

# The relationship between language and reading

## *Preliminary results from a longitudinal investigation*

Hugh W. Catts<sup>1</sup>, Marc E. Fey<sup>2</sup> and Kerry Proctor-Williams<sup>2</sup>

From the <sup>1</sup>University of Kansas, Lawrence, KS, <sup>2</sup>University of Kansas Medical Center, Kansas City, KS, USA

Log Phon Vocol 2000; 25: 3–11

This longitudinal study investigated the relationship between language and reading from three perspectives. First, we examined the reading and writing outcomes of children identified with spoken language impairments (LIs). Second, the early language abilities of children identified as poor readers were investigated. Finally, reading and language abilities were treated as continuous variables and the developmental relationship between them was studied. In general, the results indicated that language abilities (both phonological processing and oral language) significantly contributed to achievement in the early stages of reading (2nd grade) and had an even stronger effect as children acquired greater reading proficiency (4th grade).

*Key words:* reading development, reading disabilities, phonological awareness, language impairment.

*Hugh W. Catts, 3031 Dole Bld., University of Kansas, Lawrence, KS 66045, USA. E-mail: catts@dole.lsi.ukans.edu*

The importance of reading and other literacy skills in today's society is widely acknowledged (25). Whereas these skills are in part the result of direct instruction, they also appear to be strongly influenced by language development and disorders (11). Over the last few decades, researchers have sought to provide an understanding of the relationship between literacy and language development (6, 13, 30, 31). This work has been approached from several different perspectives. One approach has been to examine the reading and writing outcomes of children identified as having language impairments (LIs) (1, 4, 8, 17, 19, 24, 27). In another approach, researchers investigated the language abilities of children identified as poor readers (16, 30). In a third approach, reading and language abilities were treated as continuous variables and the developmental relationship between these abilities was examined (31). In this paper, we will present data from an ongoing longitudinal study in which we have examined the relationship between reading and language abilities from each of these perspectives. We begin with a brief description of our project.

### A LONGITUDINAL STUDY OF LANGUAGE AND READING

Over the last few years, we have followed a large group of children from kindergarten (mean age 5.6

years) through 4th grade (mean age 8.6 years). The participants originally took part in an epidemiologic study of LI in children (28). This epidemiologic investigation utilized a stratified cluster sample of 7218 kindergarten children. This normative sample was stratified by residential setting (i.e. rural, urban, suburban) and cluster sampled by school building. All available kindergarten children in selected schools were screened for LI. Children who failed the screening and a random sample who passed it were given a diagnostic battery of language, cognitive and early literacy measures. The results of this assessment were used to estimate the prevalence of LI in kindergarten children (28). Upon completion of the epidemiologic study, those children who received the diagnostic battery were solicited to participate in a follow-up longitudinal investigation conducted by the Child Language Research Center (CLRC), a federally funded center for the study of LI in children. Because the primary purpose of the center is the study of LI in children, the CLRC sample included a larger proportion of children with LI than is found in the general population.

Data concerning the language, cognitive, and early literacy abilities of all participants in kindergarten were available from the epidemiologic study. Participants were given a follow-up assessment in the 2nd and 4th grade. This assessment included tests of oral

language, phonological processing, and non-verbal IQ. In addition, reading and writing abilities were assessed. The latter involved students writing a narrative in response to a set of pictures. Information concerning the test battery is presented in Table 1. For further information, see Catts *et al.* (9) or Tomblin *et al.* (28).

#### READING AND WRITING OUTCOMES IN CHILDREN WITH LI

One of the primary purposes of our research has been the investigation of the reading and writing

outcomes of children with LI. Included in the CLRC sample were 225 children who had been identified as having an LI in kindergarten. These children performed at least 1.25 SD below the mean on at least 2 of 5 composite language scores. These composite scores represented vocabulary, grammar, narrative, expressive, and receptive language abilities. These children had normal hearing and no history of mental retardation, emotional disorders, or frank neurological signs (see Tomblin *et al.* (28) for a further description of LI children). For our most current analyses, we have complete data on the 2nd and 4th grade reading outcomes of

