

## Cover Page

### Title

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# Understanding the nature and severity of reading difficulties among students with language and reading comprehension difficulties

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## Abstract

This study investigated the presence of word reading difficulties in a sample of students in Grades 1–4 ( $n=357$ ) identified with language and reading comprehension difficulties. This study also examined whether distinct word reading and listening comprehension profiles emerged within this sample and the extent to which these groups varied in performance on cognitive and demographic variables. Findings showed that the majority of students (51%) with language and reading comprehension difficulties demonstrated significant risk in word reading (more than 1 SD below the mean), even though the participant screening procedures did not examine word reading directly. Three latent profiles emerged when students were classified into subgroups based on their performance in listening comprehension (LC) and word reading (WR): (1) severe difficulties in LC and moderate difficulties in WR (11%), (2) mild difficulties in both LC and WR (50%), and (3) moderate difficulties in LC and mild difficulties in WR (39%). Of note, even though students were identified for participation on the basis of poor oral language and reading comprehension abilities, all profiles demonstrated some degree of word reading difficulties. Findings revealed there were differences in age and performance on measures of working memory, nonverbal reasoning, and reading comprehension performance between profiles. Implications for educators providing instruction to students with or at risk for dyslexia and developmental language disorders were discussed.

**Keywords** Developmental language disorder · Dyslexia · Elementary · Reading difficulties

Dyslexia is considered a neurobiological disorder that primarily arises from a phonological processing deficit and manifests in difficulties in learning to read and spell (e.g., Lyon et al.,

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2003; Miciak & Fletcher, 2020). The prevailing opinion for the past several decades is that phonological deficits are the primary and proximal causal factor associated with dyslexia (Catts, 2021; Miciak & Fletcher, 2020). Put more specifically, students with dyslexia have difficulty storing, retrieving, and using the sounds in language and connecting these sounds to the orthography of printed language in order to decode and spell effectively. Although deficits in phonological processing remain the primary source of word reading difficulties for students with dyslexia, there is growing evidence to suggest that dyslexia results from multiple factors (e.g., Catts & Petscher, 2020; Snowling et al., 2020). For instance, Catts and Petscher (2020) presented a risk-resilience framework that posits dyslexia is the product of multiple risk factors (e.g., deficits in phonology, vocabulary/grammar, attention), as well as protective factors (e.g., quality instruction, high intelligence, adult/peer support) which interact to influence students' ability to read.

In accordance with this multifactorial model of dyslexia, research also suggests that students with dyslexia represent a diverse subgroup of students whose difficulties in word reading may co-occur with other difficulties, such as broader oral language difficulties (e.g., Catts et al., 2005; Snowling et al., 2019) or speech sound disorders (Anthony et al., 2011; Tambyraja et al., 2020). When these co-occurring oral language difficulties are acute, students with dyslexia may be identified with comorbid developmental language disorder (DLD; Bishop et al., 2009; Snowling et al., 2019, 2020), which is characterized as a neurodevelopmental condition that manifests in difficulties in learning, understanding, and using spoken language in early childhood (Bishop, 2017; Gillam et al., 2017). Empirical research reveals that students with comorbid dyslexia and language learning difficulties, such as DLD, may present with more significant reading comprehension problems than students with either dyslexia or DLD (e.g., Catts et al., 1999; Duff et al., 2021; Snowling et al., 2020).

Results showing students with comorbid dyslexia and language disorders present, on average, the most significant deficits in reading comprehension comports with the simple view of reading (SVR; Gough & Tunmer, 1986). The SVR posits that reading comprehension results from the multiplicative combination of decoding and linguistic comprehension. The SVR, by identifying word reading and linguistic comprehension as separate (yet interrelated) component skills of reading, can serve as a valuable heuristic for identifying the sources of reading comprehension difficulties in a way that aligns with the primary challenges of students with dyslexia and DLD. This was not lost on the developers of the SVR, Gough and Tunmer (1986), who considered the identification of subgroups to be an important implication of the SVR, and discussed the implications for students with dyslexia in their early work. Since the publication of the SVR, numerous studies have successfully used the model as a framework for identifying subgroups of struggling readers using different methodological approaches (e.g., Catts et al., 2006; Hoover & Gough, 1990). For instance, Catts et al. (2006) used cut-off scores on predictor variables of language comprehension and word reading to categorize children into reader profiles (e.g., specific word reading deficits, specific comprehension deficits, and mixed deficits). Other researchers have used variable-centered, regression-based methods to identify subgroups of struggling readers (e.g., Buly & Valencia, 2002; Morris et al., 1998). In recent years, researchers have used rigorous person-centered analytic approaches, such as latent class or profile analyses, to advance knowledge about the reading profiles of struggling readers (e.g., Brasseur-Hock et al., 2011; Capin et al., 2021; Clemens et al., 2017; Lesaux & Kieffer, 2010). There is also robust literature base using latent class and profile analyses to examine the literacy skills of students not identified with reading difficulties (Foorman et al., 2017; Kapantzoglou et al., 2015; Kim et al., 2020; Lonigan et al., 2018a; Norwalk et al., 2012). Person-centered analytic approaches have been recommended (Pastor et al.,

2007; Spurk et al., 2020) over regression-based approaches, because they allow for consideration of the covariance between predictors when identifying groups and whether students scored higher or lower on predictor variables (Logan & Pentimonti, 2016).

In this study, we sought to advance our understanding of individual differences among a population sample of linguistically diverse students identified with language and reading comprehension difficulties in Grades 1 through 4 by exploring the prevalence of word reading difficulties among these students, and determining the extent to which latent profiles emerged based on difficulties in word reading and linguistic comprehension. We were interested in students with difficulties in oral language because it is foundational to literacy development and learning more broadly (e.g., Whitehurst & Lonigan, 2001; Kim et al., 2020). Oral language ability may become increasingly important to reading comprehension as students matriculate to the secondary grades and face significant language demands during content area instruction (Biancarosa & Snow, 2004). Our study included students both native English speakers and those learning English as a second language given there is a continuing need to understand the sources of reading difficulties among linguistically diverse students and to identify evidence-based practices for these students (Cho et al., 2019). We sought to study the intersection between oral language and word reading because that is the aim of this special issue and because recent research shows there is a high rate of co-occurrence between dyslexia and DLD (e.g., Snowling et al., 2020). Given dyslexia and DLD are dimensional disorders that exist on the lower end of a continuous distribution of word reading and broader oral language difficulties, respectively, it stands to reason there are also many students at risk for dyslexia and DLD whose difficulties will co-occur. Additionally, only a few studies have used rigorous, person-centered analyses to identify subgroups among struggling readers (e.g., Brasseur-Hock et al., 2011; Capin et al., 2021; Clemens et al., 2017; Lesaux & Kieffer, 2010), and this research has not specifically focused on elementary students screened for language and reading comprehension difficulties. Research that sheds light on the sources of reading difficulties of students with language and reading comprehension difficulties has important implications for practice. For instance, students with language-based difficulties are often referred for speech-language services in schools but may not be considered for services that attend to word reading difficulties, such as dyslexia services.

