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# Exploring the distribution and cognitive profiles of poor readers across varying levels of reading difficulty: implications for identification and support

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**Background:** This study explored the impact of different cut-off points used to identify children with reading difficulties on the distribution of these children across the three poor reader groups predicted by the simple view of reading (dyslexia, specific comprehension difficulty and mixed difficulty). Additionally, the study investigated whether the cognitive profiles of these poor reader groups remained consistent across varying levels of reading impairment.
**Methods:** This study included 209 primary school children from New Zealand, in Years 4–6 and aged 8–10 years, who experienced reading comprehension difficulties. Using a two-step cluster analysis, participants were assigned to one of three poor reader groups: dyslexia, specific comprehension difficulty (SCD) and mixed difficulty. We examined the distribution of children across these groups at eight levels of reading comprehension difficulty and conducted strengths and weaknesses profiles at four levels of reading ability across 14 tests that assessed a range of reading-related skills. Additionally, we compared the performance of children in these groups who performed above and below the 10th percentile on a reading comprehension assessment across these tests.
**Results:** The results showed that the proportion of children assigned to each group varied across the reading levels, with children at the lower end of the reading comprehension continuum more likely to exhibit the mixed difficulty profile than the SCD and dyslexia profiles. Overall, the research found that dyslexia, SCD and mixed difficulty profiles could be identified at all levels of reading comprehension difficulty, though weaknesses in their reading-related skills increased as reading comprehension difficulties also increased.
**Conclusions:** Our findings suggest that struggling readers demonstrate distinct cognitive profiles across all levels of reading ability. These results have important

implications for identifying and supporting struggling readers, as well as enhancing our understanding of the underlying mechanisms of reading difficulties. The possible relationship between the results obtained in this study and tiered models of reading support is discussed.

**Keywords:** dyslexia, specific comprehension difficulty, mixed difficulty, simple view of reading, prevalence

## Highlights

*What is already known about this topic*

- Children with reading comprehension difficulties can be classified into three groups based on their decoding and language comprehension proficiency: dyslexia, specific comprehension difficulty (SCD) and mixed difficulty.
- Several factors influence the proportion of children assigned to these three groups.

*What this paper adds*

- The dyslexia, SCD and mixed difficulty profiles are identifiable at all levels of reading comprehension difficulty.
- Children with the most pronounced reading comprehension difficulties are likely to exhibit decoding and language comprehension difficulties.

*Implications for theory, policy or practice*

- The findings suggest that children with the most pronounced reading comprehension difficulties may require the most intensive support focusing on decoding and language comprehension skills.
- Children with less pronounced reading comprehension difficulties may require programmes that emphasise either decoding or language comprehension to a greater extent.

Reading difficulties are a challenge for many children, with approximately 18% of 15-year-olds in Organisation for Economic Cooperation and Development countries scoring below the baseline for reading proficiency according to the latest Programme for International Student Assessment results (Ministry of Education, 2017). However, not all children who struggle with reading comprehension have the same root cause for their difficulties. The simple view of reading (SVR; Gough & Tunmer, 1986) identifies three groups of children with reading comprehension difficulties: dyslexia, specific comprehension difficulty (SCD) and mixed difficulty. Dyslexia is characterised by decoding difficulties (inaccurate word reading) without language comprehension difficulties, SCD by language comprehension difficulties without decoding difficulties and mixed difficulty by difficulties in both decoding and language comprehension.

Research suggests that 6–17% of school-aged children experience dyslexia (Fletcher, 2009), while a comparable proportion struggles with language-based skills akin to those exhibited by children with SCD (Hall-Mills, 2019). Studies classifying poor readers into one of the three poor reader groups predicted by the SVR suggest a similar proportion may exhibit the mixed difficulty profile (Catts et al., 2003; Morris et al., 2017; Sleeman et al., 2022). Many factors influence the prevalence rates reported in studies, including (a) the placement of the cut-off point used to identify reading difficulties; (b) the theoretical approach that underpins the research; (c) the age of the participants; (d) the type of assessments that are used; (d) the study's methodology; (e) participant selection criteria; and (f) factors that sit outside the control of researchers. The present study focused on the issue of cut-off points and whether the cut-off points used to identify children with reading difficulties had an impact on the distribution of children across the three poor reader groups predicted by the SVR.

According to the SVR, reading comprehension depends on two fundamental components, namely, decoding and language comprehension. Children with dyslexia or specific comprehension difficulties may compensate for their weaknesses in one component by relying on the other, whereas those with mixed difficulties experience difficulties in both components, resulting in more severe reading comprehension difficulties (Catts et al., 2003; Sleeman et al., 2022; Tunmer & Greaney, 2010). This has been suggested to be due to the interdependent relationship between decoding and language comprehension, which is compounded by the absence of compensatory strategies available to children with mixed difficulties (Catts et al., 2005). Children with mixed difficulties are less likely to recognise words accurately and comprehend the meaning of the text than children in the other two groups (Tunmer & Greaney, 2010). As a result, their reading comprehension difficulties are likely to be amplified, which may mean that a greater proportion of children with pronounced reading comprehension difficulties exhibit this profile (Tunmer & Greaney, 2010). The distribution of children across the dyslexia and SCD groups could also be affected by the severity of reading impairment because the relative contribution of decoding and language comprehension skills to reading comprehension may change as reading difficulty increases.

This research also examined whether grade level influenced the proportion of students assigned to each group. Children's age is predicted to influence the proportion of children who exhibit the dyslexia, SCD and mixed difficulty profiles because the relative importance of decoding and language comprehension to reading comprehension changes over time. Studies indicate that decoding ability explains a greater proportion of the variance in reading comprehension than language comprehension for beginning readers, typically up to around fourth grade (Carver, 1998; Savage, 2001; Tilstra et al., 2009). However, for children above the fourth grade, language comprehension becomes a better predictor (Carver, 1998; Savage, 2001; Tilstra et al., 2009). Evidence for this shift can also be found in classification research. Catts et al. (2005) followed the same group of children from kindergarten to Grade 8, allowing them to examine the stability of the poor reader groups over time. They found that the proportion of poor readers within the dyslexia group decreased over time, from 32% in Grade 2 to 13% in Grade 8. In contrast, the proportion of children within the SCD group increased from 16% to 30%. The authors noted that this change was not due to poor readers changing in group placement. Instead, they found that although the children exhibited a similar profile over time, by eighth grade, some children with dyslexia were no longer classified as poor readers. However, it was not until eighth grade that some

readers who exhibited language comprehension difficulties in Grade 2 met the poor reader criteria.

Previous studies have compared the cognitive profiles of some or all of the poor reader groups predicted by the SVR (Lauterbach et al., 2017; Snowling et al., 2019; Tunmer & Chapman, 2007). However, only a few classification studies have identified a group of children with reading comprehension difficulties and then classified these children into one of the three poor reader groups predicted by the SVR based on their decoding and language comprehension performance (Catts et al., 2003; Ebert & Scott, 2016; Morris et al., 2017; Sleeman et al., 2022). These studies allow for the best comparisons between groups because all struggling readers are included in the classification process. This is important because previous research has indicated there may be only subtle differences between groups on measures of rapid naming and phonological awareness (Catts et al., 2003; Sleeman et al., 2022). These differences may not be apparent if some struggling readers are excluded from the research or comparisons are made between only two of the groups. While earlier studies illuminate distinctions between the groups, interpreting variations between the studies becomes challenging due to methodological differences.