Table 1. *Tests administered in the longitudinal study.*

	Kindergarten <sup>a</sup>	2nd grade	4th grade
<i>Language measures</i>			
Test of Language Development-2:P			
Picture vocabulary	X		
Oral vocabulary	X		
Grammatical closure	X		
Grammatical understanding	X		
Sentence imitation	X		
Word articulation	X		
Narrative story task (12)	X		
Clinical Evaluation of Language Fundamentals-III			
Sentence structure		X	X
Concepts and directions		X	X
Word structures		X	X
Recalling sentences		X	X
Listening to paragraphs		X	X
Peabody Picture Vocabulary Test—revised		X	X
Comprehensive receptive and expressive vocabulary test			
Expressive vocabulary		X	X
Narrative production task		X	X
<i>Phonological processing</i>			
Deletion task	X	X	X
Rapid naming of animals task	X	X	X
<i>Reading and writing measures</i>			
Woodcock Reading Mastery Tests—revised			
Letter identification	X		
Word identification		X	X
Word attack		X	X
Passage comprehension		X	X
Gray Oral Reading Test—3		X	X
Diagnostic Achievement Battery-2			
Reading comprehension		X	X
Test of word/non-word reading efficiency			X
Test of written spelling		X	X
Narrative writing task		X	X
<i>Cognitive measures</i>			
Wechsler Preschool and Primary Scale of Intelligence—revised			
Block design		X	
Picture completion		X	
Wechsler Intelligence Scale for Children—III			X
Performance scale			

<sup>a</sup> Kindergarten testing from the Epidemiological Study of Language Impairments (27).

Table 2. Mean score (and standard deviations) of reading achievement in the 2nd and 4th grade for N and LI groups.

	Word recognition		Reading comprehension	
	2nd grade	4th grade	2nd grade	4th grade
N ( $n = 246$ )	101.9 (13.7)	101.4 (13.3)	102.6 (12.9)	101.9 (12.6)
LI ( $n = 178$ )	87.9 (8.9)	88.3 (10.8)	84.6 (7.6)	84.5 (8.8)

178 children with LI and of 246 typically developing children. Table 2 displays the means and the SDs of reading achievement for the children with LI and for those with normal language development (N) in the 2nd and 4th grade. Reading achievement was based on composite scores for word recognition and reading comprehension. These scores were standardized using weighted values that reflected the degree to which children in our sample were more or less likely to have been sampled from the 7218 children who took part in the earlier epidemiologic study. Data are presented here in terms of standard scores with a mean of 100 and a SD of 15. Results indicated that the children with LI had significantly lower scores in reading achievement in the 2nd and 4th grade than did children with no history of the condition.

Reading outcomes were also examined in relationship to the domain (vocabulary, grammar, narration) and modality (receptive, expressive) of kindergarten LIs. By our definition, most children with LI had deficits in more than one language domain. Some children, however, had primary deficits in one domain or another. Among these children, those with primary deficits on grammatical measures ( $n = 29$ ) had lower reading achievement scores than those with primary deficits on vocabulary ( $n = 16$ ) or narrative measures ( $n = 22$ ). These differences in reading outcome, however, were small and not statistically significant. In the case of language modality, most children with LI had deficits in both expressive and receptive language abilities ( $n = 88$ ). Some had primary deficits in either expressive ( $n = 46$ ) or receptive language ( $n = 43$ ). No significant differences in reading outcome were found between the latter two subgroups. However, these subgroups performed significantly better in the 2nd and 4th grade reading comprehension (but not word recognition) than did children with deficits in both receptive and expressive language.

We also subgrouped children with LI into those with specific (SLI) and non-specific language impairments (NLI) based on the presence or absence of concomitant deficits in non-verbal abilities. Traditionally, this distinction has been an important

one in both research and clinical practice (1, 4, 15). Thus, data on the reading outcomes of children with SLI and NLI could have both theoretical and policy implications. In our primary analyses, we used a cut-off approach that identified non-verbal deficits as a performance of at least 1 SD below the mean on a composite standard score derived from the Block Design and Picture Completion subtests of the Wechsler Preschool and Primary Scale of Intelligence—Revised (32). As seen in Table 3, children with NLI had poorer reading outcomes in the 2nd and 4th grade than did those with SLI. Multivariate Analysis of Variance (MANOVA) and follow-up comparisons indicated that children with NLI performed significantly less well in reading than did those with SLI, who, in turn, scored significantly less well than did children with normal language in kindergarten. A second approach, which used a regression analysis to predict language score based on non-verbal IQ, was also employed to identify children with SLI and NLI. Results achieved with this procedure were essentially the same as those found using the cut-off approach.

