issues including homelessness, juvenile delinquency, depression, substance use and abuse, and suicide. The current federation legislation for dyslexia includes the Individuals with Disabilities Education Act (IDEA) reauthorized in 2004 which lists 13 categories of eligibility for special education services in the public schools. One of the categories is a specific learning disability (SLD) including dyslexia as a type of SLD. Because this federal law does not specify how dyslexia is defined or how services should be provided for students with dyslexia in public schools, special education services provided to children with dyslexia vary greatly across states. Many states have proposed or passed dyslexia laws that provide more detail than the IDEA and attempt to give students with dyslexia additional right and protections. There are 38 states with dyslexia laws, three with approved dyslexia initiatives or resolutions, and nine states with no current dyslexia laws.

The specific topics related to dyslexia addressed in one or more of these recent laws include employment of specialists with training in dyslexia, screening and identification of dyslexia, definition of dyslexia, training of teachers and specialists, intervention for students with dyslexia, and dyslexia awareness. Regarding SLP involvement, the American Speech-Language-Hearing Association’s (ASHA) position paper, SLPs have a major responsibility and role to play in supporting both spoken and
written language development in students. SLPs receive training that enables them to play a role in the identification, assessment, and intervention of students who struggle to read and write, including those with dyslexia. SLPs may serve as important contributing members of interprofessional practice teams to serve students with dyslexia. They are well equipped to support individual needs of students with dyslexia and other types of language-learning disabilities through direct intervention and collaboration. This article shares that literacy is not owned by a single discipline.

Conclusion: There has been a dramatic increase in state legislation, indicating that there will be others acted in the near future. With this in mind, it is important to consider SLPs in services for individuals with dyslexia.

Relevance to current study: This study shows the current legislation regarding the support of services for children with dyslexia. It talks about the importance of collaborating with multiple professionals including SLPs as SLPs have unique expertise of language that can contribute to services for individuals with dyslexia. This study supports and advocates for SLPs to be involved in the process of assessment and treatment for individuals with dyslexia.
# APPENDIX B

## Article Coding Instructions

*Instructions given to the research assistants when coding articles. These are the relevant instructions to this systematic review.*

Some articles may not include all information requested. If the article does not have the requested information, type “NR” into the cell. (NR stands for “not reported”).

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<td>G</td>
<td>Authors</td>
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<td>K</td>
<td>Number of participants</td>
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<td>L</td>
<td>Mean age (in years)</td>
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<td>M</td>
<td>Grade (in school) if specified</td>
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<td>N</td>
<td>Language spoken</td>
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<td>O</td>
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<td>Y</td>
<td>Criteria used for classification of dyslexia</td>
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<td>Z</td>
<td>Word Reading (Y/N)</td>
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<td>Column</td>
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<tr>
<td>AA</td>
<td>Mean Word Reading Score</td>
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<td>AB</td>
<td>Mean Word Reading Score</td>
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<td>Word Reading Cut Point</td>
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<td>Non-word Reading (Y/N)</td>
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<td>AE</td>
<td>Mean Non-word Reading Score</td>
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<td>AF</td>
<td>Mean Non-word Reading Score</td>
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<td>AG</td>
<td>Non-word Reading Cut Point</td>
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<td>AL</td>
<td>Language (Y/N)</td>
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<td>AM</td>
<td>Language Assessments Used</td>
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<td>AN</td>
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<td>AO</td>
<td>Mean Language Score</td>
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<tr>
<td>AP</td>
<td>Criteria used for assessment of language skills</td>
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## APPENDIX C