## Previous research examining reading profiles

Understanding the reading profiles of students with language and reading comprehension difficulties is important because it can inform decisions about the language and literacy interventions provided to students. In particular, identifying the sources and severity of component skills (word reading and language comprehension) within the SVR can inform instructional design (e.g., the components of reading to address) and delivery (i.e., the intensity of interventions). Previous research indicates that designing reading instruction to meet individual needs of students, based on their performance on the component skills of reading, is associated with improved outcomes (e.g., Connor et al., 2007). Evidence suggests that code-focused instruction that includes explicit and systematic word reading instruction is critical for students with significant word-level reading difficulties (i.e., dyslexia; e.g., Castles et al., 2018). Alternatively, meaning-focused interventions that contain a strong focus on developing language abilities should be employed to address the needs of children with weaknesses in language comprehension (e.g., Duff & Clarke, 2011).

Thus, if latent profile results show that the majority of students with language and reading comprehension challenges (whether monolingual or bilingual) present reading profiles characterized by difficulties in broader oral language *and* word reading, then educators will want to design interventions that include both code- and meaning-focused instructional components. At present, many interventions primarily focus on either word reading *or* language comprehension. Consider Orton-Gillingham-based programs that are commonly implemented by reading specialists for students with or at risk for dyslexia, which focus primarily on code-based skills through direct, highly structured decoding instruction that incorporates visual, auditory, and kinesthetic modalities (Stevens et al., 2021). Conversely, language interventions provided by speech language pathologists to students, with or at risk for DLD, often focus on phonological, lexical, or syntactic development but rarely focus on orthographic code-based difficulties (e.g., Cleave et al., 2015; Dawes et al., 2019; Ebbels, 2014; Plante et al., 2019). If results suggest that the majority of struggling readers present word reading and language difficulties, then it stands to reason that the approaches of reading specialists and speech language pathologists may need to be integrated to best meet the needs of students with co-occurring difficulties.

Previous studies using latent profile analyses have sought to better understand the reading profiles of struggling readers by determining the extent to which subgroups emerge based on differences in the *specificity* or the *severity* of their reading difficulties (Capin et al., 2021). In other words, do subgroups emerge based on *specific* difficulties in word reading or language comprehension? Or, do subgroups emerge based on differences in the *severity* of difficulties? Much of this research has been conducted with poor comprehenders in Grades 6 through 9 (Brasseur-Hock et al., 2011; Clemens et al., 2017; Lesaux & Kieffer, 2010). Findings suggest that latent classes emerge based on both the severity and specificity of component skill reading deficits; however, class formation is more often representative of differences in the severity of reading difficulties than the specificity of those difficulties (Brasseur-Hock et al., 2011; Clemens et al., 2017). For instance, Clemens et al. (2017) formed latent profiles for a sample of 180 middle school students with significant reading comprehension difficulties based on their passage reading fluency and vocabulary performance. Findings revealed that most students (61%) did not exhibit a single deficit, but rather displayed underachievement on both component skills (reading fluency and vocabulary) and that groups varied in the severity of these difficulties. The findings of another study conducted with poor comprehenders by Brasseur-Hock et al. (2011) also revealed the majority of subgroups reflected deficits in both reading fluency and language comprehension. This was particularly true for students with the most significant reading comprehension problems (85% of these students presented moderate or global weaknesses across the component skills of reading).

There has been less research conducted using person-centered techniques with struggling readers in the elementary grades. Capin et al. (2021) analyzed reading profiles of a linguistically diverse sample of fourth graders with significant reading comprehension problems (identified based on scoring at least 1 standard deviation below the normative mean on reading comprehension). They found that less than 10% of students demonstrated specific difficulties in either word recognition or linguistic comprehension. There are two sample characteristics worth noting when interpreting the findings of this study: (1) the sample presented significant reading comprehension difficulties (on average more than 1.5 SDs below normative average on a standardized measure of reading comprehension) and (2) about one-half of the sample examined by Capin et al. were classified as English learners (ELs) based on their performance on a state English language proficiency test. Previous research suggests that the primary source of reading comprehension difficulties

among bilingual students with reading difficulties relates to their developing language proficiency (e.g., Cho et al., 2019). Thus, the high number of ELs and overall severity of reading comprehension difficulties may contribute to the prevalence of both word reading and linguistic comprehension difficulties in this sample. Yet, it is worth noting that the Capin et al.'s (2021) findings correspond with the findings of latent profile analyses conducted by Brasseur-Hock et al.'s (2011) study of monolingual secondary students which also found students with the most significant reading difficulties presented difficulties in the component skills of reading (word recognition and language comprehension).

Foorman et al. (2017) used latent profile analyses with a large representative sample of students in kindergarten through Grade 10 ( $n=7,752$ ) to better understand their reading skill profiles. Their results with students across the distribution of reading skills found that students in the elementary grades demonstrated greater heterogeneity of reading skills than older students. The authors interpreted these findings as suggestive that interventions in the elementary grades (particularly in the primary grades) need to be responsive to the learning profiles of these students. Given the limited research examining students in the elementary grades with reading difficulties using person-centered approaches, further research is needed to understand the reading and language skills of these students.

There is a particular need for understanding the reading and language skills of a linguistically diverse sample of struggling readers. Previous research indicates that a single label of bilingual belies the significant heterogeneity that exists among bilingual students. In particular, research using person-centered approaches show that in as early as the preschool years, discrete subgroups of bilingual subgroups emerged based on language and early literacy skills (Ford et al., 2013; Francot et al., 2021; Kapantzoglou et al., 2015; Lonigan et al., 2018a). Research examining bilingual children in the elementary grades also identifies subgroups of students with heterogeneous language and reading skill profiles, indicating that it is possible to predict students who are at risk for learning disabilities with accuracy (Swanson et al., 2020). However, additional research is needed to examine individual differences within a sample of students identified with language-based comprehension difficulties, as this is the population in need of intensive intervention.

## Current study

This exploratory study extends extant research by using a person-centered approach to characterize the reading profiles of a linguistically diverse sample of elementary students in Grades 1 through 4 identified with language and reading comprehension difficulties. This study addresses three primary aims. First, we examined the word reading difficulties of these students to better understand the co-occurrence of language and word reading difficulties. Based on research documenting the high co-occurrence of word reading and language difficulties in elementary students (e.g., Capin et al., 2021; Catts et al., 1999), we anticipated many students in the sample would present with word reading difficulties. Second, we aimed to understand individual differences among students with language and reading comprehension challenges by exploring whether reading profiles emerged based on performance on SVR variables (i.e., decoding and linguistic comprehension). Although there are other theoretical frameworks with empirical support (e.g., the reading systems framework; Perfetti & Stafura, 2014), we used the SVR as our theoretical framework because it is been a robust model for predicting variance in reading comprehension performance across diverse samples (e.g., Catts et al., 2015; Florit & Cain, 2011) and the components of the SVR align

well to understanding the intersection between broader oral language and word reading difficulties, a focal interest of this study. Identifying distinct profiles has the potential to inform intervention. Based on prior research (Brasseur-Hock et al., 2011; Clemens et al., 2017; Lesaux & Kieffer, 2010), we hypothesized that subgroups would emerge and vary based on both the specificity and severity of their reading difficulties.

