Language Deficits in Poor Comprehenders: A Case for the Simple View of Reading

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Purpose: To examine concurrently and retrospectively the language abilities of children with specific reading comprehension deficits ("poor comprehenders") and compare them to typical readers and children with specific decoding deficits ("poor decoders").
Method: In Study 1, the authors identified 57 poor comprehenders, 27 poor decoders, and 98 typical readers on the basis of 8th-grade reading achievement. These subgroups' performances on 8th-grade measures of language comprehension and phonological processing were investigated. In Study 2, the authors examined retrospectively subgroups' performances on measures of language comprehension and phonological processing in kindergarten, 2nd, and 4th grades. Word recognition and reading comprehension in 2nd and 4th grades were also considered.
Results: Study 1 showed that poor comprehenders had concurrent deficits in language comprehension but normal abilities in phonological processing. Poor decoders were characterized by the opposite pattern of language abilities. Study 2 results showed that subgroups had language (and word recognition) profiles in the earlier grades that were consistent with those observed in 8th grade. Subgroup differences in reading comprehension were inconsistent across grades but reflective of the changes in the components of reading comprehension over time.
Conclusions: The results support the simple view of reading and the phonological deficit hypothesis. Furthermore, the findings indicate that a classification system that is based on the simple view has advantages over standard systems that focus only on word recognition and/or reading comprehension.

KEY WORDS: poor comprehenders, specific reading comprehension deficit, simple view of reading, phonological processing, language comprehension deficits

Considerable research attention has focused on children with reading disabilities (Catts & Kamhi, 2005; Shaywitz, 2003; Vellutino, Fletcher, Snowling, & Scanlon, 2004). Most of this work has been directed toward children with either specific deficits in word reading or dyslexia. However, some researchers have begun to investigate children with specific comprehension problems (e.g., Cain, Oakhill, Barnes, & Bryant, 2001; Nation, Clarke, Marshall, & Durand, 2004). These children, often referred to as *poor comprehenders,* have significant deficits in reading comprehension despite normal or near-normal abilities in word reading. Research suggests that perhaps as many as 5% to 10% of school-aged children may show this pattern of reading difficulty (Nation & Snowling, 1997; Yuill & Oakhill, 1991).

The *simple view of reading* (Gough & Tunmer, 1986; Hoover & Gough, 1990) predicts that the difficulty poor comprehenders have in understanding

written text is the result of deficits in language comprehension. The simple view states that reading comprehension is composed of two components: word recognition and language comprehension. According to this view, the word recognition component translates print into language, and the comprehension component makes sense of this linguistic information. Because poor comprehenders by definition have normal or near-normal word recognition abilities, it is predicted that their underlying problems are in the area of language comprehension. Indeed, there is an emerging body of literature that demonstrates that poor comprehenders perform less well than typical readers on tasks measuring a wide range of language comprehension abilities.

Studies have shown that poor comprehenders have deficits in receptive vocabulary and semantic processing (Nation et al., 2004; Nation & Snowling, 1998a, 1998b, 1999). For example, Nation and Snowling (1998b) found that 9-year-old poor comprehenders were slower and less accurate at synonym judgments than age-matched control children. Nation et al. (2004) reported similar semantic deficits in 8-year-old poor comprehenders. They also reported that poor comprehenders showed difficulties in grammatical understanding of sentences. Other investigations have documented that poor comprehenders have deficits in the comprehension of spoken discourse. For example, Nation and Snowling (1997) found that 7- to 9-year-old poor comprehenders not only had problems answering questions after reading a passage but showed similar problems when a passage was read to them. Cain and colleagues also examined the listening comprehension deficits of poor comprehenders. In one study (Cain et al., 2001), 8-year-old poor comprehenders and age-matched typical readers were taught a knowledge base about an imaginary planet. After this knowledge base was taught to criterion, children were read a six-episode story about the planet, and literal and inferential questions were asked. Typical readers recalled more literal information and made more correct inferences than poor comprehenders. Lack of knowledge and memory problems were ruled out as primary causes of poor comprehenders' inference-making difficulties (also see Cain, Oakhill, & Elbro, 2003; Oakhill, Cain, & Bryant, 2003).

Despite the problems that poor comprehenders have in language comprehension, studies have shown that they have normal abilities in phonological processing. Such a result would be predicted by the phonological deficit hypothesis (Stanovich, 2000). This hypothesis proposes a link between word-reading deficits and problems in phonological processing (also see Gillon, 2004). Research has shown that children with specific word-reading deficits or dyslexia often have difficulties in areas such as phonological awareness and phonological memory (Catts & Kamhi, 2005; Lyon, Shaywitz, & Shaywitz, 2003). Poor comprehenders, on the other hand, perform comparable to typical readers on such tasks (Cain, Oakhill, & Bryant, 2000; Nation, Adams, Bowyer-Crane, & Snowling, 1999; Nation & Snowling, 1998b; Stothard & Hulme, 1995).

In the present investigation, we further examined the language problems of poor comprehenders in two studies. In Study 1, we investigated the language comprehension and phonological processing abilities of children who were identified as poor comprehenders based on eighth-grade reading achievement. This allowed us to extend knowledge about the language abilities of poor comprehenders to children who were 5 to 6 years older than children in most previous studies. This approach also enabled us to investigate poor comprehenders at a point in reading achievement when reading comprehension and word recognition should be maximally distinct. Studies have shown that the correlation between reading comprehension and word recognition is high in the early school grades but then declines until reaching an asymptote in middle or high school grades (Francis, Fletcher, Catts, & Tomblin, 2005; Gough, Hoover, & Peterson, 1996).

In Study 2, we retrospectively examined the earlier reading and language abilities of participants in Study 1. Longitudinal data were available on language comprehension and phonological processing in kindergarten, second, and fourth grades and word recognition and reading comprehension in second and fourth grades. Examination of these data enabled us to investigate the developmental progression of language problems in poor comprehenders and the impact of these problems on reading achievement.

In both Studies 1 and 2, we compared poor comprehenders with typical readers in the same grade. We also used a contrast group of children who had deficits in word recognition but normal reading comprehension (referred to as *poor decoders*). Such a subgroup has seldom been included in studies of poor comprehenders (but see Stothard & Hulme, 1995). However, the inclusion of a poor decoder subgroup allowed us to compare poor comprehenders with a group of poor readers who we predicted would have a different profile of language abilities. Specifically, we expected poor decoders to have deficits in phonological processing abilities but normal language comprehension abilities, whereas we predicted the poor comprehenders to have the opposite profile.

Study 1

Method

Participants

The participants in this study comprised three groups of children subdivided on the basis of eighth-grade reading

achievement: a subgroup of 57 children with poor reading comprehension but normal word recognition (i.e., poor comprehenders), a subgroup of 27 children with poor word recognition but normal reading comprehension (i.e., poor decoders), and a control subgroup of 98 children with normal word recognition and reading comprehension (i.e., typical readers). The criteria used to select these subgroups are detailed at the end of the Method section after the description of the reading achievement measures. In the section below, we describe the sample from which these subgroups were selected.

All participants originally took part in an epidemiologic study of language impairments in kindergarten children (Tomblin et al., 1997). This epidemiologic investigation used a stratified cluster sample of 7,218 children to estimate the prevalence of language impairments in kindergarten children. On completion of the epidemiologic study, a subsample of children was solicited to participate in a follow-up longitudinal investigation conducted by a team of researchers from several midwest universities. Because the primary interest of the team is the study of language impairments, all children who displayed these impairments on a kindergarten diagnostic battery were asked to participate. Of the 642 children who met this criterion, permission to participate was received for 328. In addition to these children, a random sample of the children without impairments was recruited. Permission to participate was obtained for 276 nonimpaired children, yielding a total sample of 604 children. These children, separated by diagnostic category, did not differ significantly in terms of demographic characteristics or language and cognitive abilities from those children who were not asked or did not choose to participate.