Another way of examining the reading outcomes of children with SLI and NLI is to calculate the percentages of these children who were poor readers in the 2nd and 4th grade. For the purpose of this analysis, a poor reader was defined as a child who scored at least 1 SD below the mean in reading comprehension. Fig. 1 shows that children with SLI in kindergarten were approximately 4–5 times more likely to be poor readers in the 2nd and 4th grade than children without a history of LI, whereas children with NLI in kindergarten were 7–8 times more likely to be poor readers.

These results, combined with the data shown in Table 3, appear to lend support for the role of non-verbal abilities in reading achievement. While, at first glance, the subgroup data seem to indicate that non-verbal skills are closely related to reading outcome in children with LI, this relationship is confounded somewhat by language abilities. Children with NLI in kindergarten had significantly lower language abilities (mean language composite  $z$ -score =  $-1.87$ ) than did children with SLI ( $z$ -

Table 3. *Mean score (and standard deviations) of reading achievement in the 2nd and 4th grade for LI subgroups.*

	Word recognition		Reading comprehension	
	2nd grade	4th grade	2nd grade	4th grade
SLI ( $n = 99$ )	90.8 (13.2)	92.0 (14.8)	87.5 (10.8)	87.4 (12.3)
NLI ( $n = 79$ )	83.5 (14.5)	81.6 (18.8)	79.5 (15.0)	78.6 (14.6)

score =  $-1.54$ ). In addition, children with NLI showed less change in language abilities from kindergarten to the 2nd grade (mean change in  $z$ -score =  $0.16$ ) than did children with SLI (mean change =  $0.51$ ). Both groups showed essentially no mean change in language composite scores from the 2nd to the 4th grade. Language factors, however, do not completely explain the observed relationship between non-verbal abilities and reading achievement. Hierarchical multiple regression analyses indicated that, in children with LI, kindergarten non-verbal abilities accounted for a small but significant amount of the variance (5%) in 2nd grade reading comprehension after removing the effects of kindergarten language abilities, as well as the effects of change in language abilities from kindergarten to the 2nd grade.

Additional findings highlighted the relationship between change in language development, specifically LI status, and reading achievement. These results showed that children with LI in kindergarten who no longer met the diagnostic criterion for LI in the 2nd grade (Table 4) had significantly better reading outcomes than did children who continued to meet this criterion. The former children did, however, have reading achievements scores that were significantly lower than those of children without a history of LI. Similar results were found when using SLI and NLI subgroups or when change in language status from kindergarten to 4th grade was considered.

Tables 2–4 generally show that the reading achievement scores of children with LI were consistent from the 2nd to the 4th grade. We actually anticipated that reading scores, particularly reading comprehension scores, might decline over this period for children with LI. By the 4th grade, tests of reading comprehension begin to rely less on word recognition and more on language skills (14). Thus, children with LI might be expected to have greater difficulties in reading comprehension in the 4th than in the 2nd grade. While there was no evidence of a systematic decline in reading comprehension scores between the 2nd and 4th grade, such a decline might still be observed in later grades.

### *Writing outcomes*

Besides data on reading outcomes, we also obtained data on writing outcomes in the 2nd and 4th grade. Each participant wrote a short narrative, which was elicited through presentation of a series of pictures. At present, we have completed some initial analyses on the 2nd grade narratives for all participants. These analyses have focused primarily on variables related to productivity and grammatical complexity. Our results showed that children with LI in kindergarten wrote significantly shorter stories and made more grammatical errors per sentence than did children with no history of LI. Children with LI did not differ significantly from children with typical language in either mean length of utterance in words (MLU) or clausal density. For the most part, children with SLI and NLI did not differ significantly on the writing measures we have considered so far. Finally, we compared the written narratives of LI children who did or did not meet the criterion for LI in the 2nd grade. Those meeting the criterion in both kindergarten and the 2nd grade had significantly lower MLUs, less clausal density, and made more grammatical errors per sentence than did children who were LI in kindergarten but not in the 2nd grade. The children, nevertheless, wrote significantly shorter narratives, and made significantly more grammatical errors per sentence than did children with no history of LI.