Finally, we explored whether reading profiles varied based on demographic information (age, EL status, special education status), reading comprehension performance, and cognitive variables known to underlie language and reading abilities (working memory, nonverbal reasoning). Evaluating performance on external dimensions can provide further support for the subgroup classification results and implicate underlying processes (such as working memory) that may need to be considered when developing specific and effective interventions (e.g., Miciak et al., 2019). We hypothesized that profiles marked by more severe reading difficulties would demonstrate lower performance on working memory and nonverbal reasoning abilities. And, if groups emerged based on specific component skill deficits, then these groups would present corresponding deficits in empirically implicated cognitive processes. Based on previous research examining nonverbal reasoning among students with DLD (e.g., Gallinat & Spaulding, 2014), we hypothesized that a group characterized by difficulties in language comprehension might demonstrate greater deficits in nonverbal reasoning than other profiles. It is common for both students with dyslexia as well as those identified with DLD to exhibit underlying difficulties in working memory. Some research suggests that working memory is more strongly associated with word reading than language comprehension (Peng et al., 2018). For this reason, we speculated students with primary deficits in word reading, whether EL or not, may exhibit greater deficits in working memory. We also hypothesized that if more severe subgroups emerged, these groups would be older and would consist of higher proportions of students with disabilities. This hypothesis is based on data to suggest that students with disabilities (National Center for Education Statistics, 2019) and older students (e.g., Vaughn & Fletcher, 2012) are more likely to demonstrate more substantial difficulties than their counterparts.

## Methods

This paper is a secondary analysis using pretest data from a multi-site, multi-cohort randomized control trial (RCT; Gillam et al., 2021) collected to assess the efficacy of narrative language program for students in Grades 1–4 with narrative language and reading comprehension difficulties. The broader efficacy trial was conducted over three years with three cohorts of non-overlapping students. This data was collected in two states, one located in the Southwestern state and the other in a Western state. Fourteen schools from seven school districts participated in the intervention, with school sites ranging from urban to rural.

### Student participants

Each year in winter, for three consecutive school years, researchers systematically identified students with difficulties in narrative language and reading comprehension using multiple screening measures. All students ( $n = 3,380$ ) from participating schools in Grades 1–4, whose families consented to screening, were initially tested using the Gates-MacGinitie Reading Test (GMRT; MacGinitie et al., 2000). Students who scored at or below the 33rd percentile on the GMRT and provided parent consent and student assent to participate

in the intervention ( $n=550$ ) were assessed using the Test of Narrative Language-2 (TNL; Gillam & Pearson, 2017). Students who scored at or below the 33rd percentile cutoff were identified as having language and literacy difficulties and were invited for participation in the study. A total of 357 students met all qualifying screeners and were consented to participate over the course of three consecutive years. All students participated in the study for only one year (i.e., the full sample consisted of students from three non-overlapping cohorts that each lasted one year).

A large percentage of the 357 participating students were Latino (56.7%) with the remaining students identified as Caucasian (31.6%), African American (4.5%), and Asian (1.4%) (Table 1). A substantial percentage (41.5%) of parents also self-reported that the students were ELs with a home language other than English. Slightly more than half (54.3%) of the sample were male. Thirty-seven percent of participants were receiving special education services for a previously identified disability. The two most commonly identified disability classifications of participants were speech language impairment (19.2%) and learning disabilities (16.1%).

## Measures

Trained assessment administrators at both sites administered all measures to students. The assessment administrators were hired and trained by senior researchers who were responsible for the data collection. These administrators were all blind to students' condition in the study. Testers were given a full-day training on how to appropriately deliver each measure with high fidelity and reliability. Prior to being approved to administer the assessments, each tester first had to demonstrate the ability to do so in a mock session with a senior researcher. Students were administered the assessments during the latter part of fall semester (November and December) All measures are briefly described below.

**Table 1** Student demographics

Variable	<i>n</i>	%
Gender		
Male	194	54.3
Female	163	45.7
Ethnicity		
African American	16	4.5
Asian	5	1.4
Latino	203	56.9
White	112	31.4
Two or more	9	2.5
Other	5	1.4
Receives special education services	133	37.3
English learner status	148	41.5
Grade		
1	61	17.1
2	93	26.1
3	109	30.5
4	94	26.3

## Measures of word reading

### Test of Word Reading Efficiency (TOWRE-2), Sight Word Efficiency (SWE), and Phonemic Decoding Efficiency (PDE) subtests

The TOWRE-2nd Edition (Torgesen et al., 2012) consists of two subtests, SWE and PDE, and was normed on individuals ages 6–24. The SWE subtest consists of real words the students are asked to read that increase in difficulty as the student advances. The SWE subtest was designed to measure a person's sight word vocabulary or words that can be read as single orthographic units instantly. There is no ceiling rule to discontinue the assessment and students are given 45 s to read as many words as they can. The SWE subtest is scored by how many correct words the student reads in those 45 s. The PDE subtest requires the test taker to use their graphophonetic knowledge to read nonwords accurately. Students again have 45 s to read as many nonsense words correctly as they can. Average alternative form coefficients for the TOWRE-2 were 0.91 on the SWE and 0.92 on the PDE. Test–retest reliabilities ranged from 0.89–0.93 with interrater reliability being 0.99 (Torgesen et al., 2012). We report standard scores ( $M=100$ ;  $SD=15$ ) based on grade level throughout this paper.

### Measures used to identify latent profiles of reading

Two reading measures were used to identify latent profiles: a measure of listening comprehension (Test of Narrative Language, 2nd Edition; TNL-2) and a measure of decoding (TOWRE-2 PDE). The TOWRE-2 PDE, described briefly above, was designed to include a list of nonsense words that utilize a range of grapheme-phoneme correspondence. As the student advances through the test, the nonsense words increase in number and complexity of phonemes used, as well as in the number of syllables. Because the PDE only consists of nonsense words, it requires the student to rely heavily on their decoding skills to read the words as the student is unable to use either context or their own lexical knowledge to read the nonsense words fluently (Silverman et al., 2013).

The Test of Narrative Language-2 (TNL-2; Gillam & Pearson, 2017) is a standardized, norm-referenced test designed to measure narrative comprehension and production of stories in children aged 4–14 years. Similar to past studies (e.g., Catts et al., 2015; Harlaar et al., 2010; Kim & Petscher, 2020), we used the Narrative Comprehension subtest of the TNL-2 as an indicator of language comprehension. The Narrative Comprehension subtest consists of three narrative stories that are read aloud to the examinee, followed by open-ended, literal and inferential comprehension questions about each story. There are 30 total questions across the three stories. Most items are scored on a dichotomous scale (0 or 1); however, few items are scored on a trichotomous scale (0, 1, or 2). The max score a student can earn on the Narrative Comprehension subtest is 40. The TNL-2 has a Cronbach alpha of 0.80. Inter-scoring reliability is above 0.90 and test–retest reliability is greater than 0.80 (Gillam & Pearson, 2017). The TNL-2 reports scaled scores for the comprehension subtest with a mean of 10 and standard deviation of three.