Participants were administered a battery of assessments in kindergarten, second, fourth, and eighth grades. Complete data on all language and reading assessments through the eighth grade were available on 522 children. Thirty-two of these children scored more than 2 *SD* below the mean on the eighth-grade measure of Performance IQ and were excluded from this study. The remaining 490 students served as the sample from which the participants of this study were selected.

Materials

Reading Achievement

Reading comprehension. Three tests of reading comprehension were administered. These included the Passage Comprehension subtest of the Woodcock Reading Mastery Tests—Revised (WRMT–R; Woodcock, 1987), the comprehension component of the Gray Oral Reading Test—3 (GORT–3; Wiederholt & Bryant, 1992), and a comprehension measure involving two grade-appropriate passages from the Qualitative Reading Inventory, Second Edition (QRI–2; Leslie & Caldwell, 1995). These tests and subtests measure comprehension in different ways. The WRMT–R subtest uses a cloze procedure, whereas the other two measures assess comprehension by having the participants read a passage and answer multiple-choice questions (GORT–3), or open-ended questions (QRI–2). Grade-appropriate passages included both narrative and expository texts and were approximately 30 words in length for the WRMT–R, 150 words for the GORT–3, and 350 words for the QRI–2. Raw scores were obtained from the QRI–2, which is not norm referenced. Raw scores on the WRMT–R were converted to standard scores using grade-based norms provided in the test manual. Only age-based norms were available for the GORT–3 and were used to convert raw scores to standard scores. The raw or standard scores from these measures were subsequently converted to *z* scores and combined to derive a composite score for reading comprehension.

Word recognition. The Word Identification and Word Attack subtests of the WRMT–R (Woodcock, 1987) were administered. The Word Identification subtest measured participants' ability to accurately pronounce printed English words, ranging from high to low frequency of occurrence. Some examples of eighth-grade words are *causation, proximity,* and *judicious*. The Word Attack subtest assessed participants' ability to read pronounceable nonwords varying in complexity. Grade-appropriate nonwords include *gaked, cigbet,* and *darlanger*. To form a composite score for word recognition, standard scores for these subtests were converted to *z* scores and combined.

Intelligence

The Block Design and Picture Completion subtests of the Wechsler Intelligence Scale for Children—Third Edition (WISC–III; Wechsler, 1991) were administered as a shortened version of the Performance Scale (Bishop & Adams, 1990; LoBello, 1991). These subtests measure a range of nonverbal cognitive abilities, including visual attention, visual recognition, visual–motor coordination, and spatial reasoning (Kaufman, 1979).

Language

Language comprehension. A battery of standardized and experimental measures of language comprehension was administered. This included standardized measures of receptive vocabulary, grammatical understanding, and discourse comprehension. The Peabody Picture Vocabulary Test—Revised (PPVT–R; Dunn & Dunn, 1981) was used to assess receptive vocabulary. The Concepts and Directions subtest from the Clinical Evaluation of Language Fundamentals, Third Edition (CELF–3; Semel, Wiig, & Secord, 1995) served as a measure of grammatical understanding. This subtest

assesses participants' ability to understand sentential commands involving syntactic structures (e.g., "Before you point to the little, white triangle, point to the little squares"). Local age-adjusted norms were used to convert raw scores into standard scores for both the PPVT–R and CELF–3. Local norms were used to take advantage of our large representative sample and to ensure that comparisons of these data with similar data in earlier grades (Study 2) were not influenced by changes in the population used to derive standardized test norms.

Discourse comprehension was assessed by the listening comprehension score from two age-appropriate passages of the QRI–2. Passages were presented to participants via headphones and a high-quality audio-recorder. After each passage, the examiner asked 10 questions; 5 asked about information explicitly presented in the passage (explicit questions), and 5 required an inference to be made (implicit questions).

Participants were also administered an experimental measure of discourse comprehension developed by the third author. This measure used narrative passages adapted from Crais and Chapman (1987) and Kertoy and Goetz (1995) to assess discourse inference making. Participants listened to three stories (207, 260, and 268 words in length) presented via headphones and a high-quality audio-recorder. Following the presentation of each passage, the examiner asked the participant eight questions, and the participant's responses were audiotaped for subsequent transcription and scoring. Four of these questions required an inference: Two questions were based on information that was contained within the same sentence or in an adjacent sentence (adjacent inference), and two questions were based on information separated by four or more sentences (distant inference). The other four questions for each passage referred to information explicitly presented in the passage (premise questions). Two of these questions required an answer that was the premise for a distant inference question, and two involved an answer that was the premise for an adjacent inference question. Such a design allowed us to evaluate whether subgroups' differences in answering inference questions were related to differences in retention or comprehension of explicitly presented information in the passage. The order of presentation for the stories was counterbalanced across participants. All participants heard the same sequence of questions for a given story. A semi-random approach was used to determine the question sequences, such that no more than three questions of one type (premise or inference) could occur consecutively and related premise and inference questions were not presented successively.

Phonological processing. Three measures of phonological processing were administered. These included two measures of phonological awareness (phoneme deletion and pig Latin) and a measure of phonological memory (nonword repetition). The phoneme-deletion task required participants to repeat 46 nonwords individually and then delete a phoneme to derive a real word. Nonwords were presented via headphones and a high-quality audio-recorder, and the participants' responses were recorded. The pig Latin task required participants to strip the initial phoneme from a spoken word, move it to the end of the word and add "ay." There were 27 items (15 one-syllable and 12 two-syllable) words. Within each syllable condition, half (or approximately half) of the items began with a single consonant and the remainder with a consonant cluster. Words were presented live voice, and the participants' responses were recorded. Both of these phonological awareness measures were adapted from Gayan and Olson (2003).

The nonword repetition task (Dollaghan & Campbell, 1998) was used as a measure of phonological memory. In this task, students were required to repeat 16 nonwords ranging from one to four syllables in length. There were 4 words at each length. Each of the nonwords was composed of early-developing phonemes and contained syllables that did not correspond to English lexical items. The latter constraint was imposed to reduce the effects that differences in vocabulary knowledge might have had on performance on this task. The task was administered via headphones and a high-quality audio-recorder, and participants' responses were recorded. These responses were scored in terms of the percentage of consonants produced correctly.

Criteria for Reading Group Classification

Reader subgroups were selected on the basis of their performance on the reading comprehension and word recognition composite scores in eighth grade. Participants with specific deficits in reading comprehension (i.e., poor comprehenders) scored below the 25th percentile in reading comprehension and above the 40th percentile in word recognition. Although a more extreme cut-off score than the 25th percentile has often been used to identify poor readers (e.g., 1 *SD*; Meyer, Wood, Hart, & Felton, 1998), it is not uncommon to use the 25th percentile as a cut-off score (e.g., Fletcher et al., 1994; Stanovich & Siegel, 1994).

Participants with specific word recognition deficits (i.e., poor decoders) performed below the 25th percentile in word recognition and above the 40th percentile in reading comprehension. Participants whose word recognition and reading comprehension composite scores were between the 40th and 84th percentiles formed the typical reader subgroup. Exceptionally good readers were not included in the typical reader subgroup so that this subgroup would be matched, as a group, to the poor reader subgroups on appropriate variables. As shown in Table 1, the typical and the poor decoder subgroups did

Table 1. Subgroups' means (*SD*s) on measures of reading comprehension, word recognition, and Performance IQ.