### *Language abilities of poor readers*

To further examine the relationship between reading and language abilities, we investigated the kin-

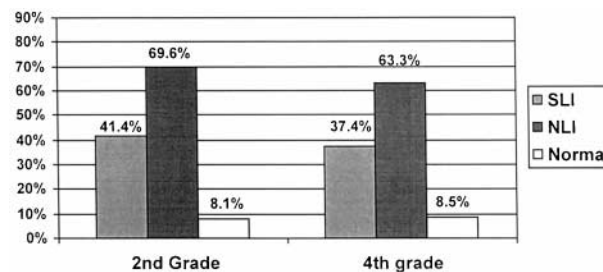


Fig. 1. Percentage of poor readers among children with SLI, NLI, and normal language development.

Table 4. Mean score (and standard deviations) on measures of reading achievement of children with LI according to 2nd grade language status.

	Word recognition		Reading comprehension	
	2nd grade	4th grade	2nd grade	4th grade
LI in kindergarten and 2nd grade ( $n = 107$ )	83.9 (14.4)	84.1 (18.7)	79.7 (11.6)	79.5 (14.4)
LI in kindergarten but not 2nd grade ( $n = 71$ )	93.1 (12.0)	92.3 (13.9)	90.4 (9.6)	89.5 (10.5)

dergarten language abilities of children identified as poor readers in the 2nd and 4th grade. For the purposes of this analysis, a poor reader was defined as a child scoring at least 1 SD below the mean on a composite measure of reading comprehension. To date, our analyses have focused primarily on 2nd grade poor readers (see Catts *et al.* (9)). Our study of poor readers had several advantages over many previous studies. First, we were able to examine the language abilities of poor readers at a time prior to the emergence of their reading problems. Many previous studies have been limited in their conclusions by the concurrent investigation of reading and language abilities. A second strength of our study was the availability of a large, well-defined sample of children from which to identify poor readers. Although our sample was not randomly selected, data from the epidemiologic sample from which it was drawn allowed us to weight our results to ensure that they would be representative of good and poor readers from the general population. Furthermore, this sample allowed us to examine children with a broad range of cognitive abilities. Children with below-average IQs ( $< 80$  or  $90$ ) have often been systematically excluded from investigations of poor readers (e.g. (21, 30)). This practice can have a significant effect on results concerning the language basis of reading disabilities, because most IQ tests tap verbal abilities. By using a sample with a broad range of cognitive abilities, like that found in the general population, we were able to better estimate the contributions of language problems to reading disabilities.

Our findings concerning poor readers are consistent with those of others (5, 7, 13, 26) in demonstrating deficits in phonological awareness and rapid naming (see Table 5). In addition, however, we showed that a history of problems in a variety of other language abilities was also common in poor readers (also see Lombardino *et al.* (16) and Velluntino *et al.* (30)). Poor readers differed significantly from good readers on tests of vocabulary, grammar, and narration (Table 5). For the purposes of this discussion, the latter tests are referred to as measures of oral language and are distin-

guished from tests of phonological processing (i.e. phonological awareness, rapid naming).

We further calculated the percentage of poor readers who had kindergarten deficits in phonological processing alone, oral language (e.g. vocabulary, grammar, narration) alone, both areas, or neither area. In this analysis, a deficit was defined as performance of at least 1 SD below the mean in a given area. Fig. 2 shows that the largest portion of poor readers had deficits in both phonological and oral language processing.