### Reading comprehension measures

To assess reading comprehension, we administered the Gates-MacGinitie Reading Test-Fourth edition Reading Comprehension subtest (GMRT-RC; MacGinitie et al., 2000). The

GMRT-RC subtest is a timed assessment given in a group setting, designed to assess student's reading comprehension abilities. Students are given expository and narrative passages, ranging between three to fifteen sentences in length. Students read the passages silently and then respond to multiple choice comprehension questions about each passage. For grade levels included in this study, the GMRT-RC's internal reliability ranges from 0.91 to 0.93. Alternate form reliability for the included grade levels ranges from 0.80 to 0.87 (MacGinitie et al., 2000). We report standard scores based on grade level.

We also administered the Test of Silent Reading Efficiency and Comprehension (TOSREC, Wagner et al., 2010). On the TOSREC, students in a group setting are given 3 min to silently read a list of sentences and then determine if each statement is true or false by circling "yes" or "no." Previous research suggests that the TOSREC alternate-form reliability ranges from 0.86 to 0.95 with a test-retest score range of 0.81 to 0.87 (Wagner et al., 2010). The TOSREC has a Cronbach alpha of 0.97. We report raw scores on the TOSREC because grade-level standard scores are not available.

### Cognitive measures

The Woodcock-Johnson-III Test of Cognitive Abilities (WJ-III COG, Woodcock et al., 2001) Auditory Working Memory subtest and the Kaufman Brief Intelligence Test Second Edition (KBIT-2, Kaufman & Kaufman, 2004) were used to assess students' cognitive abilities. The Auditory Working Memory subtest measures a person's ability to hold a list of words and numbers in their short-term memory and then perform "a mental operation on the information" which entails reordering the words and numbers into two discrete categories and then repeating the words in order and the numbers in order (Mather & Woodcock, 2001). Median test reliability for this age group is 0.88 and median cluster reliability for the same age range was 0.90 (Schrank, 2011).

The Kaufman Brief Intelligence Test Second Edition (KBIT-2, Kaufman & Kaufman, 2004) Matrices subtest was used to assess examinees nonverbal reasoning abilities. The Matrices subtest measures the ability to solve problems, recognize patterns, and complete visual analogies. The examiner shows the participant pictures or abstract designs that follow a pattern but are missing an element, and then asks the participant to point to the picture that would show the best answer. The Matrices subtest includes 46 items. Adjusted test-retest reliability for ages 4–12 is 0.88 to 0.93. Split-half reliability coefficients ranged from 0.80 to mid-0.90 with the mean reliability for ages 4–12 being 0.91 (Kaufman & Kaufman, 2004). We report standard scores ( $M = 100$ ;  $SD = 15$ ) on the TOSREC and KBIT.

### Data analysis

We addressed Aim 1 by examining descriptive information on students' word reading performance to determine the extent to which students identified with language and reading comprehension difficulties also struggle with word reading. To address Aim 2, we identified profiles using latent profile analyses (LPA) based on students' word reading and linguistic comprehension performance. LPA is an exploratory, person-centered approach that identifies an optimal number of distinct latent subgroups from a larger sample, based on observed data by maximizing homogeneity within each class and maximizing heterogeneity between subgroups. These subgroups are latent because membership is not directly observed but inferred based on patterns of means and interrelations among multiple observable indicators. Based on the SVR, we used the TOWRE phonemic decoding subtest (word reading) and the TNL comprehension

subtest (listening comprehension) to index unique profiles of reading among struggling readers. We considered fit indices, theoretical interpretability, and number of students assigned to each profile when choosing from competing models (Bauer & Curran, 2003; Muthén, 2003). We evaluated model fit using the Akaike information criterion (AIC; Akaike, 1987), Bayesian information criterion (BIC; Schwarz, 1978), sample size adjusted BIC (SABIC; Sclove, 1987), the Lo-Mendell Rubin adjusted likelihood ratio test (LMR; Lo et al., 2001), the parametric bootstrap likelihood ratio test (BLRT), and entropy (Geiser, 2013; Morin & Wang, 2016). Models with the lowest AIC, BIC, and ABIC values indicate better fit to the data and higher probability of replication (Muthén, 2004). The likelihood-based LMR estimator evaluates the improvement in model fit of adding an additional latent class. A non-significant  $p$ -value on the LMR indicates that the  $k-1$  class model fits the observed data significantly better than the  $k$  class model. The BLRT is a likelihood ratio test that uses bootstrap parameter estimates to create a significance test. A significant BLRT (i.e.,  $p < 0.05$ ) denotes that the  $k-1$  profile model should be rejected, and that the  $k$  profile model fits the data significantly better, and a non-significant BLRT indicates the more parsimonious model (i.e.,  $k-1$ ) should be retained. Lastly, entropy represents overall classification quality with values closer to 1 indicating better model classification (McCutcheon, 2002).

Once the final solution was determined, we addressed Aim 3a by examining the extent to which reading profiles differed by demographic variables (age, EL, and special education status). We used the three-step method (R3STEP; Asparouhov & Muthén, 2021; Vermunt, 2010) with auxiliary variables in Mplus 8.3. In the first step, we determined the number of latent profiles in the unconditional model (i.e., the model without covariates). Based on the results, we created the most likely class variable based on the posterior distribution of classes. In the final step, we regressed the most likely class on selected covariates using multinomial logistic regression.

Next, we examined how distal outcomes (performance on measures of reading comprehension and cognitive processes) differ as a function of reading profiles. We used the Bolck-Croon-Hagenaars method (BCH; Bakk & Vermunt, 2016; Bolck et al., 2004) with auxiliary variables in Mplus 8.3. The BCH method avoids shifts in latent classes by using a weighted multiple group analysis, where groups correspond to latent class, and thus the class shift is not possible because the classes are known (Asparouhov & Muthén, 2021; Bakk & Vermunt, 2016). BCH outputs an equality test that compares class-specific means of the distal outcomes across reading profiles. To calculate effect sizes, we converted the standard error (SE) of the class mean into a standard deviation (SD;  $SE * (\text{square root}(n))$ ) and divided the raw mean difference between two classes by their pooled SDs (WWC, 2020). Per recommendations of the WWC (2020), we adjusted for false discovery rates (the probability of type 1 error) using the Benjamini–Hochberg correction (Thissen et al., 2002).