Measure	Typical (n = 98)	Poor decoders (n = 27)	Poor comprehenders (n = 57)	F(2, 179)
Word recognition	105.13 (6.47)	84.19 (5.36)	104.85 (5.72)	149.89
Reading comprehension	105.33 (6.53)	103.11 (5.13)	83.43 (4.58)	220.90
Performance IQ	102.99 (14.4)	103.68 (14.1)	92.70 (8.91)	10.38

not differ significantly from each other on the reading comprehension composite score ($p > .05$, $d = 0.35$), but each differed significantly from the poor comprehender subgroup on this variable ($p < .001$, ds = 3.72 and 4.14, respectively). Furthermore, the typical and the poor comprehender subgroups did not differ significantly from each other on the word recognition composite score ($p > .05$, $d = 0.05$), but each differed significantly from the poor decoder subgroup on this variable ($p < .001$, ds = 3.35 and 3.69). Last, analyses showed that the typical and poor decoder subgroups did not differ significantly in Performance IQ ($p > .05$, $d = 0.05$), but each differed significantly from the poor comprehender subgroup on this measure ($p < .01$, ds = 0.81 and 1.01). To evaluate the effects of this difference (in both Studies 1 and 2), we conducted a series of secondary analyses with Performance IQ as a covariate. The results from these analyses were essentially the same as those of the primary analyses that did not include Performance IQ as a covariate. Any relevant differences are reported in the results section.

Results

In this investigation, we sought to ensure that our results reflected the patterns exhibited by good and poor reader subgroups from the general population. As noted previously, the sample from which we selected our reader subgroups contained a higher proportion of children with a history of language and nonverbal cognitive deficits than that found in the general population. Such a composition could bias our results, particularly because we were interested in language problems in poor readers. For example, our poor comprehender subgroup might have included more children with a history of language impairments than would have been found in a comparable group drawn from a more representative sample. To address the potential bias presented by our sample, we used weighted scores in all analyses. The weighting procedure we used has been described in detail elsewhere (Catts, Adlof, Hogan, & Ellis Weismer, 2005; Catts, Fey, Zhang, & Tomblin, 1999). In essence, the procedure took advantage of knowledge of the prevalence rates for different categories of children on the basis of the epidemiologic sample from which our participants were drawn (Tomblin et al., 1997). Using these rates, we determined how likely it was that a given participant in this study, with his/her gender, language, and nonverbal cognitive profile, would have participated in the representative sample seen in the epidemiologic study. Then, each child's scores were weighted accordingly. In other words, although our sample contained more children with language and nonverbal cognitive deficits than found in a representative sample, the scores of these children were given proportionally less weighting to assure the representativeness of the results.

Analysis of variance (ANOVA) procedures were used to test for overall group differences. In follow-up comparisons, we used the Dunnett's T3 test (Dunnett, 1980) . This test controls for heterogeneity of variance, which can become problematic when group sizes are unequal, as they were in this study. Figure 1 displays the subgroups' performances on measures of receptive vocabulary and grammatical understanding. An ANOVA revealed that subgroups differed significantly in both receptive vocabulary, $F(2, 179) = 31.35$, $p < .001$, and grammatical understanding, $F(2, 179) = 20.43$, $p < .001$. Follow-up tests showed that the poor comprehender subgroup performed significantly worse than the typical ($p < .001$, $d = 1.47$) and the poor decoder subgroups ($p < .01$, $d = 0.96$) in receptive vocabulary. Poor decoders

Figure 1. Subgroups' mean standard scores on eighth-grade measures of vocabulary and grammatical understanding. PPVT–R = Peabody Picture Vocabulary Test—Revised (Dunn & Dunn, 1981); CELF–3 = Clinical Evaluation of Language Fundamentals, Third Edition (Semel, Wiig, & Secord, 1995).

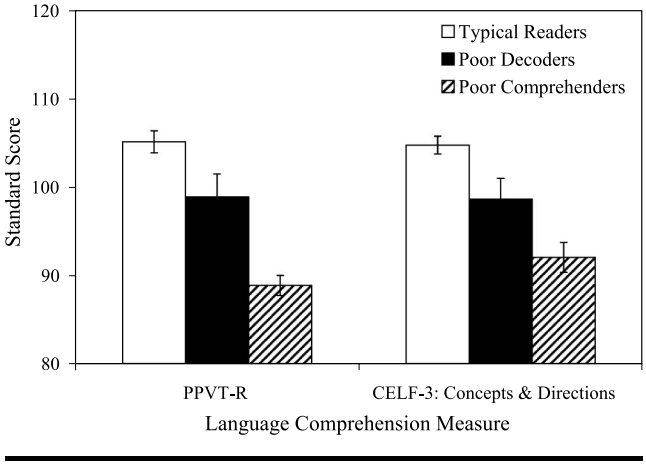


Table 2. Subgroups' means (*SD*s) for raw scores on measures of discourse comprehension.

Measure (no. of items)	Typical (n = 98)	Poor decoders (n = 27)	Poor comprehenders (n = 57)
QRI–2			
Explicit (10)	4.47 (2.03)	4.87 (2.44)	2.33 (1.20)
Implicit (10)	3.27 (2.05)	3.02 (2.26)	1.55 (1.27)
Discourse inference task			
Adjacent inference (6)	5.36 (0.97)	5.20 (0.96)	4.74 (1.09)
Distant inference (6)	4.06 (1.53)	3.79 (1.32)	3.22 (1.07)
Adjacent premise (6)	4.85 (1.05)	4.76 (1.27)	4.18 (1.00)
Distant premise (6)	5.33 (1.00)	4.99 (1.37)	4.99 (1.15)

Note. QRI–2 = Qualitative Reading Inventory, Second Edition (Leslie & Caldwell, 1995).

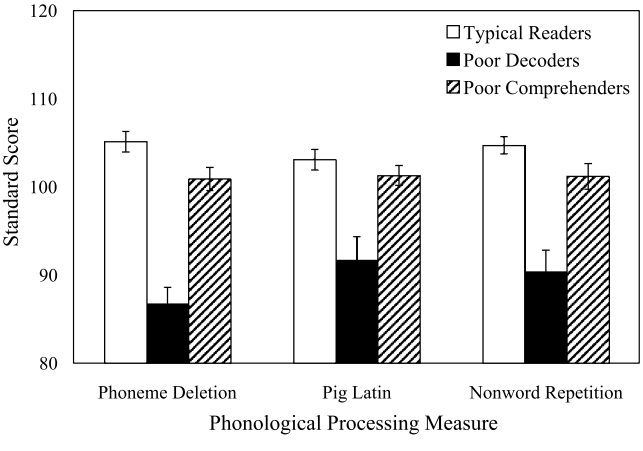
also scored somewhat lower than typical readers in receptive vocabulary, but this difference failed to reach significance ($p > .05$, $d = 0.50$). In grammatical understanding, the poor comprehender subgroup performed significantly worse than the typical subgroup ($p < .001$, $d = 1.15$) and scored lower but not significantly different from the poor decoder subgroup ($p > .05$, $d = 0.52$). The poor decoders differed significantly from the typical readers in grammatical understanding ($p < .01$, $d = 0.59$).