Three of the previous SVR classification studies have used cut-off points to identify struggling readers (Aaron et al., 1999; Catts et al., 2003; Morris et al., 2017). Among the three studies conducted, two included children who performed below the 16th percentile on a reading comprehension assessment (Aaron et al., 1999) or a composite measure of reading comprehension (Catts et al., 2003), while the other study included those who performed below the 50th percentile on an end-of-grade reading assessment (Morris et al., 2017). As the magnitude of children's reading comprehension difficulties increases, more children may be expected to exhibit the mixed difficulty profile (Tunmer & Greaney, 2010). However, this cannot be confirmed by comparing previous studies. Catts et al.'s (2003) research included children with the most pronounced reading comprehension difficulties (bottom 16th percentile). They identified fewer children who exhibited the mixed difficulty profile (35.7%) than Morris et al.'s (2017) research (48%), which included children with less pronounced reading comprehension difficulties (bottom 50th percentile). Several factors could account for this difference between the studies, such as differences in participant age, the assessments used and the approach used to classify children into groups. This complexity makes it challenging to gauge the impact of reading comprehension difficulties on distribution by comparing results across studies. To mitigate these challenges, our study maintained consistency by utilising the same participants to assess group assignments at various reading ability levels. This approach allowed us to control for potential influences of participant age, assessment variations and classification methods.

The dyslexia, SCD and mixed difficulty groups each have distinct cognitive profiles with relative strengths and difficulties in decoding and language comprehension, as well as varying levels of proficiency in foundational skills such as phonological awareness (Sleeman et al., 2022). Previous research has shown that a phonological awareness test assessing a child's ability to delete a sound to create a new word, along with assessments of verbal comprehension and phonemic decoding efficiency, can differentiate between participants with dyslexia from those with developmental language disorder (DLD; Lauterbach et al., 2017). Children with DLD and SCD exhibit similar difficulties in language comprehension (Cain & Oakhill, 2006; Lauterbach et al., 2017) and phonological awareness (Bishop & Snowling, 2004; Lauterbach et al., 2017). However, Catts et al. (2003) found no significant differences between the dyslexia and SCD groups on tests of phonological awareness and rapid naming ability. Rapid naming tests also require

phonological skills, including the ability to integrate visual information with phonological information, access and retrieve phonological codes and provide an oral response (Araújo et al., 2015). The absence of identified phonological differences between the dyslexia and SCD groups in Catts et al.'s study, compared to Lauterbach et al.'s (2017) research, may be attributed to the younger age of participants. Challenges in understanding task demands could contribute to the phonological awareness results for the SCD group not accurately reflecting their abilities (Catts et al., 2003). In a recently published study (2022), we found it was possible to accurately predict membership to one of the three poor reader groups based on children's performance on four skills: decoding (word recognition), language comprehension (receptive vocabulary), reading comprehension and phonological awareness (phoneme deletion). However, not all phonological awareness assessments administered in our study revealed differences between the groups. Taken together, these findings suggest that there may be subtle differences in the phonological difficulties exhibited by children in the dyslexia, SCD and mixed difficulty groups. These differences between the groups may be magnified at lower levels of reading comprehension ability (Tunmer & Greaney, 2010).

This study examined whether the cognitive profiles of the dyslexia, SCD and mixed difficulty groups remained consistent across the various levels of reading impairment. Overall, it appears likely that the proportion of children who exhibit these profiles may vary across levels of reading comprehension ability. The children within each group should demonstrate similar profiles across these levels of reading comprehension ability because they are grouped according to their proficiency on decoding and language comprehension assessments. However, research suggests there may be subtle differences in the difficulties that these groups exhibit at different levels of reading ability, particularly on tasks that require phonological skills. This research sought to answer the following research questions:

1 Do the proportion of children assigned to the dyslexia, SCD and mixed difficulty categories vary across different levels of reading comprehension ability?
2 Do children within the dyslexia, SCD and mixed difficulty groups exhibit the same profile of relative strengths and difficulties on reading-related skills across different levels of reading comprehension ability?

## Method

In this study, we reanalysed data from the authors' SVR classification study (Sleeman et al., 2022), which identified three distinct groups of poor readers using a cluster analysis approach: those with dyslexia, SCD and mixed difficulty. The participants in this research came from 216 English-language speakers in Years 4, 5 and 6 (aged 8–10 years) from nine primary schools in an urban city in New Zealand. These schools were selected because they included children from varying socioeconomic backgrounds, with some schools serving primarily high or middle-socioeconomic-status communities and others serving primarily low-socioeconomic-status communities within the same region of the city. To identify participants for the classification study, schools were asked to identify children who performed below the 40th percentile on one of two school-based standardised assessments commonly used within New Zealand: the e-asTTle Reading test (Auckland UniServices Limited, 2009) or the Progressive Achievement Test for Reading Comprehension (Darr et al., 2008). These assessments include passages of text covering a diverse range of topics,

each followed by multiple-choice questions. The results from these assessments were not used in the analyses conducted in this research. Teachers could also nominate children who exhibited reading difficulties on other school assessments. All the children identified were invited to take part in this research, and consent to participate was obtained from the participating children and their parents. Approval for this research was obtained from the Education Research and Human Ethics Committee (ERHEC) at the New Zealand university where the authors were working (2019/05/ERHEC).

To confirm reading comprehension skills at or below the 40th percentile, the first author administered the Passage Comprehension test from the WJIV (Schrank et al., 2014). Seven children performed above the 40th percentile on this test and were excluded from the study, leaving a final sample of 209 children with an average age of 9 years and 8 months ($SD_{age}$ = 11 months). Table 1 provides an overview of the participants by year and gender. Males comprised the largest proportion of participants at each year level, which is consistent with national (Ward & Thomas, 2012) and international research (Ministry of Education, 2017) that found that a greater proportion of boys than girls exhibit reading difficulties in New Zealand. All children were able to complete the assessments following standard administration procedures without any accommodations. As per the hosting university's human ethics board requirements, parents were not required to report their child's ethnicity, and they were not asked to disclose whether their child had obtained a previous diagnosis of a learning difficulty. However, children of this age in Aotearoa New Zealand are not typically assessed for learning difficulties.

## Procedure and Measures

The children undertook 14 individually administered assessments over four separate sessions within a 2-week period. The assessment sessions lasted approximately 20 min and were completed in a quiet room at each school. All assessments were administered by the first author, who possessed the requisite training and expertise in administering these assessments. The data were collected between March 2019 and March 2020 and processed using the appropriate conversion table or software given the age of the child and the date the data were collected. To ensure accuracy, a second marker reviewed 20% of the assessment record sheets. They checked that raw scores had been summed correctly and that the correct raw scores were entered into the conversion software. No errors were identified during this process. All tests were administered to manual requirements.