## Results

### Preliminary analyses

We present descriptive statistics and intercorrelations in Table 2. On average, students scored one standard deviation below the mean on the TNL comprehension ( $M=6.26$ ,  $SD=2.22$ ) and TOWRE phonemic decoding subtests ( $M=87.40$ ,  $SD=15.02$ ) and near the mean on the auditory working memory ( $M=95.01$ ,  $SD=19.15$ ) and nonverbal reasoning

**Table 2** Descriptive statistics and correlations

Variables	M	SD	Skewness		Kurtosis		Correlation								
			s	s	s	s	1	2	3	4	5	6			
1. TNL Comprehension	6.26	2.22	-0.52	-0.24	1										
2. TOWRE Phonemic Decoding	87.40	15.02	0.21	-0.32	0.04	0.04	1								
3. GMRT Reading Comprehension	82.49	9.23	-0.67	-0.71	0.15**	0.31**	0.31**	1							
4. TOSREC	13.59	8.89	0.20	-0.84	0.04	0.43**	0.43**	0.25**	1						
5. WJ Auditory Working Memory	95.01	19.15	-0.73	0.43	0.18**	0.11*	0.07	0.13*	0.07	1					
6. KBIT Nonverbal Reasoning	95.24	15.84	0.10	-0.67	0.08	0.03	0.12*	0.03	0.12*	0.03	0.08	1			

TNL, Test of Narrative Language; TOWRE, Test of Word Reading Efficiency; GMRT, Gates MacGinitie Reading Test; TOSREC, Test of Silent Reading Efficiency and Comprehension; WJ, Woodcock-Johnson; KBIT, Kaufmann Brief Intelligence Test. \* = p value less than .05; \*\* = p value less than .01

subtests ( $M=95.24$ ,  $SD=15.84$ ). Variables were distributed normally based on estimates of skewness and kurtosis, and we identified no outlying values.

### Aim 1: Examining word reading performance of students with language and reading comprehension difficulties

Our first research aim was descriptive. Means and standard deviations for all language and reading measures are presented in Table 2. We found that performance on the word reading measures was quite low on average, but there was variability in performance on the TOWRE phonemic decoding subtest ( $M=87.43$ ;  $SD=14.83$ ) and sight word subtest ( $M=87.40$ ;  $SD=14.71$ ). The composite score for these measures ( $M=85.39$ ;  $SD=14.75$ ) was about one standard deviation below the normative average. A majority of students (51%) performed 1 or more SD below the mean according to the composite scores. How did students' word reading scores compare to their language and reading comprehension performance? As expected, given students were screened for participation based on scoring in the bottom tertile relative to the normative population in language and reading comprehension, student performance on these measures was slightly lower. Specifically, students' performance on the TNL-2 comprehension subtest and the GMRT reading comprehension subtest were just over one standard deviation below the mean (TNL-2 Comprehension  $M=6.25$ ;  $SD=2.23$ ; GMRT reading comprehension subtest  $M=82.43$ ;  $SD=9.29$ ). Put differently, whereas the mean performance of the students on the reading and language measures was approximately one standard deviation below the mean, there was important variability across the three measures. All students scored in the bottom tertile on language and reading comprehension, but 77% of students in the sample scored in the bottom tertile in word reading.

### Aim 2: Identification of latent profiles based on SVR variables

Model fit statistics (Table 3)—with the exception of entropy—suggested a three-profile solution. The AIC, BIC, and ABIC values were lowest for the three-profile solution. LMR and BLRT were not significant for solutions with more than three profiles, suggesting the three-profile solution, as well. Relying on a traditional cutoff point of 0.80 or above for entropy would suggest a five-profile solution. However, previous research suggests that this traditional cutoff may not be appropriate depending on the number of latent classes, sample

**Table 3** Latent profile analysis model fit summary

Model	Log likelihood	AIC	BIC	SABIC	Entropy	LMR $p$ -value	BLR $p$ -value
1	-2217.03	4442.05	4457.48	4444.79			
2	-2205.17	4424.35	4451.35	4429.14	0.67	0.00	0.00
3	-2196.60	4413.20	4451.77	4420.05	0.74	0.00	0.00
4	-2195.43	4416.87	4467.02	4425.78	0.68	0.36	0.67
5	-2190.01	4412.01	4473.74	4422.98	0.86	0.06	0.10
6	-2188.21	4414.41	4487.71	4427.44	0.84	0.18	0.67

AIC, Akaike information criterion; BIC, Bayesian information criterion; SABIC, sample size adjusted BIC; LRM, Lo-Mendell Rubin

sizes, latent class separation, and number of indicators (Wang et al., 2017). Specifically, in a simulation study, Wang et al. (2017) found that with 3 latent class solutions, entropy values of 0.76 and above were related to at least 90% correct assignment. The entropy value for our three class solution was 0.74, which suggests that the three class solution was still a decent fit according to entropy. Moreover, Bengt Muthén (June 16, 2016, personal communication) has suggested that entropy can be disregarded when all the indices except entropy provide clear support for a specific solution. Table 4 presents estimated means for the classification variables for each profile in the three-profile solution.

Profile 1 (10% of the sample,  $n=34$ ) is referred to as “severe difficulties in LC, moderate difficulties in WR” because their performance was, on average, more than 2 SDs below the mean of the normative sample on listening comprehension and 1 SD below the mean in word reading. This profile had the lowest scores on listening comprehension (scaled score  $M=1.96$ ) and the lowest performance in word reading (standard score  $M=83.12$ ), making it the most severe subgroup in terms of reading deficits. Profile 2 (40% of the sample,  $n=143$ ) included students with mild difficulties in word reading (less than 1 SD below mean) and moderate difficulties in listening comprehension (more than 1 SD below mean). We referred to this profile as “moderate difficulties in LC, mild difficulties in WR.” The students in this subgroup demonstrated higher listening comprehension (scaled score  $M=5.16$ ) than students in Profile 1. Their word reading performance ( $M=88.57$ ) was in the normal range and was higher than the students in Profile 1.

The final subgroup, Profile 3 (50% of the sample,  $n=180$ ), included students with mild difficulties in both listening comprehension and word reading. We labeled this profile as “mild difficulties in both areas” because students scored less than 1 SD below the normative mean in both areas. The students in this profile demonstrated the highest performance on listening comprehension (scaled score  $M=7.95$ ). Their performance on word reading ( $M=87.39$ ) was in the normal range, higher than students in Profile 1, and similar to students in Profile 2. We also present the means for each of the three profiles graphically in Fig. 1.

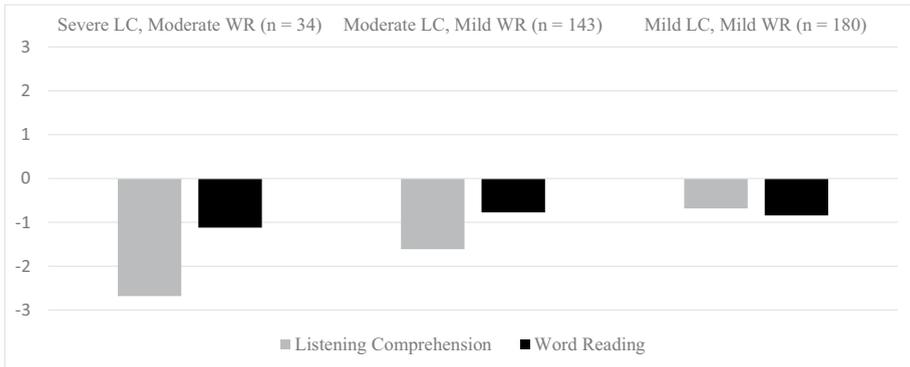
### Aim 3a: Comparing latent profiles by demographic information