Table 2 presents subgroups' performances in discourse comprehension. Recall that discourse comprehension was measured by the QRI–2 and an experimental discourse inference task. The QRI–2, which included both explicit and implicit questions, proved to be moderately difficult for the participants. On average, participants answered approximately 4 of the 10 explicit questions and 3 of the 10 implicit questions correctly. A 3 (subgroup) × 2 (type of question) mixed-model ANOVA on data from the QRI–2 showed that the difference in performance across types of questions was significant, $F(1, 179) = 62.35$, $p < .001$, and did not interact with subgroups, $F(2, 179) = 2.75$, $p > .05$. There was also a main effect for subgroup, $F(2, 179) = 22.56$, $p < .001$. Follow-up tests revealed that poor comprehenders scored lower than typical readers ($p < .001$, $d = 1.26$) and poor decoders ($p < .001$, $d = 1.39$). Poor decoders performed in a comparable manner with typical readers ($p > .05$, $d = 0.04$).

The results from the experimental discourse inference task are also shown in Table 2. Recall that this task included adjacent and distance inference conditions. A 3 (group) × 2 (type of inference) mixed-model ANOVA on data involving these two conditions revealed a significant main effect for type of inference, $F(1, 179) = 113.27$, $p < .001$, and subgroup, $F(2, 179) = 9.51$, $p < .001$. The Subgroup × Type of Inference interaction was not significant, $F(2, 179) = 0.33$, $p > .05$. Follow-up testing indicated that the poor comprehenders performed significantly worse than the typical readers ($p < .001$, $d = 0.78$) and poor decoders ($p < .05$, $d = 0.62$) on this task. There was no significant difference between the latter two subgroups ($p > .05$, $d = 0.22$). Further examination of the data in Table 2 indicates that the subgroups differed in their knowledge of the premises needed to make inferences. To control for this difference, analyses of covariance (ANCOVAs) were conducted using participants' performance in the adjacent premise condition as a covariate for performance in the adjacent inference condition and performance in the distant premise condition as the covariate for that in the distant inference condition. The results showed a significant subgroup difference for the distant inference condition, $F(2, 178) = 5.07$, $p < .01$, but not for the adjacent inference condition, $F(2, 179) = 2.12$, $p > .05$. In the distant inference condition, the poor comprehenders scored significantly lower than the typical readers ($p < .01$, $d = 0.61$). Poor decoders did not differ significantly from the typical readers ($p > .05$, $d = 0.18$) or poor comprehenders ($p > .05$, $d = 0.49$).

Figure 2 shows subgroups' performances on measures of phonological processing. An ANOVA indicated that subgroups differed significantly on the phoneme deletion, $F(2, 179) = 34.52$, $p < .001$; pig Latin, $F(2, 179) = 13.64$, $p < .001$; and nonword repetition tasks, $F(2, 179) = 21.79$,

Figure 2. Subgroups' mean standard scores on eighth-grade measures of phonological processing.



$p < .001$. Unlike the results for language comprehension measures, it was the poor decoder subgroup that scored lower than the others. On the phoneme deletion task, the poor decoder subgroup scored significantly lower than the typical ($p < .001$, $d = 1.62$) and poor comprehender subgroups ($p < .001$, $d = 1.41$). The poor comprehender and typical reader subgroups did not differ significantly on this task ($p > .05$, $d = 0.38$). On the pig Latin task, the poor decoders performed significantly lower than the typical ($p < .001$, $d = 0.98$) and poor comprehender subgroups ($p < .001$, $d = 1.00$). Similarly, on the nonword repetition task, the poor decoder subgroup scored significantly lower than the typical ($p < .001$, $d = 1.25$) and poor comprehender subgroups ($p < .01$, $d = 1.00$). Again, on both of the latter tasks, there was no significant difference between the typical and poor comprehender subgroups ($p > .05$, ds = 0.17 and 0.35, respectively).

Discussion

The above results indicated that poor comprehenders, who were identified on the basis of reading achievement in eighth grade, had deficits in language comprehension but normal abilities in phonological processing. Poor decoders, on the other hand, showed the opposite pattern of results. These children performed poorly on measures of phonological processing but scored relatively well on measures of language comprehension. This "double dissociation" in language deficits is predicted by the simple view of reading and the phonological deficit hypothesis. As described above, the simple view argues that reading comprehension is composed of word recognition and language comprehension. Thus, according to this view, children with deficits in reading comprehension, but with normal word-reading skills (i.e., poor comprehenders) would be expected to have problems in language comprehension. In contrast, children with poor word reading but normal reading comprehension (i.e., poor decoders) would be expected to have normal, or even above normal, abilities in language comprehension.

Our results are consistent with those of others who have examined language abilities in poor comprehenders at a younger age. These findings suggest that poor comprehenders have at least mild deficits in semantic and syntactic processing (Nation et al., 2004; Nation & Snowling, 1998a, 1998b). We found that as a group, poor comprehenders scored near the 20th percentile in receptive vocabulary and the 30th percentile in grammatical understanding. Whereas these deficits may be mild in nature, they could lead to problems understanding text-length material, even when these texts are read aloud (also see Nation & Snowling, 1997; Yuill & Oakhill, 1991).

Poor comprehenders' difficulties in discourse or text-level comprehension may go beyond problems in vocabulary and grammar. To be more specific, it has been argued that poor comprehenders have difficulties in drawing inferences from text (Cain et al., 2003; Oakhill et al., 2003). We examined inferencing in two tasks. On the QRI–2, we found that poor comprehenders performed significantly lower than typical readers and poor decoders in answering questions concerning information not explicitly contained within the text (i.e., required an inference). Because poor comprehenders also scored lower on explicit questions, these results do not necessarily point to a specific deficit in making inferences. The latter issue was better tested in the experimental inference task. In this task, participants were asked questions requiring an inference (adjacent or distant) as well as questions about the premise of the inference. The poor comprehenders scored significantly worse than typical readers and poor decoders on inference questions. To further examine inferencing abilities, we partialed out subgroup differences in premise knowledge. Results showed that in the adjacent inference condition, there were no significant group differences after partialing out premise knowledge. In general, participants did well on inferences in which the premise was adjacent. In fact, all three subgroups scored higher in the adjacent inference condition than the adjacent premise condition. Closer inspection of the data indicated that one question in the adjacent premise condition was disproportionately more difficult than the others. However, when this question and its corresponding adjacent inference question were omitted, the ANCOVA continued to show no significant group differences. Participants' performance in the distant inference condition was more in line with expectations. All three subgroups performed worse in the distant inference condition than the distant premise condition. After partialing out premise knowledge, poor comprehenders scored significantly worse than typical readers (but not poor decoders) in the distant inference condition.

Whereas the above findings suggest that poor comprehenders have a deficit in inference making, they could alternatively be interpreted as evidence of a problem in working memory. Poor comprehenders may have scored poorly in the distant inference condition (and not in the adjacent inference condition) because of capacity limitations or resource-allocation difficulties that prevented them from storing and/or processing information contained at some distance in the text. Although such an interpretation is consistent with other studies that have shown that poor comprehenders have problems in working memory, additional investigation is necessary to understand the complex relationships among working memory, language abilities, and inferencing for reading comprehension (see Cain, Oakhill, &

Bryant, 2004; Nation et al., 1999; Stothard & Hulme, 1992). Last, it should be noted that our conclusions concerning poor comprehenders' deficits in discourse processing are limited to the comprehension of narrative or literate-style texts. Additional investigation will be needed to determine if these problems extend to other contexts such as conversational discourse.