#### Subgroups of poor readers

We also examined the kindergarten language abilities of poor readers, defined on the basis of word recognition deficits. The investigation of poor readers classified in this manner was of interest because word recognition is believed to be more closely related to phonological processing and to be less dependent on oral language abilities than is reading comprehension. Our results, however, were very similar to those found for children with poor reading comprehension. One reason for this similarity was the overlap of these two groups of poor readers. In the 2nd grade, 77% of children who met the criterion for poor word recognition also met the criterion for poor reading comprehension, while 66% of those who met the criterion for poor reading comprehension also met it for poor word recognition. We anticipated that there would be less overlap between these groups of poor readers in the

Table 5. Mean score (and standard deviations) of good and poor readers on measures of phonological processing and oral language in kindergarten.

	Good readers ( $n = 421$ ) Mean (SD)	Poor readers ( $n = 184$ ) Mean (SD)
Phonological Awareness	102.6 (14.2)	86.6 (8.7)
Rapid Naming	102.9 (14.0)	87.3 (15.9)
Vocabulary	103.1 (14.8)	88.1 (10.9)
Grammar	104.0 (14.5)	83.8 (11.0)
Narrative	101.8 (14.9)	87.4 (14.8)

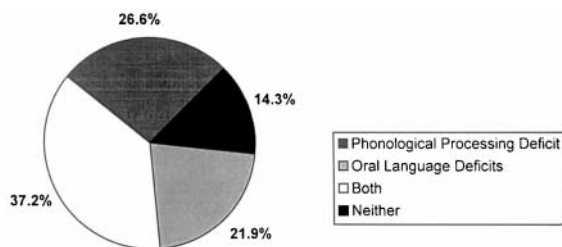


Fig. 2. The proportions of poor readers with deficits in phonological process, oral language, both or typical language in kindergarten.

4th grade. Our preliminary results showed this to be the case: 62% of children with poor word recognition also met our criterion for poor reading comprehension, while 55% of poor comprehenders were also poor in word recognition. Still, when treated as partially overlapping groups, children with poor reading comprehension in the 4th grade had similar language abilities in kindergarten to those with poor word recognition. We further divided our 4th graders into those with reading comprehension deficits (below the 25th percentile) and normal word recognition (above the 40th percentile) versus those with word recognition deficits (below the 25th percentile) and normal reading comprehension (above the 40th percentile). Our preliminary results indicated that children with primarily reading comprehension problems ( $n = 44$ ) performed significantly less well on kindergarten measures of oral language than did those with primarily word recognition deficits ( $n = 22$ ). No significant differences, however, were observed between these subgroups in kindergarten measures of phonological processing.

We also examined the stability of reading problems from the 2nd to the 4th grade. Our results showed that 62% of children identified as poor readers (on the basis of reading comprehension) in the 2nd grade met the poor reader criterion in the 4th grade. When poor readers were defined in terms of word recognition deficits, 72% showed consistent problems in both the 2nd and the 4th grade. Further analyses indicated that poor readers with lower

IQs (non-discrepant poor readers) had a somewhat higher rate of stability of reading problems from the 2nd to the 4th grade than did poor readers with higher IQs (IQ-discrepant poor readers). The rates of stability that we observed in reading problems in the early school grades are similar to or somewhat higher than those reported by other investigators (3, 20, 22, 23). Consistent with our findings concerning stability, we found that 2nd grade reading achievement was a good predictor of 4th grade reading achievement in poor readers ( $r = 0.71$ ). In addition, we found that 2nd grade measures of the oral language composite score ( $r = 0.44$ ), phonological awareness ( $r = 0.47$ ), rapid naming ( $r = 0.37$ ), and non-verbal IQ ( $r = 0.46$ ) were moderately related to 4th grade reading comprehension in poor readers. However, only the 2nd grade oral language composite score accounted for unique variance in 4th grade reading comprehension (2.6%) beyond that predicted by 2nd grade reading comprehension. Such a finding suggests that the relationship between oral language and reading comprehension changes between the 2nd and the 4th grade.

## PREDICTING READING ACHIEVEMENT

We also investigated the continuous relationship between reading and language abilities across our entire sample of children. In this analysis, data were weighted in order to ensure that they were representative of good and poor readers from the general population (see Catts *et al.* (9)). Multiple regression analyses were employed to determine the relative contributions of kindergarten measures of phonological processing, oral language abilities, and non-verbal skills in predicting 2nd and 4th grade reading achievement. As shown in Table 6, the best kindergarten predictor of 2nd grade reading comprehension was the oral language composite score. Measures of phonological awareness, rapid naming, and non-verbal IQ each explained additional unique variance in reading comprehension. In the case of 2nd grade word recognition, the oral language com-

Table 6. Stepwise regression analyses between 2nd grade reading achievement and kindergarten measures.