We addressed this question using the R3STEP method and logistic regression as described earlier (Asparouhov & Muthén, 2021). The results in Table 5 suggest that older students were more likely to be members of Profile 1 relative to Profiles 2 or 3. ELs appeared to show a significantly higher likelihood of membership in Profile 1 than Profile 3. However, after controlling for type I error using the Benjamini–Hochberg procedure, the difference

**Table 4** Estimated means of classification variables and cognitive process variables

	Profile 1 ( $n=34$ )		Profile 2 ( $n=143$ )		Profile 3 ( $n=180$ )	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Index variables						
TNL Comprehension	1.96	0.23	5.16	0.18	7.95	0.13
TOWRE Phonemic Decoding	83.12	2.65	88.57	1.52	87.39	1.18

*TNL*, Test of Narrative Language; *TOWRE*, Test of Word Reading Efficiency



**Fig. 1** Group sizes and component reading skill Z-score means for the latent profiles. Note. LC, listening comprehension; WR, word reading. This figure demonstrates the mean scores of word reading and listening comprehension for each profile. We report Z-scores because the measures of listening comprehension report different standard score metrics (the TOWRE reports a standard score with mean of 10 and standard deviation of 3 whereas the TNL reports a scale score with a mean score of 10 and standard deviation of 3)

**Table 5** Results of multinomial logistic regression

Covariates	Profile 1 vs Profile 3			Profile 2 vs Profile 3			Profile 2 vs Profile 1		
	Coeff	SE	p	Coeff	SE	p	Coeff	SE	p
Age	0.05	0.02	0.01*	0.01	0.01	0.42	-0.05	0.02	0.02*
English learner status	1.03	0.49	0.04	0.03	0.27	0.90	-1.00	0.55	0.07
Special education status	0.55	0.47	0.24	-0.23	0.30	0.45	-0.78	0.55	0.16

\* = significant ( $p < .05$ ) after controlling for type I error using the Benjamini–Hochberg procedure ( $q = .03$ )

was no longer significant. Finally, special education status was not significantly associated with profile membership.

**Aim 3b: Comparing latent profiles by reading comprehension and cognitive processes**

The result of the equality test of means across classes using the BCH procedure (Table 6) showed that students in Profile 1 tended to have lower working memory scores (ES = -0.64) and lower reading comprehension scores (ES = -0.58) than students in Profile 3. Additionally, there were significant differences in nonverbal reasoning scores between students in Profiles 2 and 3 (ES = -0.30). More specifically, students in Profile 3 demonstrated higher nonverbal reasoning than students in Profile 1, on average. Profiles did not differ on performance on the TOSREC, a timed measure of reading efficiency/fluency and comprehension.

**Table 6** Estimated means and equality tests of means across classes using the BCH procedure

Variables	Profile 1		Profile 2		Profile 3		Profile 1 vs Profile 3		Profile 2 vs Profile 3		Profile 2 vs Profile 1	
	M	SE	M	SE	M	SE	p	ES	p	ES	p	ES
WJ-III Auditory Working Memory	84.18	4.44	93.75	1.88	98.14	1.53	0.00*	-0.64	0.10	-0.21	0.06	0.41
KBIT Nonverbal Reasoning	95.44	3.29	92.39	1.68	97.78	1.24	0.50	-0.14	0.02*	-0.30	0.44	-0.15
GMRT Reading Comprehension	77.99	1.98	81.66	0.96	83.92	0.73	0.01*	-0.58	0.09	-0.22	0.12	0.32
TOSREC	12.95	1.58	13.40	0.91	13.99	0.75	0.55	-0.10	0.65	-0.06	0.82	0.04

\* = significant after controlling for type I error using the Benjamini–Hochberg procedure ( $q = .03$ )

## Discussion

This study extends our understanding of the co-occurrence of word reading and language difficulties by (a) exploring the prevalence of word reading difficulties among a large sample of students with language and reading comprehension difficulties in Grades 1–4, (b) employing person-centered and rigorous statistical methods to identify latent reading profiles, and (c) considering the cognitive processes that underlie these language and literacy difficulties. We discuss our main findings and their implications below.

### Prevalence of word reading difficulties in students with narrative language and reading comprehension difficulties

Our first aim was to examine the nature of word reading difficulties in a linguistically diverse sample of students with language and reading comprehension difficulties. Our findings provide support for previous research that has documented the high co-occurrence of word reading and language difficulties in students with reading difficulties (e.g., Capin et al., 2021; Catts et al., 1999). Descriptive data showed that 77% of participants demonstrated commensurate difficulties in word reading, linguistic comprehension, and reading comprehension (i.e., they scored in the bottom tertile on all measures). However, only half of the sample (51%) scored one or more SDs below the normative mean in word reading. This is particularly compelling because inclusion in this study required that participants score in the bottom tertile in language and reading comprehension, not word recognition. It is important to note that although our inclusion criteria in the parent study did not include poor performance in word recognition difficulties, it is well-known that measures of reading comprehension correlate with measures of word recognition, particularly in the early grades (Gough & Tunmer, 1986). Thus, for struggling readers in Grades 1 and 2 in this sample, who were reading relatively brief passages with limited complex vocabulary and syntax, measures of reading comprehension may be assessing, to some degree, decoding. Nonetheless, from a practical perspective, the finding that about three out of four students who show underperformance in language and reading comprehension present commensurate difficulties (i.e., in the bottom tertile) in word recognition has important implications. This finding, coupled with the results of the latent profile analyses (discussed next), suggests that students identified with language and reading comprehension difficulties in the elementary grades may require multicomponent interventions to address both word recognition and language deficits (Gillam et al., 2021; Donegan & Wanzek, 2021).

### Latent reading profiles of elementary students with language and reading comprehension difficulties

We also aimed to understand individual differences among this linguistically diverse sample of students with language and reading comprehension difficulties by evaluating whether reading profiles emerged based on performance on SVR variables (i.e., decoding and linguistic comprehension). In our sample, three distinct profiles emerged. Students in Profile 1, which constituted the smallest subgroup (10% of the sample), demonstrated severe language comprehension deficits (more than 2 SDs below the mean) and moderate word reading difficulties (1 SD below the mean). This group showed the lowest performance on both classification variables and may represent students with the most intractable type of reading disorders. Students with double deficits (i.e., deficits in word reading and linguistic

comprehension) such as this may require significantly greater time in instruction designed to target multiple skills related to improving word recognition (e.g., refining knowledge of orthographic expectancies) and language comprehension (e.g., vocabulary in context, sentence structures, text organization, and inference-making). Students in this group may include those who demonstrate comorbid speech-language impairments and dyslexia (though special education status did not differ across the three profiles as discussed in further detail in the next section).