As stated above, we predicted that poor decoders would perform well on tests of language comprehension. Recall that these children were matched with typical readers on reading comprehension but had word-reading deficits. Given the match in reading comprehension, the simple view would suggest that poor decoders might even have better than normal skills in language comprehension to compensate for their decoding deficits. Snowling (2005) has also suggested that some children with dyslexia (which likely would include some poor decoders) may have advanced language processing skills that they use to compensate for poor decoding skills. Our results showed that poor decoders as a group scored near the 50th percentile in receptive vocabulary and grammatical understanding. However, they performed worse in these areas than the typical children with whom they were matched on reading comprehension. Given the lower performance in vocabulary and grammar, we might ask how the poor decoders were able to score as well as typical readers in reading comprehension. Our results suggest that poor decoders may have ample discourse processing skills that aid them in their reading comprehension. Poor decoders did not differ significantly from typical readers on the QRI–2 listening comprehension task or the experimental inference task. Poor decoders may have developed discourse-level skills and/or strategies that allowed them to extract meaning from text despite deficits in decoding. It should be kept in mind, however, that reading comprehension in this study was measured with nontimed tests. Given poor decoders' difficulties in word reading, we would expect that they would not score as well as typical readers on a timed reading comprehension measure.

In addition to examining language comprehension, we also investigated subgroup differences in phonological processing. Our results were consistent with those predicted by the phonological deficit hypothesis (Stanovich, 2000). We observed that poor decoders had deficits in phonological awareness and nonword repetition. Poor comprehenders, on the other hand, had normal phonological processing skills, which were in line with their relative strengths in word recognition. Others have also reported that poor comprehenders have normal abilities in phonological awareness (Nation & Snowling, 1998b; Stothard & Hulme, 1995) and nonword repetition (Nation et al., 2004). Findings regarding poor comprehenders' typical performance in nonword repetition are interesting in light of the proposed link between deficits in nonword repetition and language impairments (Dollaghan & Campbell, 1998; Gathercole & Baddeley, 1990). To be more specific, researchers have argued that poor performance in nonword repetition is a psycholinguistic marker of language impairments in children (Bishop, North, & Donlan, 1996; Conti-Ramsden, Botting, & Faragher, 2001). Our results and those of Nation et al. (2004), which show a dissociation between nonword repetition and language comprehension in poor comprehenders, seem problematic for such a proposal. We acknowledge in Study 2, below, that the language problems of poor comprehenders are often not severe enough to meet the diagnostic criteria for a language impairment. Nevertheless, the observation of normal nonword repetition in children with even moderate language deficits is inconsistent with a close link between nonword repetition and language abilities. Catts et al. (2005) addressed this issue in more detail and showed that problems in nonword repetition are more closely related to decoding deficits, which can cooccur with language problems, than they are to language problems alone.

Up to this point, we have focused on the language comprehension and phonological processing abilities of poor comprehenders and poor decoders concurrently with their identification in eighth grade. Our results have shown a clear distinction in their language abilities. However, it seems important to determine whether these distinctions were present primarily in eighth grade or whether they were also apparent at earlier grades. If the language profiles of these groups of poor readers are present in early school grades and stable over time, this finding would add to the validity of a classification system that included these subgroups and support the possibility of their early identification. Therefore, in Study 2, we examined retrospectively the language abilities (and reading achievement) of these subgroups at earlier grades.

Study 2

As noted in the introduction, longitudinal data were available on language comprehension and phonological processing in kindergarten, second, and fourth grades. Data on word recognition and reading comprehension were also collected in second and fourth grades. In Study 2, we examined the differences in these data among the subgroups identified in Study 1. We predicted that the subgroup differences in language comprehension and phonological processing observed in eighth grade would be present in the earlier grades. We also expected comparable subgroup differences in word recognition abilities to those found in eighth grade. However, we predicted that subgroups' differences in reading comprehension might be different in the earlier grades than in eighth

grade. In the early school grades, reading comprehension is more heavily dependent on word recognition than listening comprehension (Francis et al., 2005; Gough et al., 1996). Most children enter school with vocabulary and grammar knowledge that exceeds what is needed to understand early reading materials, which are linguistically simple. Reading instruction during the primary grades focuses on teaching children to decode words and read fluently. Thus, given the relative importance of word recognition skills in reading comprehension in the early grades (compared to listening comprehension skills), we predicted that poor decoders (based on eighth-grade reading achievement) would score poorly in reading comprehension in second and, perhaps, even fourth grade. We expected poor comprehenders, on the other hand, with their strengths in word recognition, to score better in reading comprehension in the early grades than in eighth grade.

Method

Participants

The participants in this study were the same as those described in Study 1: 57 poor comprehenders, 27 poor decoders, and 98 typical readers (based on eighth-grade reading achievement).

Materials

Reading Achievement

Reading comprehension. The WRMT–R Passage Comprehension and the GORT–3 comprehension score, described in Study 1, were also used to assess reading comprehension when participants were in the second and fourth grades. Scores from these measures were combined with those from the Reading Comprehension subtest of the Diagnostic Achievement Battery, Second Edition (DAB–2; Newcomer, 1990) to form a composite measure of reading comprehension at these grades. The DAB–2, like the QRI–2, which was used in its place in eighth grade, involved silent reading and open-ended comprehension questions.

Word recognition. The Word Identification and Word Attack subtests of the WRMT–R (Woodcock, 1987), described in Study 1, were administered in second and fourth grades.

Language

Language comprehension. In second and fourth grades, participants were given the Concepts and Directions subtest from CELF–3 and the PPVT–R (described in Study 1). The Listening to Paragraphs subtest from the CELF–3 was given as a measure of discourse comprehension. In kindergarten, participants took the Test of Language Development—Primary, Second Edition (TOLD–P:2; Newcomer & Hammill, 1988). This included the Picture Vocabulary (a measure of receptive vocabulary) and Grammatical Understanding subtests. An experimental measure of discourse comprehension was also administered. In this task, developed by Culatta, Page, and Ellis (1983), participants were read a brief story (134 words) and were asked 10 questions, most of which were literal in nature. For all language comprehension measures, raw scores were converted to standard scores using local age-adjusted norms. Last, at each grade, scores on tests of language comprehension were combined to form a composite score for language comprehension.

Phonological processing. The nonword repetition task, described in Study 1, was also administered when participants were in second grade. In kindergarten, second, and fourth grades, phonological awareness was assessed by a sound deletion task. In this task, participants were required to delete a syllable or phoneme of a real word and say the remaining sound sequence (see Catts et al., 2001). The kindergarten version of this task comprised 21 items, and 9 items were added in the second- and fourth-grade versions. The stimulus items were presented live voice and students' responses were recorded. A ceiling of six consecutive incorrect responses was used. The scores from this and other measures of phonological processing were converted to z scores on the basis of the weighted means and standard deviations of the entire sample available at a given grade.

Results

In our initial analyses, we compared the language comprehension composite scores of the subgroups in kindergarten, second, and fourth grades. In these and all other analyses, we used weighted scores as described in Study 1. An ANOVA indicated that subgroups differed significantly in the language composite score in kindergarten, $F(2, 179) = 27.41$, $p < .001$; second, $F(2, 179) = 51.58$, $p < .001$; and fourth grades, $F(2, 179) = 43.36$, $p < .001$. Follow-up tests showed that poor comprehenders performed significantly worse than the typical readers and poor decoders in kindergarten ($p < .001$, $d = 1.37$, and $p < .01$, $d = 0.76$, respectively), second ($p < .001$, ds = 1.79 and 1.51, respectively), and fourth grades ($p < .001$, ds = 1.64 and 1.40, respectively) on the language comprehension composite score. The poor decoders' language composite score was significantly lower than the typical readers in kindergarten ($p < .01$, $d = 0.55$) but not in second ($p > .05$, $d = 0.42$) and fourth grades ($p > .05$, $d = 0.39$).

Figure 3. Subgroups' mean *z* scores on individual measures of language comprehension in kindergarten (K), second (2nd), and fourth (4th) grades.