**Table 1.** Participant Demographics.

| Year | Male *n* (% of year) | Female *n* (% of year) | Total *n* (% of all participants) |
|---|---|---|---|
| 4 | 35 (62.5) | 21 (37.5) | 56 (26.8) |
| 5 | 49 (68.1) | 23 (31.9) | 72 (34.4) |
| 6 | 46 (56.8) | 35 (43.2) | 81 (38.8) |
| Total | 130 (62.2) | 79 (37.8) | 209 (100.0) |

### Reading Comprehension

Reading comprehension ability was assessed using the Passage Comprehension test from the WJIV (Schrank et al., 2014). This test required children to read short passages of text silently and then supply a key missing word in each passage. The initial items on this test were one sentence in length. As children progressed through the test, the items increased in length and complexity. The *Examiner's Manual* (Schrank et al., 2014) reports median reliability of .89 for the Passage Comprehension test within the 5–19 age range. Administration of the test items continued until children answered six consecutive items incorrectly.

### Decoding/Word Reading

Decoding ability was assessed using the Letter-Word Identification and Word Attack tests from the WJIV (Schrank et al., 2014) and the Burt Word Recognition Test (Burt test; Gilmore et al., 1981). The Letter-Word Identification test assessed children's ability to identify and pronounce individual letters and words. The Word Attack test assessed children's ability to pronounce non-words that conform to English spelling rules. The WJIV manual reports median reliability of .92 for the Letter-Word Identification and .90 for the Word Attack tests (Schrank et al., 2014). The Burt test assessed children's ability to read a range of regular and irregular words that increased in length and complexity. Test administration was terminated when children were unable to correctly read 10 consecutive items. The test manual reports high internal consistency (.97) within the 8.03–10.09 age range (Gilmore et al., 1981).

Reading fluency was assessed using the Word Reading Fluency test from the WJIV. This test assessed children's ability to quickly read rows of words (e.g., mum, bag, dot, dad) and circle the two words that share a relationship (e.g., synonyms, antonyms, members of the same category). Children had 3 min to complete as many items as possible. Each correctly answered item received one mark. The administration manual reports a median reliability of .92 for the 7–11 age range (Schrank et al., 2014).

### Language Comprehension

Language comprehension was measured using the Oral Comprehension and Oral Vocabulary tests from the WJIV. The Oral Comprehension test required children to listen to short passages and then supply a missing final word to each. The Oral Vocabulary test required children to provide synonyms and antonyms for orally presented words. The WJIV manual reports median reliability of .75 for the Oral Comprehension and .84 for the Oral Vocabulary tests (Schrank et al., 2014).

The British Picture Vocabulary Scale, 3rd Edition (BPVS-III; Dunn et al., 2009) was administered to assess children's receptive vocabulary. Children were required to identify one picture from a selection of four that represented an orally presented word. The BPVS-III provides norms for individuals aged 3–16 years with excellent reliability ($\alpha = .91$; Dockrell & Marshall, 2015). This test was discontinued once children made eight or more errors in a set of 12 items.

### Rapid Naming

Children's rapid automatic naming speed was assessed using the Rapid Digit Naming and Rapid Letter Naming tests from the Comprehensive Test of Phonological Processing (CTOPP-2; Wagner et al., 2013). These tests assessed how quickly children could name an array of digits or letters. The *Examiner's Manual* reported excellent test–retest reliabilities for these tests within the 7–11 age range (Rapid Digit Naming test = .90; Rapid Letter Naming test = .93).

### Phonological Awareness

The phonological awareness construct was assessed using the Phonological Processing test from the WJIV and the Blending Words, Phoneme Isolation and Elision tests from the CTOPP-2. The Phonological Processing test is composed of three subtests. The first subtest assessed children's ability to state a word that contained a given sound either at the start, middle or end of the word; the number of correct responses was the score for this test. The second subtest assessed children's ability to rapidly name words that started with a particular sound. Children had two attempts to name as many words as possible within 1 min, with the initial sound varying across the two presentations; the number of correct words per minute was the score for this task. The final subtest required children to substitute a sound in a word for another sound to create a new word (e.g., change the/t/sound in tag to/b/), with the correct number of items being the score. The test has a median reliability of .83 in the 5–19 age range (Schrank et al., 2014).

The Blending Words test from the CTOPP-2 assessed children's ability to combine sounds to form words. These items increased in length and complexity as the test progressed. The Phoneme Isolation test assessed children's ability to identify specific sounds within words. For example, children were asked to identify the last sound in *laugh*. The Elision test assessed children's ability to delete a sound within a word to create a new word, say, *cup* without saying/k/. The measures have reliability coefficients greater than .93 (Wagner et al., 2013).

### Standard and Composite Scoring

To standardise the raw scores from the WJIV and CTOPP-2 subtests, we converted them into standard scores using the relevant administration manuals or conversion software. To generate composite scores for decoding and language comprehension, we calculated each child's average score on the Word Attack and Letter-Word Identification tests ((WA + LWI)/2) the Oral Comprehension and Oral Vocabulary tests ((OC + OV)/2), respectively. These composite scores were then used to classify children into dyslexia, SCD or mixed difficulty groups. As reported in Sleeman et al. (2022), the use of weighted decoding and language comprehension scores based on a principal components analysis generated similar scores and results in the subsequent analyses. The internal consistency of the tests was evaluated using Cronbach's alpha, and the results indicated excellent reliability across these tests (Letter-Word Identification, $\alpha = .95$; Word Attack, $\alpha = .87$; Oral Comprehension $\alpha = .75$; Oral Vocabulary $\alpha = .84$). All analyses were performed using IBM SPSS Statistics for Windows, version 26.0.

## Data Analyses

To answer research questions 1 and 2, analyses were performed on the poor reader groups that were identified in the classification study (Sleeman et al., 2022). In that study, children were assigned to the dyslexia, SCD or mixed difficulty groups using a two-step cluster analysis and log-likelihood as the distance measure. In accordance with the software's default procedures, each record was either merged with a previously formed group of records (pre-cluster) or formed the basis for a new pre-cluster based on the log-likelihood distance criterion. Pre-clusters were grouped into the optimal number of groupings, defined as the point at which the Bayesian Information Criterion (BIC) started to diminish as the number of clusters increased. Models with small BIC are considered good models. The initial estimate was revised if the merging of clusters resulted in a large ratio change in the BIC as this indicates the two clusters should not be merged (for a more detailed description of the two-step cluster analysis procedure, see Bacher et al., 2004; Chiu et al., 2001). The analysis identified three poor reader groups, with 17% of children assigned to the mixed difficulty group, 39% of children assigned to the dyslexia group and 44% of children assigned to the SCD group. For a detailed description of this analysis, please refer to Sleeman et al. (2022). While the previous research classified struggling readers into three distinct groups predicted by the SVR, it did not investigate whether the distribution of children across these groups varied based on different levels of reading comprehension ability. Additionally, it did not examine whether the relative strengths and weaknesses of each group remained consistent across varying degrees of reading comprehension proficiency. These questions were the focus of the current research.