### Oral Language Assessments Categorized in Each Language Domain

<table>
<thead>
<tr>
<th>Domain</th>
<th>Test</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Phonological Awareness</strong></td>
<td>&quot;Phonological awareness tasks: Rhyme detection, odd-one-out (simple and complication), oral comprehension, first phoneme deletion&quot;</td>
<td>&quot;Chinese Phonological Awareness Test: subtests pseudo-syllable reading in Zuyin Fuhao, tone identification and onset deletion tasks, oddity task for onset, rime, and lexical tone&quot;</td>
</tr>
</tbody>
</table>
|                                | "Prueba para la evaluación del conocimiento fonológico. [Test for assessing the phonological awareness] (PECO)" | "Phoneme deletion in the Dutch Screenings instrument, Beginnende Geletterdheid (Screening Instrument for Emerging Literacy)"
|                                | "Hong Kong Test of Specific Learning Difficulties in Reading and Writing (HKT-SpLD) "phonological awareness tests of rhyme detection onset detection" | "Phonological abilities were investigated by means of the pseudo- word repetition test of the BELEC and the phoneme deletion test of the same test"
|                                | "The York Assessment of Reading for Comprehension (YARC) - "Phoneme isolation of initial and final sounds" | "Short-term phonological memory (Dutch version of Digit Span subtest of Wechsler Intelligence Scale for Children (WISC)"
|                                | "Rapid Automated Naming (RAN)" | "3DM phoneme deletion"
|                                | "Phonological Processing" | Early Repetition Battery (ERB) - "Alliteration Matching"
|                                | "Grapheme Parsing, Grapheme - Phoneme Knowledge" | "verbal fluency (semantic and phonemic)"
|                                | "Comprehension Test of Phonological Processing (CTOPP)" | "auditory discrimination"
|                                | "phonological and visual differentiation" | "German phonological awareness test (BAKO)"
|                                | "Metaphonological awareness assessed with a phoneme subtraction test" | "syllabic manipulation"  I WAL-auditory interference and phoneme analysis test"
|                                | "Phoneme Synthesis (subtest language test for children)" | "syllable deletion"  "Phonological Assessment Battery"
|                                | "auditory closure, digit span, auditory interference" | "phonological short-term memory"  "Verbal Working Memory"
|                                | "phonological memory" | "homophones"  "rhyme detection and onset detection"
### Vocabulary

<table>
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<tr>
<th>Test</th>
<th>Description</th>
<th>Notes</th>
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<tbody>
<tr>
<td><em>Wechsler Intelligence Scale for Children-III</em> vocabulary subtest</td>
<td><em>Echelle de Vocabulaire en Images Peabody (EVIP)</em>, French version of the Peabody Picture Vocabulary Test-Revised</td>
<td>&quot;vocab via British Ability Scales (BAS)&quot;</td>
</tr>
<tr>
<td>&quot;Passive vocabulary&quot;</td>
<td><em>ABFW Vocabulary Test</em> (Brazilian vocabulary test)</td>
<td>&quot;Chinese Version of PPVT-R&quot;</td>
</tr>
<tr>
<td><em>Peabody Picture Vocabulary Test (PPVT)</em></td>
<td>Receptive one word picture vocabulary test (ROWPVT)</td>
<td>&quot;Chinese Vocabulary Test and Assessment Scale for primary school children&quot;</td>
</tr>
<tr>
<td>&quot;Expressive Vocabulary Receptive Vocabulary&quot;</td>
<td>&quot;Expressive (British Ability Scales-II) and receptive (British Picture Vocabulary Scale–II) vocabulary&quot;</td>
<td>Character Recognition Measures and Assessment Scale (CRM) - standardized vocabulary test</td>
</tr>
</tbody>
</table>

### Grammar/Syntax

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<thead>
<tr>
<th>Test</th>
<th>Description</th>
<th>Notes</th>
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<tbody>
<tr>
<td>&quot;Receptive grammar&quot;</td>
<td><em>Test for the Reception of Grammar</em></td>
<td>&quot;Grammatical competence: The Recalling Sentences subtest of CELF&quot;</td>
</tr>
<tr>
<td>&quot;Semantic and syntactic ability&quot;</td>
<td>&quot;Grammatical morphology&quot;</td>
<td><em>The Test for the Reception of Grammar (TROG-II)</em></td>
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<tr>
<td>&quot;Morphological awareness&quot;</td>
<td>&quot;Morphological production&quot;</td>
<td>&quot;Sentence repetition&quot;</td>
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### Full Language Battery

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<thead>
<tr>
<th>Test</th>
<th>Description</th>
<th>Notes</th>
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<tbody>
<tr>
<td>&quot;N-EEL, Nouvelles Epreuves pour l'Examen du Langage, new tests for examining language&quot;</td>
<td><em>Hong Kong Test of Specific Learning Difficulties in Reading and Writing for Primary School Students-Second Edition (HKT-SpLD II)</em></td>
<td>CELF-Preschool 2 – “Basic Concepts, Sentence Structure, Word Structure, and Expressive Vocabulary&quot;</td>
</tr>
<tr>
<td>&quot;locally developed Curriculum-Based test: Reading Comprehension, Oral Expression, Listening Comprehension&quot;</td>
<td>&quot;Expressive language of Basic Diagnostics of Specific Developmental Disorders in Elementary School&quot;</td>
<td>&quot;Test of Language Comprehension, subtests auditory memory, syntactic comprehension, semantic judgement, and passage understanding&quot;</td>
</tr>
<tr>
<td>&quot;Oral language abilities&quot;</td>
<td>&quot;Chinese Language Test&quot;</td>
<td>&quot;Core language composite of CELF-4&quot;</td>
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