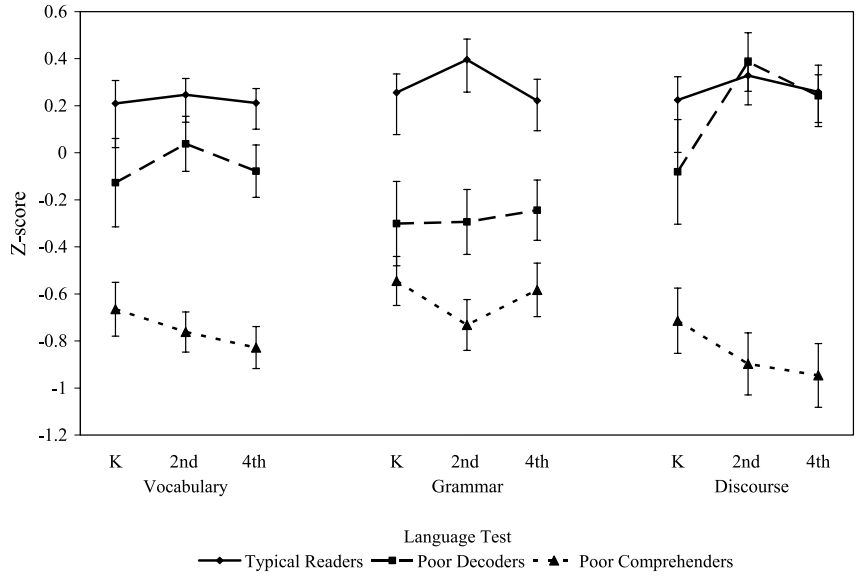


Figure 3 displays subgroups' performances by grade on each of the measures that were used to form the language comprehension composite score. The poor comprehenders showed poor performance across grades on each of the measures included in this composite. Further inspection of Figure 3 shows that poor decoders scored comparably with the typical readers in discourse comprehension in second and fourth grades but somewhat lower in kindergarten discourse comprehension and in vocabulary and grammatical understanding in each of the earlier grades.

Given poor comprehenders' difficulties in language comprehension during the early school grades, it seemed appropriate to consider how many of these children met diagnostic criteria of a language impairment. Recall that our participants were a subsample of a large group of children who took part in an epidemiologic study of language impairments in kindergarten (Tomblin et al., 1997). In that study, children were diagnosed as language impaired on the basis of poor performance on measures of language comprehension and production.[1] A distinction was also made between those participants with specific language impairments (SLI) and those with nonspecific language impairments (NLI). The latter children had a Performance IQ that was more than 1 *SD* below average. Thus, data were available to retrospectively examine the incidence of kindergarten language impairments in our subgroups. Weighted analyses of these data showed that, in kindergarten, only a small percentage of typical readers (4.1% and 0.3%) and poor decoders (5.8% and 2.7%) met the diagnostic criteria for SLI and NLI, respectively. Language impairments in kindergarten were more common in poor comprehenders. However, only about one third of these children had severe enough language impairments to meet the criteria for SLI (21.2%) or NLI (10.8%) in kindergarten. Parental reports further indicated that only 18% of the poor comprehenders had received speech and/or language services in the early grades. In contrast, parental reports for children with language impairments in the epidemiologic study indicated that 35% had received speech and/or language services.

Data were also available on measures of phonological processing in kindergarten, second, and fourth grades. As seen in Figure 4, subgroups differed significantly in phonological awareness in kindergarten, $F(2, 179) = 24.78$, $p < .001$; second, $F(2, 179) = 14.61$, $p < .001$; and fourth grades, $F(2, 179) = 24.98$, $p < .001$; and in nonword repetition in second grade, $F(2, 179) = 6.76$, $p < .001$. Follow-up analyses indicated that poor decoders scored significantly lower than typical readers in kindergarten in phonological awareness ($p < .001$, $d = 1.02$) and lower than both typical readers and poor comprehenders in phonological awareness in second ($p < .001$, $d = 1.13$, and $p < .05$, $d = 0.65$, respectively) and fourth grades ($p < .001$, ds = 1.29 and 1.24, respectively) and in nonword repetition in second grade ($p < .001$,

[1]Children were considered to have a language impairment if they scored more than 1.25 *SD* below the mean on at least two of five language composite scores (vocabulary, grammar, narration, receptive language, expressive language). Such a criterion translates to performance of at least 1.14 *SD* below the mean on the overall language composite score (Tomblin, Records, & Zhang, 1996).

Figure 4. Subgroups' mean standard scores on phonological processing measures in kindergarten, second, and fourth grades.

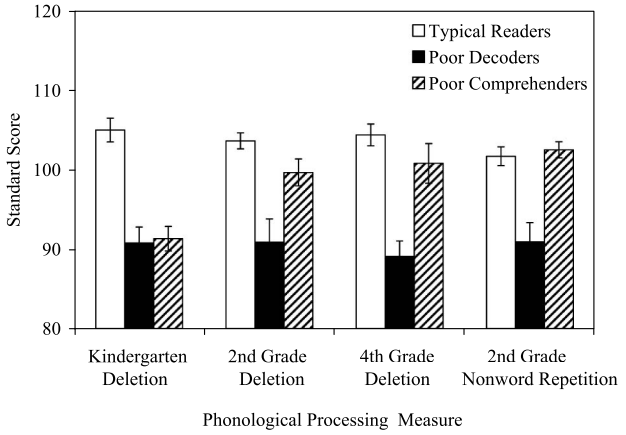
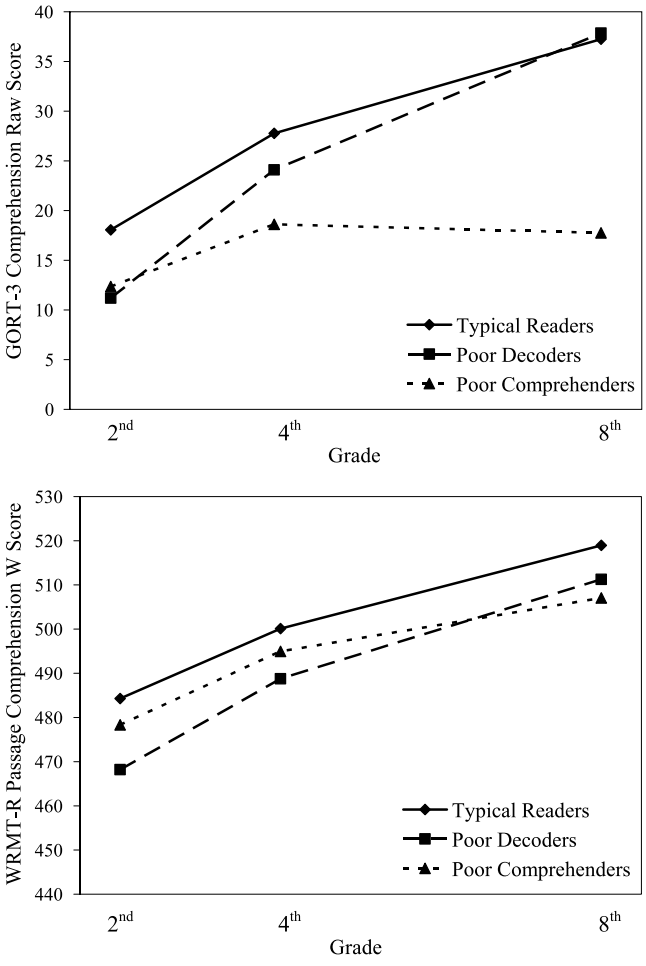


Figure 5. Subgroups' mean scores on measures of reading comprehension in second, fourth, and eighth grades. GORT–3 = Gray Oral Reading Test—3 (Wiederholt & Bryant, 1992); WRMT–R = Woodcock Reading Mastery Tests—Revised (Woodcock, 1987).



d = 0.73, and $p < .01$, d = 0.81, respectively). Poor comprehenders did not differ significantly from typical readers except in the case of kindergarten phonological awareness ($p < .001$, d = 0.99).