The first analysis in this study examined the distribution of poor readers based on their performance on the Passage Comprehension test, which evaluated reading ability across eight different levels. A multidimensional chi-square test was conducted to determine whether year level (Year 4, 5 or 6) significantly influenced group assignment. To address the second research question, we conducted two profile analyses. The first profile analysis examined the strengths and weaknesses exhibited by each group of poor readers across four independent levels of reading ability based on cut-off points identified in the first analysis (40th, 25th, 10th, 5th). The second profile analysis examined whether there were significant differences between the dyslexia and SCD groups at two levels of reading difficulty. We split the dyslexia and SCD groups into a low group, which included all the children who performed at or below the 10th percentile on the Passage Comprehension test and a high group, which included all the remaining children. The mixed difficulty group was not included in this analysis because all children in this group performed below the 10th percentile. A series of two-way between-subject analysis of variance (ANOVA) were conducted to examine whether group (SCD or dyslexia) and level of reading difficulty ($>$10th, $\leq$10th) had a significant impact on children's performance on the 14 tests. A Bonferroni correction was used to control for Type 1 errors in multiple comparisons.

## Results

### Prevalence Rates

To address research question 1, we examined the distribution of children across the poor reader categories at eight reading comprehension percentiles, as shown in Figure 1. The

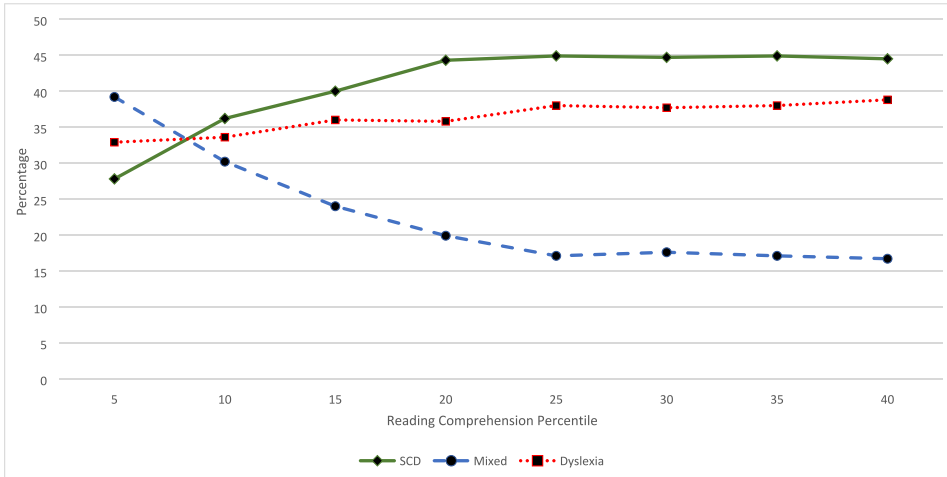


**Figure 1.** Proportion of poor readers assigned to each poor reader category at different reading comprehension cut-off points. *Note*: This figure shows the distribution of children across the poor reader categories at eight reading comprehension percentiles ranging from the 5th percentile to the 40th percentile. [a]Reading comprehension ability was assessed using the Passage Comprehension test.

**Table 2.** Proportion of Poor Readers Assigned to Each Poor Reader Category at Different Reading Comprehension Cut-Off Points.

| Percentile | SCD *n* (%) | Mixed *n* (%) | Dyslexia *n* (%) | Total *n* |
|---|---|---|---|---|
| 5th | 22 (27.8) | 31 (39.2) | 26 (32.9) | 79 |
| 10th | 42 (36.2) | 35 (30.2) | 39 (33.6) | 116 |
| 15th | 59 (39.9) | 35 (23.6) | 54 (36.5) | 148 |
| 20th | 78 (44.3) | 35 (19.9) | 63 (35.8) | 176 |
| 25th | 86 (45.5) | 35 (18.5) | 68 (36.0) | 189 |
| 30th | 89 (44.7) | 35 (17.6) | 75 (37.7) | 199 |
| 35th | 92 (44.9) | 35 (17.1) | 78 (38.0) | 205 |
| 40th | 93 (44.5) | 35 (16.7) | 81 (38.8) | 209 |

*Note*: Reading comprehension ability was assessed using the Passage Comprehension test.

results revealed a relatively stable proportion of children assigned to each category from the 40th percentile to the 25th percentile. Across these percentiles, similar proportions of children are from the SCD and dyslexia groups, with a lower proportion from the mixed group. However, at the 10th percentile, a comparable number of children were found in each group: mixed difficulty (30%), dyslexia (34%) and SCD (36%). By the 5th percentile, the majority of children were assigned to the mixed difficulty group (39%), with a smaller proportion assigned to the SCD group (28%). The SCD group and the mixed difficulty group exhibited the most substantial changes, with the proportion of children exhibiting an SCD profile decreasing from 44% at the 20th percentile to 28% at the 5th percentile, while the mixed difficulty group increased from 20% at the 20th percentile to nearly 40% at the 5th percentile. Note that these are relative changes since the number of children

in the mixed difficulty group remained relatively stable, while the number in the SCD group reduced substantially. The number and proportion of children assigned to each group are displayed in Table 2.

To explore whether the proportion of children assigned to the dyslexia and SCD groups differed based on their year level, a multidimensional chi-square test was conducted. The results revealed that year level did not have a significant influence on group assignment ($\chi^2(2174) = 4.284$, $p = .117$). This finding suggests that the proportion of children assigned to these groups within this age range is not significantly affected by their year level.

## Cognitive Profiles

To address the second research question, we conducted two profile analyses to examine the strengths and weaknesses exhibited by each group of poor readers. The first analysis compared the groups at four levels of reading comprehension ability (40th, 25th, 10th and 5th). The 40th percentile group included all children who performed above the 25th percentile and up to the 40th percentile on the Passage Comprehension assessment, while the 25th percentile group included children who performed at or below the 25th percentile and above the 10th percentile. The 10th percentile group included children who performed at or below the 10th percentile and above the 5th percentile, and the 5th percentile group included all children who performed at or below the 5th percentile. We determined the cut-off points for our analysis based on the following factors. Firstly, we included all children who participated in the study by selecting the 40th percentile. Secondly, we identified the highest percentile where a similar proportion of children were assigned to each poor reader category when compared to the 40th percentile, which was the 25th percentile. Thirdly, we chose the 10th percentile as the point where a similar proportion of children were assigned to each group. Finally, we selected the 5th percentile as the lowest cut-off point, as it was the point where the mixed difficulty group had the highest proportion of poor readers, and the SCD group had the smallest proportion of poor readers.