Profile 2 made up the second largest group in our sample (40%) and was comprised of students with moderate difficulties in listening comprehension (more than 1.5 SD below normative mean) and mild difficulties in word reading (about 0.75 SD below the normative mean). One might wonder if these students resemble what some have described as students with “specific reading comprehension deficits,” because the primary source of their difficulties stems from language comprehension, not word reading. However, it is important to note that although these students showed greater weakness in linguistic comprehension than word reading, this profile did not show *only* language and reading comprehension deficits, as we discuss further below.

Students in Profile 3 reflected the largest subgroup (50% of the sample) and demonstrated mild difficulties in listening comprehension and word reading. Their scores were about three-quarters of a SD below the normative mean in both listening comprehension (highest of the 3 groups) and word reading (higher than Profile 1 and similar to Profile 2). This subgroup varied from the other profiles primarily due to their performance on listening comprehension; it was the only group to score within 1 SD of the normative mean on oral narrative comprehension. Accordingly, this subgroup showed the highest average performance on a measure of passage reading comprehension ( $M = 83.92$ ), which was statistically significantly higher than Profile 1 but not Profile 2. Given past research shows struggling readers’ initial reading performance is a strong predictor of response to intervention (Cho et al., 2018; Tolar et al., 2014), students in Profile 3 (mild difficulties in word reading and language comprehension) may be expected to show the greatest response to an intervention that targets their word reading and linguistic challenges.

Taken together, the results of the latent profile analyses provide a few key insights into the nature and severity of reading difficulties among students with language and reading comprehension challenges. First, we found that subgroups emerged that reflected differences in both the severity and specificity of reading difficulties. Profile 3, the largest subgroup (50% of the sample), was comprised of students who showed similar difficulties in word reading and linguistic comprehension. Students in Profiles 1 (severe language comprehension and moderate word reading difficulties) and 2 (moderate listening comprehension and mild word reading difficulties) showed greater difficulty in linguistic comprehension than word reading. Although it may be imprecise to refer to these students as having *specific* comprehension problems given these subgroups showed difficulties in word reading, it is clear these students have more severe difficulties in linguistic comprehension than word reading. This may be a function of the population sampling plan, which aimed to locate students within classrooms who were most at risk for language and reading comprehension difficulties. Also, this finding may be influenced by the proportion of bilingual students in our sample (41.5%), who may be struggling with English language (lexicon and syntax) issues more than grapheme-phoneme coding issues. Nonetheless, this finding provides further evidence to suggest that interventions for students with language and reading comprehension difficulties will need to consider both the specific areas of weakness and the severity of their difficulties.

Second, the finding that no latent profiles emerged with normal word reading suggests that students with language and reading comprehension difficulties typically present difficulties in word reading. Whereas past studies have examined the language performance of students with or at risk for dyslexia to better understand the nature of reading disabilities (e.g., Snowling et al., 2020), our study examined the word reading performance of a large sample of students who had been identified with language and reading comprehension difficulties. We employed this approach to better understand the extent to which such students also experience word reading difficulties. Our results suggest that the co-occurrence of word reading and language problems is high for these students, even when identified based on underperformance in language and reading comprehension difficulties. This finding is consistent with previous research examining students with significant reading comprehension difficulties in Grade 4 (Capin et al., 2021). In their study, Capin and colleagues also identified a subgroup of students with severe listening comprehension difficulties and mild word reading difficulties, though this subgroup represented a much smaller proportion (5%) of the total sample. The results of the current study found a much larger proportion (39%) of students who showed greater underperformance in linguistic comprehension than word reading. Both samples included a large proportion of ELs (40–50%). The discrepancy in findings is likely influenced by the differences in the sampling plan between the two studies. Capin et al. (2021) enrolled students on the basis of reading comprehension difficulties only, whereas this study enrolled students who scored in the bottom tertile on measures of language comprehension and reading comprehension. Thus, it follows that the sample of students examined in this paper would include more students whose greatest area of difficulty was related to underdeveloped language.

### Differences in latent subgroups on external variables

Our final aim was to determine whether distinct reading profiles varied based on demographic variables (age, EL status, special education status; Aim 3a) and performance on cognitive (working memory, nonverbal knowledge) and reading comprehension measures (Aim 3b). In terms of demographic variables, we expected to see more older students and students receiving special education services to be identified into subgroups characterized with more severe reading difficulties, which in our study was Profile 1 (severe language comprehension and moderate word reading difficulties). Results indicated that subgroups primarily varied by age, with students in Profile 1 older than the other two profiles. This finding aligns with previous research that demonstrates older students present more established reading difficulties than younger students (e.g., Vaughn & Fletcher, 2012).

There are at least a couple of reasons we may not have observed differences in profile membership based on special education status as hypothesized. For one, it may be that students with disabilities were not significantly more likely to be identified in the most severe reading subgroup because of the unreliability of commonly used methods for identifying students with disabilities, such as the IQ-achievement discrepancy method (e.g., Bradley et al., 2002; Fletcher et al., 2018) and patterns of strengths and weaknesses (e.g., Miciak et al., 2014, 2016). Additionally, the small number of students in the most severe subgroup (Profile 1,  $n=34$ ) limits the power to detect significant differences. No association was found between EL status and profile membership, suggesting that ELs were not significantly more likely to be identified in one of the profiles.

Based on prior research, we predicted that students who demonstrated more severe deficits in language comprehension would score lower on a measure of nonverbal reasoning

ability. Our findings partially supported this hypothesis. Results showed that students in Profile 2 (moderate LC, mild WR) demonstrated greater language comprehension difficulties than those in Profile 3 and also had significantly lower nonverbal reasoning abilities. However, Profile 1, the most severe subgroup in both word reading and linguistic comprehension, did not show lower nonverbal reasoning than students in the other groups. We also hypothesized that Profiles marked by poor word reading would show particular difficulties in working memory. Profile 1, the subgroup with the lowest word reading (and linguistic comprehension) scores, demonstrated lower working memory capacity than students in the other profiles. Although it may be tempting to focus on improving working memory capacity in students with deficits in this area, research into the transfer effects of these interventions to language and reading abilities has not yielded compelling results (e.g., Gillam et al., 2018; for a review, see Melby-Lervag et al., 2016). There has, however, been some research that integrating working memory supports within reading interventions may hold some value (Fuchs et al., 2018). There is also evidence that improving academic skills directly, such as phonological awareness and decoding, results in concomitant improvements in working memory as well as word reading abilities (Park et al., 2014; van Kleeck et al., 2006). Therefore, we recommend that for the present, intervention efforts primarily treat the sources of reading comprehension difficulties, such as word reading or broader language processes.

Finally, we hypothesized that profiles with more severe deficits in word reading and listening comprehension would present lower performance in reading comprehension. Our results partially reflected this hypothesis. Profile 1, the most severe subgroup according to their performance in word reading and listening comprehension, scored significantly lower on the GMRT passage reading comprehension subtest than Profile 3, which showed the highest performance on the component skills. However, no differences were found between Profiles 2 and 3 or 1 and 2, respectively. This result is likely influenced by two factors. First, we screened students based on their reading comprehension performance and focused on students at the lower end of the distribution, which leads to a restriction in range. Second, this result is also likely influenced by the limited sample sizes among the profiles (range = 34 to 180).