	Word recognition		Reading comprehension	
	$R^2$	$R^2$ change	$R^2$	$R^2$ change
1. Oral language	0.332		0.490	
2. Phonological Awareness	0.410	0.077	0.531	0.041
3. Rapid naming	0.429	0.020	0.558	0.027
4. Nonverbal IQ	0.432	—	0.571	0.013

posite score again was the best kindergarten predictor. Phonological awareness and rapid naming accounted for unique variance in word recognition over and above that explained by oral language. Non-verbal IQ did not account for a significant amount of unique variance in word recognition. When we broke the oral language composite score into its individual components (vocabulary, grammar, narration), our results showed that the grammar component provided most of the predictive power. Measures of grammar from the Test of Language Development-2:P accounted for approximately the same amount of variance in 2nd grade reading comprehension (48%) as the oral composite score and even more of the variance in 2nd grade word recognition (38.5%) than the language composite score. Measures of vocabulary and narration accounted for less variance than did those for grammar when entered as the first variable in the regression analysis of 2nd grade reading comprehension (35.5 and 22.9%, respectively) and word recognition (23.2 and 13.5%, respectively).

To further examine the relative contributions of kindergarten predictors, hierarchical multiple regression analyses were carried out. In these analyses, phonological processing and non-verbal IQ were entered first and followed by the oral language composite score. Results showed that even when entered as the last variable, oral language accounted for a significant amount of unique variance in 2nd grade reading comprehension (10%) and word recognition (4%) (see Catts *et al.* (9)). We also conducted regression analyses on a portion of the data for 4th grade reading achievement. These results were quite similar to those for the 2nd grade. The only noteworthy difference was that our kindergarten measure of phonological awareness was the best predictor of 4th grade word recognition (28.9%). The oral language composite and rapid naming measures each explained additional unique variance in word recognition (6.6 and 2.8%, respectively).

In another set of analyses, we examined if the relationship between language abilities and reading achievement changed from the 2nd to the 4th grade (10). In these analyses, we used multiple regression procedures that included an autoregressor (18, 29). Specifically, we asked if phonological processing and/or oral language abilities would account for unique variance in 4th grade reading achievement over and above that explained by the autoregressive effects of 2nd grade reading achievement. Our results indicated that oral language accounted for 5% of the unique variance in reading comprehension over and above the autoregressor (2nd grade reading comprehension). Because the autoregressor included the influence of earlier oral language abilities on reading comprehension,

the observation of additional variance accounted for by oral language abilities suggests that these abilities have an increasing effect on reading comprehension. Finally, similar analyses for word recognition showed that only phonological awareness accounted for unique variance, but this variance was quite limited (< 1%) and only applied for the word attack test.

## CONCLUSION

Our results indicate that reading and writing abilities are clearly related to language development. Like those of others, our findings show that phonological processing plays an important role in literacy development. However, our results demonstrate that language abilities involving vocabulary, grammar, and narration also contribute to reading achievement in significant ways. While the latter abilities exert influence on reading right from the beginning stages, they appear to have an even greater effect as children acquire more reading proficiency. We plan to follow the CLRC sample through the remaining school years in order to better understand the relationship between language and reading abilities.

## ACKNOWLEDGEMENTS

This study was supported by a grant from the National Institute of Deafness and Other Communication Disorders (1-P50-DC02726-04). The completion of this study was aided considerably by a valuable research team comprising the following: Paula Buckwalter, Marlea O'Brien, Connie Ferguson, Jodi Schwartz, and Amy Kundel.