The results of the profile analysis indicate that the strengths and weaknesses exhibited by each group of poor readers remained relatively stable across the four levels of reading comprehension ability. At the 40th percentile, the dyslexia group exhibited relative difficulties on the decoding assessments, with standard scores on the Word Attack (89.42), Letter-Word Identification (91.75) and Burt (90.90) tests placing them within the bottom 25th, 30th and 27th percentiles, respectively. In contrast, they performed better on tests that assessed language comprehension ability, such as the Oral Comprehension (99.92), Oral Vocabulary (94.67) and BPVS-III (93.50) tests, where they scored within the 50th, 37th and 34th percentiles. The dyslexia groups at the 25th, 10th and 5th percentiles exhibited a similar pattern of performance, but the magnitude of their decoding and language comprehension difficulties increased as their reading comprehension ability decreased. They displayed varying levels of performance across the tests assessing phonological skills, suggesting that a relatively large proportion of these children experience difficulties in one or more of these aspects of phonological processing. Table 3 displays the results from these analyses.

At the 40th percentile, the SCD group exhibited reading comprehension difficulties primarily due to language comprehension difficulties. Standard scores on the Oral Comprehension (87.60), Oral Vocabulary (88.80) and BPVS-III (84.40) tests placed this group within the 21st, 23rd and 16th percentiles. However, the SCD group's standard scores on

**Table 3.** Comparisons by Poor Reader Group at Four Levels of Reading Comprehension.

| Test | Level of reading comprehension[a] | Dyslexia M, (SD)[b] | SCD M, (SD)[b] | Mixed M, (SD) |
|---|---|---|---|---|
| Passage Comprehension | 40th | 92.75 (1.76) | 93.80 (1.48) | [c] |
| | 25th | 85.32 (2.63) | 85.70 (2.45) | [c] |
| | 10th | 78.12 (1.76) | 79.22 (1.70) | 77.60 (1.95) |
| | 5th | 68.58 (5.20) | 70.48 (4.51) | 59.43 (14.30) |
| Word Attack | 40th | 89.42 (7.78) | 101.00 (7.00) | [c] |
| | 25th | 83.50 (7.70) | 96.18 (8.90) | [c] |
| | 10th | 81.76 (7.66) | 93.57 (7.43) | 71.20 (18.10) |
| | 5th | 75.13 (6.80) | 90.95 (9.08) | 66.17 (17.75) |
| Letter-Word Identification | 40th | 91.75 (6.08) | 98.40 (8.85) | [c] |
| | 25th | 85.07 (6.29) | 95.66 (6.74) | [c] |
| | 10th | 80.24 (9.38) | 91.83 (7.04) | 74.80 (6.83) |
| | 5th | 74.79 (7.77) | 86.24 (7.64) | 64.87 (16.58) |
| Burt | 40th | 90.90 (7.20) | 98.52 (9.55) | [c] |
| | 25th | 84.07 (10.51) | 92.74 (8.13) | [c] |
| | 10th | 83.07 (9.32) | 90.39 (8.67) | 75.61 (7.52) |
| | 5th | 76.22 (6.73) | 89.51 (9.14) | 73.36 (8.78) |
| Word Reading Fluency | 40th | 94.58 (9.72) | 104.00 (8.09) | [c] |
| | 25th | 90.29 (9.98) | 92.93 (8.50) | [c] |
| | 10th | 84.35 (10.05) | 92.09 (11.62) | 82.80 (7.89) |
| | 5th | 77.08 (10.91) | 83.48 (8.70) | 73.85 (9.57) |
| Oral Comprehension | 40th | 99.92 (6.38) | 87.60 (9.63) | [c] |
| | 25th | 96.71 (7.52) | 83.43 (9.51) | [c] |
| | 10th | 96.18 (7.44) | 82.04 (10.06) | 65.60 (16.41) |
| | 5th | 93.25 (6.00) | 78.33 (7.63) | 73.03 (13.13) |
| Oral Vocabulary | 40th | 94.67 (6.05) | 88.80 (6.30) | [c] |
| | 25th | 93.89 (10.50) | 82.98 (8.19) | [c] |
| | 10th | 89.65 (7.82) | 81.96 (9.88) | 64.00 (9.17) |
| | 5th | 84.71 (7.26) | 79.00 (6.53) | 62.83 (13.41) |
| BPVS-III | 40th | 93.50 (8.65) | 84.40 (8.62) | [c] |
| | 25th | 89.75 (13.40) | 81.25 (7.86) | [c] |
| | 10th | 88.47 (83.07) | 80.17 (8.45) | 74.80 (6.02) |
| | 5th | 85.67 (9.60) | 75.05 (7.36) | 74.83 (7.17) |
| Phonological Processing | 40th | 86.17 (11.51) | 95.40 (6.11) | [c] |
| | 25th | 82.36 (11.19) | 83.02 (11.48) | [c] |
| | 10th | 85.47 (11.35) | 84.70 (14.46) | 74.80 (15.02) |
| | 5th | 74.63 (11.05) | 79.71 (12.54) | 69.23 (11.79) |

(*Continues*)

**Table 3.** (Continued)

| Test | Level of reading comprehension[a] | Dyslexia M, (SD)[b] | SCD M, (SD)[b] | Mixed M, (SD) |
|---|---|---|---|---|
| Elision | 40th | 86.25 (9.56) | 100.00 (3.54) | [c] |
| | 25th | 82.14 (7.75) | 93.52 (8.39) | [c] |
| | 10th | 86.18 (7.81) | 89.13 (9.61) | 76.00 (6.52) |
| | 5th | 75.21 (5.21) | 89.05 (11.03) | 73.83 (8.97) |
| Blending Words | 40th | 91.25 (11.70) | 90.00 (10.61) | [c] |
| | 25th | 82.50 (12.66) | 82.95 (11.33) | [c] |
| | 10th | 88.24 (16.29) | 85.00 (15.37) | 76.00 (12.94) |
| | 5th | 76.25 (10.76) | 81.90 (9.93) | 71.67 (13.22) |
| Phoneme Isolation | 40th | 92.50 (14.06) | 87.00 (10.37) | [c] |
| | 25th | 86.61 (12.62) | 82.16 (10.14) | [c] |
| | 10th | 91.76 (11.58) | 84.78 (11.13) | 80.00 (11.18) |
| | 5th | 79.79 (12.11) | 82.38 (11.36) | 75.00 (8.81) |
| Rapid Digit Naming | 40th | 94.17 (10.19) | 100.00 (9.35) | [c] |
| | 25th | 89.29 (7.16) | 99.20 (10.99) | [c] |
| | 10th | 90.29 (9.10) | 94.57 (9.40) | 90.00 (11.18) |
| | 5th | 87.50 (8.47) | 94.29 (10.64) | 84.33 (9.54) |
| Rapid Letter Naming | 40th | 89.58 (8.11) | 92.00 (5.70) | [c] |
| | 25th | 89.46 (6.85) | 97.84 (9.30) | [c] |
| | 10th | 89.71 (9.43) | 95.00 (10.00) | 90.00 (7.906) |
| | 5th | 86.67 (8.30) | 91.43 (8.54) | 83.83 (9.80) |

[a]40th percentile *n* for dyslexia = 12, SCD = 5, mixed = 0; 25th percentile *n* for dyslexia = 28, SCD = 44, mixed = 0; 10th percentile *n* for dyslexia = 17, SCD = 23, mixed = 5; 5th percentile *n* for dyslexia = 24, SCD = 21, mixed = 30.
[b]Units of measurement = standard scores.
[c]No student in the mixed group performed above the 10th percentile.

the Word Attack (101.00), Letter-Word Identification (98.40) and Burt (98.52) tests indicated average decoding ability, with scores placing them close to the 50th percentile (53rd, 47th and 47th percentiles). Across the four levels of reading comprehension ability, the SCD group displayed challenges in language comprehension and comparatively fewer challenges in decoding. The findings also reveal some variability in this group's performance across the tests assessing phonological skills, with those demonstrating the greatest reading comprehension difficulties also displaying the most pronounced phonological challenges.