Reading achievement was also assessed in second and fourth grades. Table 3 displays the reading comprehension and word recognition composite scores for each of the subgroups. An ANOVA and follow-up comparisons indicated that poor comprehenders scored significantly lower in reading comprehension than typical readers in both second ($p < .001$, d = 0.97) and fourth grades ($p < .001$, d = 1.66). However, the magnitude of the group differences was much less pronounced in these earlier grades than in eighth grade (d = 3.72). As noted above, this result was predicted because reading comprehension in the early grades is particularly dependent on word recognition skills. Table 3 shows that poor comprehenders scored well in word recognition in second and fourth grades. In each of these grades, poor comprehenders did not differ significantly from typical readers in word reading (second grade, $p > .05$, d = 0.16; fourth grade, $p > .05$, d = 0.17). Poor decoders, on the other hand, had deficits in word recognition in second and fourth grades that were comparable in severity with those observed in eighth grade.

Poor decoders' early word recognition deficits likely impacted their reading comprehension composite scores in second and fourth grades. In both grades, they performed significantly below typical readers in reading comprehension (second grade, $p < .001$, d = 1.15; fourth grade, $p < .001$, d = 1.01). Recall that poor decoders were matched with typical readers in eighth-grade reading

Table 3. Subgroups' means (*SD*s) on composite reading measures.

Measure	Typical (n = 98)	Poor decoders (n = 27)	Poor comprehenders (n = 57)	F(2, 179)
Reading comprehension				
2nd grade	105.07 (10.14)	92.91 (12.06)	95.65 (8.96)	25.72
4th grade	104.88 (9.50)	95.35 (9.24)	90.45 (7.13)	47.29
Word recognition				
2nd grade	103.93 (10.54)	86.56 (9.02)	102.25 (9.65)	36.76
4th grade	104.64 (7.88)	84.94 (9.54)	103.33 (7.02)	77.52

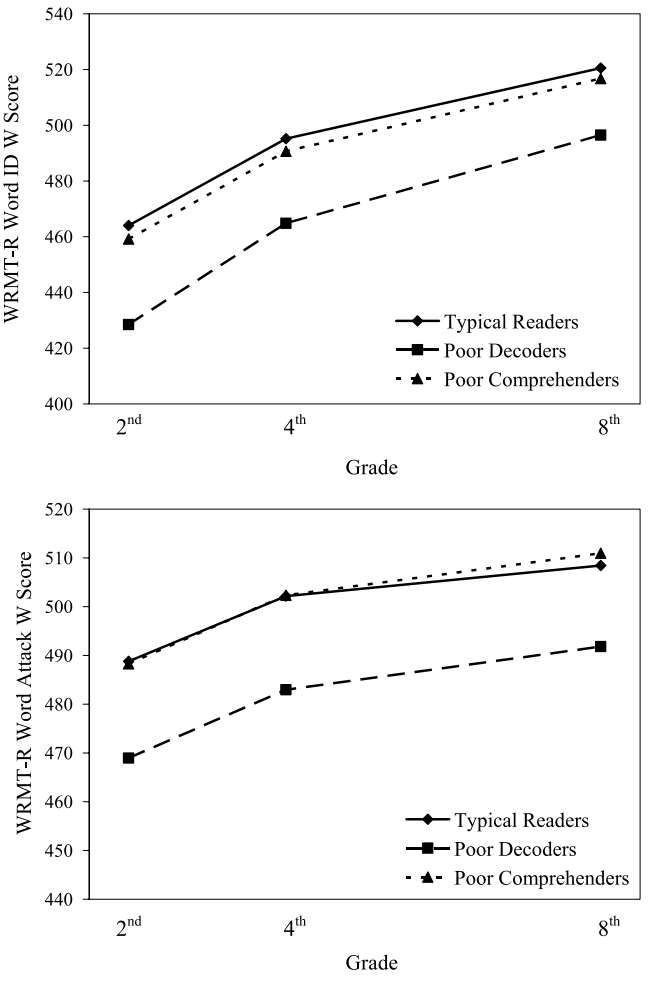
comprehension. Poor decoders did not differ significantly from poor comprehenders in second- ($p > .05$, $d = 0.27$) or fourth-grade reading comprehension ($p > .05$, $d = 0.62$).

The reading comprehension abilities of the subgroups across grades are more easily discerned from data graphically shown in Figure 5. This figure displays the subgroups' mean performances across grades for the GORT–3 Comprehension raw score and the WRMT–R Passage Comprehension W score. The latter score is a Rasch-based score devised specifically to measure growth. Similar data for the other measures of reading comprehension (i.e., DAB–2 and QRI–2) were not available because these tests were not given at all three grades. Figure 5 shows that the poor comprehenders and poor decoders had similar mean comprehension scores on the GORT–3 in second grade, but their performances began diverging in fourth grade. Posthoc analyses showed that these subgroups did not differ significantly on the GORT–3 in second grade ($p > .05$, $d = 0.15$) but did in fourth ($p < .05$, $d = 0.73$) and eighth grades ($p < .001$, $d = 4.8$). In the case of the Passage Comprehension subtest, the poor comprehenders scored significantly higher than the poor decoders in second ($p < .01$, $d = 0.88$) and fourth grades ($p < .05$, $d = 0.75$) but showed the reverse pattern in eighth grade ($p < .05$, $d = 0.61$). Figure 6 displays subgroups' mean performances for the WRMT–R Word Identification and Word Attack W scores, which formed the word recognition composite score at each grade. This figure shows that the poor decoders had consistent deficits across grades on both measures of word recognition. The poor comprehenders, on the other hand, performed in a comparable manner to typical readers across grades.

Discussion

In Study 1, we observed that poor comprehenders identified in eighth grade had concurrent deficits in language comprehension but had normal phonological processing abilities. Poor decoders identified in eighth grade demonstrated the opposite pattern. The results of Study 2 showed that this double dissociation was also apparent in the earlier grades. Poor comprehenders had problems in language comprehension in kindergarten, second, and fourth grades. As was the case in eighth grade, language problems were somewhat more apparent in vocabulary and discourse than in grammar. Poor comprehenders, on average, scored near the 20th percentile in vocabulary and discourse processing and near the 30th percentile in grammatical understanding. This suggests that the language problems of many poor comprehenders may be subclinical in nature. Indeed, only about one third of the children in the poor comprehender subgroup met a standard diagnostic criterion for language impairment in kindergarten. Furthermore, parental reports indicated that only a small percentage of the poor comprehenders received speech and/or language services in the early grades. The low percentage of poor comprehenders who met the diagnostic criteria for a language impairment may be in part a reflection of the moderate criterion we used for a reading comprehension problem (<25th percentile) and the more extreme criterion for a language impairment (composite score <1.14 *SD* or <13th percentile). However, our findings are comparable with Nation et al.'s (2004), who used a more extreme criterion for poor reading comprehension (<16th percentile). They reported that 30%–35% of their poor comprehenders met a diagnostic criterion for a language impairment similar to ours, and none had received clinical services. Thus, the language deficits of poor comprehenders may be less obvious and often missed in standard clinical practice. Nonetheless, these "hidden deficits," as Nation et al. referred to them, could by themselves, or in

Figure 6. Subgroups' mean scores on word recognition in second, fourth, and eighth grades.



combination with other processing deficits, play an important role in the difficulties poor comprehenders have in understanding written text.