## Limitations

We wish to draw attention to a few limitations. Due to school-imposed constraints on the amount of time students could be tested, we were unable to collect multiple measures of linguistic comprehension and word reading. Using multiple indicators of word reading and listening comprehension would have allowed us to use factor scores for each construct when classifying students. We attempted to mitigate this limitation by using psychometrically sound measures of word reading and linguistic comprehension that align well with recommendations for assessing these constructs within the SVR. For instance, our word reading measure (TOWRE Phonemic Decoding Efficiency) assessed students' ability to decode pseudo nonwords (as has been recommended for elementary students; Hoover & Gough, 1990). However, it is possible the pattern of findings may have varied had we used an untimed measure of reading or a measure with real words. We were also unable to take advantage of vertically scaled scores because these measures do not provide, which would have been advantageous given our sample included students across multiple grade levels. We were also unable to assess other cognitive variables related to word reading and linguistic comprehension, which may have provided further support of our subgroups. Measuring

phonological awareness and examining the extent to which performance on phonological awareness was associated with latent profile membership would have strengthened the findings related to word reading.

Another limitation relates to the size of the sample in the present study and the extent to which the findings may generalize to other samples. Although the size of the current sample compares favorably to similar studies (e.g., Brasseur-Hock et al., 2011; Clemens et al., 2017; Lesaux & Kieffer, 2010), additional investigations with samples from other geographic regions are required before conclusions can be drawn. Another limitation relates to the finding that a large proportion of students with language and reading comprehension difficulties also present word reading difficulties. Given that decoding is strongly associated with reading comprehension, particularly in the early grades (e.g., Gough et al., 1996; Lonigan et al., 2018b), it is impossible to fully disentangle word reading from reading comprehension among students in the elementary grades with reading difficulties. It is also worth considering that the analyses presented in this and other similar studies that use person-centered approaches involve some researcher discretion that influence results. Thus, these exploratory findings should be interpreted as specific to this study until findings are replicated in studies conducted by other research teams. It would be valuable to challenge the findings of this paper by examining the same or related questions with different methods (e.g., regression-based approaches) and samples, including those that are limited to ELs.

Finally, the bivariate correlations are challenging in few respects. For instance, the KBIT nonverbal knowledge is well-represented in this area of research, and its correlations with other variables in the study, as presented in Table 2, do not closely align with the same and similar correlations in the extant literature (e.g., Denton et al., 2011). The data were double-coded originally and then double checked when the correlations were first reported. The values are reliable, and the bivariate correlations are correct for this sample. The TNL-2 correlations are also relatively low across the board. It is well known that the variability of the scores on the measures in a correlation affects its magnitude. Because our entire sample was comprised of children who were at risk for language and literacy difficulties, we would expect the children in our study to also score in the low range on related measures of interest, such as decoding, working memory, and nonverbal reasoning. This would be expected to result in smaller correlations among the measures as compared to the same correlations for a sample in which the range of scores on all measures represents the full distribution. As a result, our correlations should not be interpreted to represent the relationships among our measures in a full sample of the population.

## Implications

A key practice implication of this study relates to the word reading difficulties experienced by students with language and reading comprehension difficulties, many of whom were identified as English learners. Our data are consistent with previous studies reporting that comorbid difficulties in word recognition and language comprehension in the elementary grades may be quite common (Snowling & Hulme, 2021; Snowling et al., 2020). For this reason, it is critical that classroom teachers, special educators and interventionists focused on reading, and speech language pathologists (SLPs) work together to ensure that tunnel vision on one set of skills does not preclude examination of the other. For example, as mentioned earlier, SLPs most often focus on oral language in their assessment of students referred for poor academic performance. However, it is important for SLPs to remember to

include screening for skills that contribute to proficient decoding including phonological awareness, letter-sound correspondence, and other phonological processing skills (Gosse et al., 2012; Puranik & Lombardino, 2006). Conversely, it is equally important for classroom teachers and special educators focused on reading to consider the possibility that their elementary students who are struggling to develop basic word recognition skills may also manifest difficulties in acquiring oral language proficiency (Lervag et al., 2018; Nation et al., 2004). We wish to underscore the importance of teachers, special educators focused on reading, and SLPs working together. Previous research suggests that SLPs have greater expertise in language development and instruction, whereas teachers and special educators possess more knowledge about word reading development and instruction (Wilson et al., 2015). It may be most effective for each professional to focus primarily on their area of expertise; however, we suspect their efforts will be most impactful when they are coordinated and matched to students' areas of need.

In addition to underscoring the importance of word reading and language abilities, our data suggests that it may be equally important for educators to have a firm understanding of the severity of these difficulties. Recall that the latent profiles in our data emerged on the basis of language comprehension difficulties, with Profile 1 showing the lowest performance (more than 2 SD below the normative mean) and Profile 3 showing the least severe performance (less than 1 SD below the normative mean). We believe this means that best practices for reading instruction will need to consider the *intensity* of instruction as well as the instructional focus used to target specific aspects of reading supported by the SVR. This conclusion has been supported in the literature for a long time, with one of the most seminal studies having been conducted by Torgesen et al. (2001). They provided intensive intervention to 50 students ranging in age from 8–10 who had been identified with severe reading disabilities. In their study, students were randomly assigned to one of two instructional programs, both of which incorporated evidence-based procedures for word reading instruction. Students in both groups received intensive, individual instruction over the course of 8 weeks (for a total of 67.5 h). Both approaches were shown to be associated with significant increases in immediate and long-term improvements in reading ability. Their findings suggested that the intensity of instruction was more important than differences in the approach to reading instruction. Gillam et al (2008) reported similar findings for their RCT of four different approaches to language instruction delivered on an intense schedule (120 min per day, 5 days per week, for 6 weeks).

## Conclusion

The purpose of this special issue is to highlight current research focusing on the intersection between language difficulties and word reading difficulties. We addressed this relation by examining the word reading performance of a sample of linguistically diverse students identified with language and reading comprehension difficulties in the elementary grades. Past research suggests that many students with dyslexia also present broader language difficulties and vice versa (e.g., Catts et al., 1999). Our findings suggest that about half of the students identified based on underperformance in language and reading comprehension challenges present word reading difficulties that are commensurate with their language comprehension difficulties. These students are likely to require word reading supports to make adequate reading progress. The other half of the students demonstrated more serious difficulties with language comprehension than word reading, but still demonstrate

underperformance in word reading. Our findings align with previous research examining the rate of dyslexia in students with DLD (e.g., Adlof, 2020; Duff et al., 2021; Snowling et al., 2019), further highlighting the need for careful assessment of word recognition and language comprehension in struggling readers (Snowling & Hulme, 2021). Finally, our results are consistent with a multiple risk framework of dyslexia which recognizes that many students with word-level reading problems also have more global cognitive and linguistic issues (Compton, 2021). Although language-focused instructional practices may be particularly necessary for students with language and word reading difficulties, we encourage educators to continue to monitor students' word reading development and consider multicomponent interventions that address foundational word reading skills alongside broader language skills.

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