In contrast to the dyslexia and SCD groups, the mixed difficulty group exhibited pronounced difficulties across all administered tests. All children assigned to this group performed below the 10th percentile on the Passage Comprehension test, with the majority (85.7%) performing within the bottom 5th percentile. Notably, children in the mixed difficulty group who fell within the bottom 5th percentile on the Passage Comprehension test exhibited far greater reading comprehension difficulties than children in the dyslexia and

SCD groups. These results suggest that children with both decoding and language comprehension difficulties exhibit greater reading comprehension difficulties than children who struggle with only one of these skills.

The profile analyses revealed that children in the dyslexia and SCD groups exhibited more pronounced difficulties across all the assessments that were administered as the magnitude of their reading difficulties increased. Despite this, the relative strengths and weaknesses of these groups remained consistent across different levels of reading difficulty. However, inferential analyses were not conducted due to the small number of children in some cells. To address this limitation, a second set of analyses was performed to determine whether there were significant differences between the dyslexia and SCD groups at two ability levels (≤10th, >10th). The results from these analyses are reported in Table 4.

The results from the two-way ANOVA indicate that group assignment (dyslexia or SCD) did not have a statistically significant effect on children's reading comprehension ability, as assessed by the Passage Comprehension test. However, the magnitude of children's reading comprehension difficulties had a significant effect on their performance. This finding was expected because the dyslexia and SCD groups were stratified into high (>10th percentile) and low (≤10th percentile) groups based on their performance on this test.

The group to which poor readers were assigned had a significant effect on decoding ability, as determined by the Word Attack, Letter-Word Identification, Burt and Word Reading Fluency tests. Group allocation also had a significant effect on children's language comprehension ability, as evaluated by the Oral Comprehension, Oral Vocabulary and BPVS-III tests. While the severity of children's reading challenges had a significant effect on their decoding (Word Attack, Letter-Word Identification and Burt tests) and language comprehension abilities (Oral Vocabulary), the eta-squared values revealed that, overall, the group factor had a substantially greater influence on their test performance.

Both the SCD and dyslexia groups displayed difficulties on the Phonological Processing, Blending Words and Phoneme Isolation tests. However, neither group assignment nor the severity of children's reading difficulties had a significant effect on their performance. In contrast, group assignment had a large and statistically significant effect on children's performance on the Elision test. While the severity of their reading comprehension difficulties also had a statistically significant effect, it was comparatively smaller.

Only group assignment had a statistically significant effect on rapid naming performance. The eta-squared values indicate that children's ability to rapidly name letters and numbers was impacted to a similar extent, and children in the dyslexia group exhibited the most pronounced difficulties. In this sample, our findings indicate that rapid naming difficulties are primarily associated with decoding, not language comprehension difficulties. The severity of children's reading comprehension difficulties did not influence their performance on these tests.

## Discussion

The primary objectives of this research were twofold: to examine whether the proportion of children assigned to the dyslexia, SCD and mixed difficulty groups varied across different levels of reading ability and to assess whether these groups exhibited consistent profiles across these levels. The results showed that the proportion of struggling readers within each category remained relatively stable across the 40th–25th percentiles. However,

**Table 4.** Comparisons by Poor Reader Group at Two Levels of Reading Comprehension.

| Test | Level of reading comprehension[a] | Dyslexia M, (SD) | SCD M, (SD) | Analyses[b] |
|---|---|---|---|---|
| Passage Comprehension | ≤10th percentile | 72.54 (6.28) | 75.05 (5.52) | Group: $F(1,170) = .987$, $p = .322$, $\eta^2 = .002$ |
| | >10th percentile | 87.55 (4.19) | 86.53 (3.42) | **Reading difficulty: $F(1,170) = 312.363$, $p = <.001$, $\eta^2 = .643$** |
| | | | | Interaction: $F(1,170) = 5.538$, $p = .20$, $\eta^2 = .011$ |
| Word Attack | ≤10th percentile | 77.88 (7.81) | 92.32 (8.27) | **Group: $F(1,170) = .105.341$, $p = <.001$, $\eta^2 = .350$** |
| | >10th percentile | 85.28 (8.10) | 96.67 (8.79) | **Reading difficulty: $F(1,170) = 21.792$, $p = <.001$, $\eta^2 = .072$** |
| | | | | Interaction: $F(1,170) = 1.460$, $p = .229$, $\eta^2 = .005$ |
| Letter-Word Identification | ≤10th percentile | 77.05 (8.79) | 89.16 (7.78) | **Group: $F(1,170) = 82.146$, $p = <.001$, $\eta^2 = .265$** |
| | >10th percentile | 87.08 (6.89) | 95.94 (6.92) | **Reading difficulty: $F(1,170) = 52.740$, $p = <.001$, $\eta^2 = .170$** |
| | | | | Interaction: $F(1,170) = 1.968$, $p = .162$, $\eta^2 = .006$ |
| Burt | ≤10th percentile | 79.06 (8.51) | 89.97 (8.81) | **Group: $F(1,170) = 44.563$, $p = <.001$, $\eta^2 = .192$** |
| | >10th percentile | 86.12 (10.06) | 93.33 (8.36) | **Reading difficulty: $F(1,170) = 14.735$, $p = <.001$, $\eta^2 = .064$** |
| | | | | Interaction: $F(1,170) = 1.854$, $p = .175$, $\eta^2 = .008$ |
| Word Reading Fluency | ≤10th percentile | 80.10 (11.04) | 87.98 (11.10) | **Group: $F(1,170) = 10.984$, $p = .001$, $\eta^2 = .051$** |
| | >10th percentile | 91.58 (9.98) | 94.06 (9.03) | **Reading difficulty: $F(1,170) = 31.527$, $p = <.001$, $\eta^2 = .146$** |
| | | | | Interaction: $F(1,170) = .2.974$, $p = .086$, $\eta^2 = .014$ |
| Oral Comprehension | ≤10th percentile | 94.46 (6.70) | 80.27 (9.07) | **Group: $F(1,170) = 122.796$, $p = <.001$, $\eta^2 = .412$** |
| | >10th percentile | 97.67 (7.27) | 83.86 (9.51) | Reading difficulty: $F(1,170) = 7.230$, $p = .008$, $\eta^2 = .024$ |
| | | | | Interaction: $F(1,170) = .022$, $p = .883$, $\eta^2 = <.001$ |
| Oral Vocabulary | ≤10th percentile | 86.76 (7.80) | 80.55 (8.48) | **Group: $F(1,170) = 42.643$, $p = <.001$, $\eta^2 = .186$** |