Unlike poor comprehenders, poor decoders scored in the normal range in language comprehension in the earlier grades. As in eighth grade, their scores in vocabulary and grammatical understanding were somewhat depressed compared to typical readers, but their performance in discourse comprehension was comparable. This again suggests that it may be poor decoders' strength in discourse comprehension that allows them to score well in reading comprehension despite their word-reading deficits. On measures of phonological processing, poor decoders demonstrated deficits in early grades that were similar to those seen in eighth grade. Conversely, poor comprehenders generally scored well on phonological processing measures. The one exception to this was poor comprehenders' performance on the kindergarten measure of phonological awareness. On this measure, poor comprehenders performed similar to poor decoders and significantly less well than typical readers. It may be that poor comprehenders' lowered score in phonological awareness in kindergarten was the result of other language deficits at that time. Some recent research suggests that language factors such as vocabulary can influence performance in phonological awareness (Metsala & Walley, 1998). If poor comprehenders' language deficits influenced their phonological awareness in kindergarten, such deficits did not negatively impact these skills in later grades.

Taken together, our findings showed that subgroups had similar patterns of performance in language comprehension and phonological processing in the early grades and eighth grade. The same was also true for word recognition. In second and fourth grades, poor decoders scored poorly on measures of word reading, whereas poor comprehenders performed like typical readers. The results for reading comprehension were much less consistent. Whereas poor decoders and poor comprehenders differed by design in eighth-grade reading comprehension, they did not differ significantly on the second- and fourth-grade reading comprehension composite scores. Moreover, the poor comprehenders actually scored significantly better than the poor decoders on the Passage Comprehension subtest in second and fourth grades.

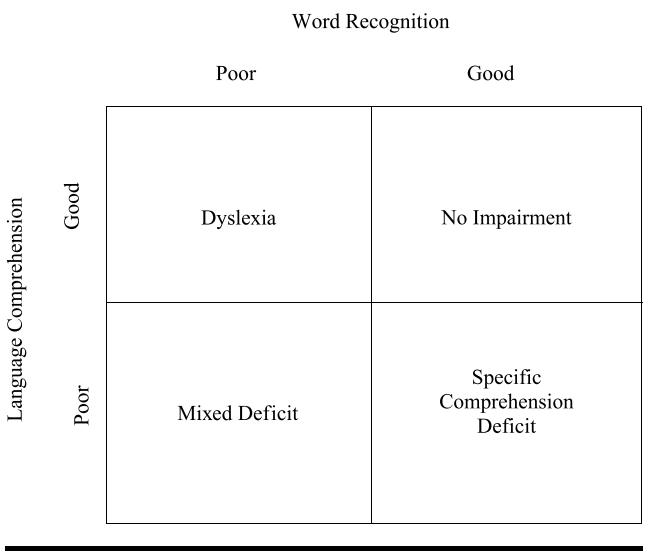
We predicted the inconsistency in the results concerning reading comprehension on the basis of the changing nature of reading comprehension (Francis et al., 2005; Gough et al., 1996). As noted above, reading comprehension in the early grades is heavily dependent on word recognition and less so on language comprehension. Thus, we expected poor decoders to have problems in reading comprehension in the early grades even though they were selected not to have these deficits in eighth grade. That poor comprehenders scored significantly better on the Passage Comprehension subtest than poor decoders is likely a reflection of the nature of that test. Unlike the other comprehension measures, the Passage Comprehension subtest uses a cloze technique in which the participant reads one or more sentences and fills in a missing word. Such a task places particular demands on word reading, which is a relative strength of poor comprehenders.

General Discussion

Consistent with previous studies, the results of our study indicate that children with specific problems in reading comprehension (i.e., poor comprehenders) have deficits in more general language comprehension. The results also suggest that these deficits may be present from the early school grades, although they may not always be clinically apparent. Furthermore, our results indicate that poor comprehenders are differentiated from poor decoders, both concurrently and retrospectively, on the basis of the language comprehension deficits and their strengths in word reading and phonological processing. However, our findings indicate that poor comprehenders and poor decoders may be less clearly differentiated on the basis of reading comprehension in the early grades. As discussed above, this may be due to the changing nature of reading comprehension. Nevertheless, these findings are problematic for a classification system intended to place poor readers in subgroups on the basis of reading comprehension. That is, such a system might lead to the identification of poor comprehenders (or poor decoders) at one grade that may not have the same reading profile at another grade.

Rather than classify readers on the basis of reading comprehension, our results suggest that they should be classified according to a system derived from the simple view of reading (Catts, Hogan, & Fey, 2003). This system would categorize readers in terms of their strengths and weaknesses in word recognition and language comprehension (see Figure 7). According to this approach, poor readers or children at risk for reading problems are classified in terms of abilities in word recognition and language comprehension. Children with deficits in word recognition, but normal language comprehension, are classified as having *dyslexia* in this system. This classification is consistent with the view that dyslexia represents a specific deficit in word reading (Lyon et al., 2003). The classification system also recognizes children who have problems in language comprehension, but not decoding. The term *specific comprehension deficit* is used here to refer to these children.

Figure 7. Classification system based on the simple view of reading.



This term seems more appropriate than *poor comprehender* because the latter has traditionally been applied to children with specific deficits in reading comprehension. As we have shown, some children who eventually are classified as poor comprehenders may not show difficulties in reading comprehension in the early grades. These children, however, most likely will have deficits in language comprehension across grades. The classification system also includes a category of children who have problems in both word recognition and language comprehension. These children are referred to as having a *mixed deficit*.

Although four categories are identified in the above system, it is likely that the strengths and weaknesses of poor readers are more dimensional than categorical in nature. Figure 7 is best conceived of as a two-dimensional space in which poor readers are distributed throughout. As such, the magnitude of the differences among poor readers in different categories may vary and some poor readers within a given category will be more characteristic of the category than others. Bishop and Snowling (2004) have also posited a similar dimensional model to differentiate dyslexia and SLI (cf. Catts et al., 2005).

A classification system that is based on the simple view has the additional advantage of more direct implications for intervention. Classifying poor readers or children at risk for reading disabilities on the basis of their strengths and weaknesses in language comprehension and word reading could lead to more effective intervention strategies. To be more specific, children with deficits in word recognition, but normal language comprehension (i.e., those with dyslexia), would receive intervention that is focused on improving decoding and word-reading skills (Lovett, Lacerenza, & Borden, 2000; Torgesen, Al Otaiba, & Grek, 2005). Other children may have adequate or better word-reading skills but have problems in language comprehension (i.e., children with specific comprehension deficit). Intervention for these children should focus on teaching language knowledge and comprehension strategies (Swanson & Deshler, 2003; Westby, 2005). Still other children will have problems in both areas and will need more comprehensive intervention that includes strategies that target both word reading and language comprehension.

Finally, this classification system also provides some guidance for early identification and intervention. Because classification is based on language comprehension skills and word-reading abilities, both of which have identifiable precursors in kindergarten (Catts et al., 2001; Storch & Whitehurst, 2002), intervention could be initiated before children begin formal reading instruction. Our results and those of others (Nation et al., 2004) suggest that to be maximally effective, early identification procedures may need to be sensitive to subclinical as well as clinical cases of language impairment. By addressing reading-related problems prior to the development of reading comprehension deficits, practitioners may be able to eliminate or reduce the severity of these problems.

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