(*Continues*)

**Table 4.** (Continued)

| Test | Level of reading comprehension[a] | Dyslexia M, (SD) | SCD M, (SD) | Analyses[b] |
|---|---|---|---|---|
| | >10th percentile | 94.13 (9.32) | 83.57 (8.16) | **Reading difficulty: $F$ (1,170) = 16.395, $p$ = <.001, $\eta^2$ = .071** |
| | | | | Interaction: $F$(1,170) = .2.862, $p$ = .093, $\eta^2$ = .012 |
| BPVS-III | ≤10th percentile | 86.83 (10.90) | 77.73 (8.27) | **Group: $F$(1,170) = 37.762, $p$ = <.001, $\eta^2$ = .177** |
| | >10th percentile | 90.87 (12.18) | 81.57 (7.90) | Reading difficulty: $F$(1,170) = 6.939, $p$ = .009, $\eta^2$ = .032 |
| | | | | Interaction: $F$(1,170) = .005, $p$ = .946, $\eta^2$ = <.001 |
| Phonological Processing | ≤10th percentile | 79.12 (12.29) | 82.32 (13.65) | Group: $F$(1,170) = 1.141, $p$ = .287, $\eta^2$ = .007 |
| | >10th percentile | 83.50 (11.28) | 84.29 (11.64) | Reading difficulty: $F$(1,170) = 2.899, $p$ = .090, $\eta^2$ = .017 |
| | | | | Interaction: $F$(1,170) = .418, $p$ = .519, $\eta^2$ = .002 |
| Elision | ≤10th percentile | 79.76 (8.36) | 89.09 (10.19) | **Group: $F$(1,170) = 56.062, $p$ = <.001, $\eta^2$ = 0.235** |
| | >10th percentile | 83.37 (8.43) | 94.18 (8.25) | **Reading difficulty: $F$ (1,170) = 10.486, $p$ = 0.001, $\eta^2$ = 0.044** |
| | | | | Interaction: $F$(1,170) = .300, $p$ = .585, $\eta^2$ = .001 |
| Blending Words | ≤10th percentile | 81.22 (14.44) | 83.52 (13.01) | Group: $F$(1,170) = .047, $p$ = .828, $\eta^2$ = <.001 |
| | >10th percentile | 85.13 (12.88) | 83.67 (11.36) | Reading difficulty: $F$(1,170) = 1.069, $p$ = .303, $\eta^2$ = .006 |
| | | | | Interaction: $F$(1,170) = .916, $p$ = .340, $\eta^2$ = .005 |
| Phoneme Isolation | ≤10th percentile | 84.76 (13.18) | 83.64 (11.17) | Group: $F$(1,170) = 3.577, $p$ = .060, $\eta^2$ = .020 |
| | >10th percentile | 88.38 (13.18) | 82.65 (10.16) | Reading difficulty: $F$(1,170) = .531, $p$ = .467, $\eta^2$ = .003 |
| | | | | Interaction: $F$(1,170) = 1.619, $p$ = .205, $\eta^2$ = .009 |
| Rapid Digit Naming | ≤10th percentile | 88.66 (8.73) | 94.43 (9.90) | **Group: $F$(1,170) = 24.208, $p$ = <.001, $\eta^2$ = .120** |
| | >10th percentile | 90.75 (8.36) | 99.29 (10.75) | Reading difficulty: $F$(1,170) = 5.703, $p$ = .018, $\eta^2$ = .028 |
| | | | | Interaction: $F$(1,170) = .902, $p$ = .344, $\eta^2$ = .004 |

(*Continues*)

**Table 4.** (Continued)

| Test | Level of reading comprehension[a] | Dyslexia M, (SD) | SCD M, (SD) | Analyses[b] |
|---|---|---|---|---|
| Rapid Letter Naming | ≤10th percentile | 87.93 (8.80) | 93.30 (9.40) | **Group: $F(1,170) = 24.514$, $p = <.001$, $\eta^2 = .122$** |
| | >10th percentile | 89.50 (7.14) | 97.24 (9.13) | Reading difficulty: $F(1,170) = 4.348$, $p = .039$, $\eta^2 = .022$ |
| | | | | Interaction: $F(1,170) = .805$, $p = .371$, $\eta^2 = .004$ |

*Note*: Units of measurement = standard scores. Significant differences between groups are recorded in the right-hand column. Greater than and less than signs de*note* the direction of these differences.
[a]≤10th percentile $n$ = dyslexia 41, SCD = 44; >10th percentile $n$ = dyslexia = 40, SCD = 49.
[b]Significant differences are shown in bold. A Bonferroni correction was applied: 0.05 (alpha level)/14 (number of tests) = 0.004 (rounded to three decimals places).

children with the most pronounced reading comprehension difficulties (bottom 5th percentile) were more likely to exhibit the mixed difficulty profile and less likely to show the SCD and dyslexia profiles, with the proportional reduction for the dyslexia group being less than for those with SCD. Despite these variations in proportions, the relative strengths and weaknesses exhibited by these groups remained consistent across different levels of reading difficulty. Specifically, the dyslexia group demonstrated decoding, phonological and rapid naming difficulties, with relatively less pronounced language comprehension difficulties. Conversely, the SCD group exhibited language comprehension and phonological difficulties, with less pronounced decoding difficulties. The mixed difficulty group demonstrated pronounced difficulties across all the assessments.

The results indicate that children with a mixed difficulty profile seem likely to exhibit more pronounced reading comprehension difficulties, a finding consistent with SVR predictions. The multiplicative viewpoint suggests that decoding and language comprehension are interdependent leading to their combined effect on reading comprehension being greater than their individual effects. Weaknesses in decoding and language comprehension may amplify each other's impact on reading comprehension: For example, poor decoding leads to poor reading experience and hence lower language exposure, and poor language proficiency can lead to poor phonological skills that impact on decoding efficiency. As a result, these children may exhibit more pronounced reading comprehension difficulties. Alternatively, many children in the dyslexia and SCD groups may exhibit less pronounced reading comprehension difficulties than the mixed difficulty group because they can compensate for their difficulties in decoding or language comprehension by relying on their relative strength in the other component. Of course, both amplifying and compensation effects may be occurring.

Previous research investigating the relationship between decoding, language comprehension and reading comprehension has found that the linear combination of decoding and language comprehension explains a similar, or greater, proportion of the variance in reading comprehension than a multiplicative approach (Chen & Vellutino, 1997; Georgiou et al., 2009; Joshi & Aaron, 2000; Savage, 2006). Researchers using multiple regression to investigate the nature of the relationship between these variables have noted that their findings might be influenced by the approach they used to investigate the relationship between

these variables (Hoover & Gough, 1990). Regression combines decoding and language comprehension with optimal weights to maximise the least squares fit to the reading comprehension data. The components in a multiplicative approach cannot be weighted in this way, which questions such comparisons (Hoover & Gough, 1990). The analyses reported in the current paper did not attempt to directly compare the additive and multiplicative approaches via such statistical approaches and so are not subject to this limitation. However, the current results seem more consistent with multiplicative predictions, which argues for more research being necessary to test these alternative theoretical approaches.

Previous longitudinal research has shown that the proportion of readers assigned to dyslexia and SCD groups changes over time, with a higher proportion of children being assigned to the SCD group as they grow older (Catts et al., 2005). Catts et al. (2005) hypothesised that older dyslexic children may be able to apply compensatory strategies to mitigate their decoding difficulties, which means they would no longer be identified as struggling readers, leading to a change in the relative proportion of poor readers assigned to these groups. This research did not find evidence for this hypothesis, as a similar proportion of children were assigned to the dyslexia and SCD groups across Years 4–6. This suggests that Year 6 children with dyslexia may not yet have access to the compensatory strategies used by the older children in Catts et al. This could be due to their lack of accuracy in decoding, which limits their ability to apply their relatively unaffected language comprehension skills. In contrast, older children with dyslexia may have surpassed an accuracy threshold, enabling them to apply their comprehension skills more effectively, albeit with fluency difficulties.

Phonological difficulties were observed in all three groups (dyslexia, SCD and mixed difficulty) for reading ability levels at or below the 10th percentile versus those greater than the 10th percentile. This is consistent with previous research, which has shown that children with language impairments or dyslexia tend to exhibit greater difficulties in phonological skills than typically achieving children (Bishop & Snowling, 2004; Lauterbach et al., 2017). Interestingly, the dyslexia group performed significantly worse than the SCD group on the Elision test, which assesses the ability to delete a sound within a word to create a new word. These findings suggest that both groups exhibit difficulties in tasks requiring the recognition and/or manipulation of sounds within words, but the SCD group exhibits relatively less pronounced difficulties on the Elision test. Such a finding aligns with Lauterbach et al.'s (2017) research, which showed that the Elision test, along with assessments of verbal comprehension and phonemic decoding efficiency, could differentiate participants (aged 7–20 years old) with dyslexia from those with DLD. The utility of the Elision test in discriminating between these groups is unclear, as it involves similar skills to the other phonological awareness tests, such as attending to phonological information at the phoneme level, mentally manipulating phonemes, comparing phonological attempts to word representations in one's lexicon and providing an oral response. The same pattern of performance was observed across ability levels ($\leq$10th, $>$10th), which indicates that any differences between these groups in such phonological processing skills are evident across varying levels of reading difficulty. Further research explaining why this task should pose less difficulties for SCD children than those with dyslexia may help with understanding the underlying differences in phonological skills between these groups. Such more subtle differences, though, do explain why sometimes it can be difficult to distinguish potentially different groups of poor readers.

Rapid naming is sometimes subsumed within tests of phonological processing. Consistent with this and the view that those with dyslexia are more likely to show phonological deficits,

the current findings indicated that the dyslexia group performed significantly worse than the SCD group on the two rapid naming tests. However, the differences were less pronounced than those observed on the Elision test, and the level of weaknesses presented in the standard scores of both groups seemed much less pronounced than for most of the phonological measures; the SCD group performed at near average levels on these tasks (from 93 to about 100), whereas the dyslexia groups performed around 90. It is not possible to definitively attribute the observed group differences to phonological factors alone, as alternative explanations cannot be ruled out. Further research, therefore, would be useful as it may inform theories explaining the relationship between these speeded naming processes and those involved in phonological and language/literacy tasks.

## Implications for Instruction

Children who exhibited the greatest reading comprehension difficulties (bottom 5th percentile) are likely to be those typically captured within Tier 3 reading programmes in schools that have adopted a response to intervention framework (RTI). In a typical RTI framework, Tier 1 involves all children receiving high-quality, evidence-based classroom instruction, with teachers monitoring children progress. At Tier 2, children who have not reached expected levels of performance are provided with more targeted intervention-based teaching, often in small groups. Children who do not respond adequately to Tier 2 instruction receive more intensive interventions designed to address their specific needs within Tier 3. Tier 3 aims to include approximately 5% of all children (Johnson & Street, 2013). Children who performed within the bottom 5th percentile on the reading comprehension measure in this research demonstrated pronounced difficulties across many skills associated with reading, which indicates they may be the children likely to benefit from the most targeted support. Children exhibiting a similar pattern of difficulties to those within the bottom 5th percentile in this research have been identified in studies using an RTI framework to identify children requiring Tier 3 support (Barth et al., 2010; Berninger et al., 2002; Compton et al., 2012; Field et al., 2019). The results from such research indicate that most of these children may require comprehensive reading programmes designed to address both the decoding and language comprehension difficulties that these children exhibited.

While children in the bottom 5th percentile are likely to require interventions that address both decoding and language comprehension, children above the 10th percentile may require programmes that emphasise one of these components to a greater extent. Some children in the dyslexia and SCD groups performed similarly to their age-equivalent peers on language comprehension and decoding tests, respectively. These results highlight the importance of interventions that focus on either decoding or language comprehension, depending on the specific needs of each child. Therefore, it is crucial to assess both decoding and language comprehension skills comprehensively to provide effective support for struggling readers.

## Limitations and Future Research Opportunities

Research has suggested that children with decoding difficulties tend to perform worse on reading comprehension tests that use a cloze format than those with language comprehension difficulties (Keenan et al., 2008; Keenan & Meenan, 2014; Nation & Snowling, 1997). Thus, while the cloze format test used in this research is a widely accepted measure of reading comprehension, it may not capture the full range of reading difficulties experienced

by children with decoding or language comprehension difficulties. Although the children also had to perform poorly on teacher-administered assessments that used alternative formats, such as multiple-choice formats based on larger passages of text, the use of only one format to measure reading comprehension may have affected the prevalence rates reported. Future research using different reading comprehension test formats would be helpful to determine the impact of the factors investigated in this study on a range of comprehension tasks.

## Conclusion

This study found that the proportion of children assigned to the dyslexia, SCD and mixed difficulty groups varied across different levels of reading ability. Children with severe reading comprehension difficulties were more likely to exhibit the mixed difficulty profile than the SCD or dyslexia profiles. Despite these variations in proportions, the relative strengths and weaknesses exhibited by these groups remained consistent across different levels of reading difficulty. The results also suggest that children in the dyslexia and SCD groups may use compensatory strategies to mitigate some of the decoding and language comprehension difficulties they experience. Nevertheless, the strategies used by those children with dyslexia who are in the bottom 5% of reading comprehension levels may be less effective than those used by older children who exhibit this profile. Phonological difficulties were observed in all three groups. However, the SCD group exhibited significantly less difficulty than the dyslexia group on the Elision test, which assessed their ability to delete a sound within a word to create a new word. This finding suggests that there are subtle differences in the phonological difficulties experienced by these groups. This research has implications for identifying struggling readers, as well as understanding the underlying mechanisms of reading difficulties.

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## Conflict of interest

We have no conflicts of interest to disclose.

## Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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