## REFERENCES

1. Aram D, Morris R, Hall N. The validity of discrepancy criteria for identifying children with developmental language disorders. *J Learn Disabil* 1992; 25: 549–54.
2. Aram D, Nation J. Preschool language disorders and subsequent language and academic difficulties. *J Commun Disord* 1980; 13: 159–79.
3. Badian NA. Reading disability defined as a discrepancy between listening and reading comprehension: a longitudinal study of stability, gender differences, and prevalence. *J Learn Disabil* 1999; 32: 138–49.
4. Bishop D, Adams C. A prospective study of the relationship between specific language impairment, phonological disorders and reading retardation. *J Child Psychol Psychiatry* 1990; 21: 1027–50.
5. Bowers P, Wolf M. Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Read Writ: Interdiscip J* 1993; 5: 69–85.
6. Brady S, Shankweiler D. Phonological processing in literacy. Erlbaum, NJ: Hillsdale, 1991.
7. Bradley L, Bryant P. Categorizing sounds and learning to read: a causal connection. *Nature* 1983; 30: 419–21.

8. Catts HW. The relationship between speech-language impairments and reading disabilities. *J Speech Hear Res* 1993; 36: 948–58.
9. Catts HW, Fey ME, Tomblin JB, Zhang X. Reading outcomes of children with language impairments. Poster to be presented at the annual convention of the American Speech-Language-Hearing Association, San Francisco, CA; 1999.
10. Catts HW, Fey ME, Zhang X, Tomblin JB. Language basis of reading disabilities: evidence from a longitudinal investigation. *Sci Stud Read* 1999; 3: 331–61.
11. Catts HW, Kamhi AG. Language and reading disabilities. Needham Heights: Allyn & Bacon, 1999.
12. Culatta B, Page J, Ellis J. Story retelling as a communicative performance screening tool. *Lang Speech Hear Serv Sch* 1983; 14: 66–74.
13. Fletcher JM, Shaywitz SE, Shankweiler DP, Katz L, Liberman IY, Stuebing KK, Francis DJ, Fowler AE, Shaywitz BA. Cognitive profiles of reading disability: comparisons of discrepancy and low achievement definitions. *J Educ Psychol* 1994; 86: 6–23.
14. Hoover W, Gough P. The simple view of reading. *Read Writ: Interdiscip J* 1990; 2: 127–60.
15. Lahey P. Who shall be called language disordered? Some reflections and one perspective. *J Speech Hear Disord* 1990; 55: 612–20.
16. Lombardino LJ, Riccio CA, Hynd GW, Pinheiro SB. Linguistic deficits in children with reading disabilities. *Am J Speech-Lang Pathol* 1997; 6: 71–8.
17. Magnusson E, Naucler K. The development of language and linguistic awareness in language disordered and normally speaking children as related to reading and spelling acquisition. *Prakt Lingvist* 1989; 13: 13–30.
18. Manis FR, Seidenberg MS, Doi LM. See Dick RAN: Rapid naming and longitudinal prediction subskills in first and second graders. *Sci Stud Read* 1999; 3: 129–58.
19. Menyuk P, Chesnick M, Liebergott J, Korngold B, D'Agostino R, Belanger A. Predicting reading problems in at-risk children. *J Speech Hear Res* 1991; 34: 893–903.
20. Scarborough H. Predicting future achievement of second graders with reading disabilities: contributions of phonemic awareness, verbal memory, rapid naming, and IQ. *Ann Dyslexia* 1998; 48: 115–36.
21. Shankweiler D, Crain S, Katz L, Fowler AE, Liberman AM, Brady SA, Thornton R, Lundquist E, Dreyer L, Fletcher JM, Stuebing KK, Shaywitz SE, Shaywitz BA. Cognitive profiles of reading-disabled children: comparison of language skills in phonology, morphology, and syntax. *Psychol Sci* 1995; 6: 149–56.
22. Share DL, Silva PA. The stability and classification of specific reading retardation: a longitudinal study from 7 to 11. *Br J Educ Psychol* 1986; 56: 32–9.
23. Shaywitz SE, Escobar M, Shaywitz B, Fletcher J, Makuch R. Evidence that dyslexia may represent the lower tail of a normal distribution of reading ability. *New Engl J Med* 1992; 326: 145–50.
24. Silva PA, McGee R, Williams S. Developmental language delay from three to seven years and its significance for low intelligence and reading difficulties at age seven. *Dev Med Child Neurol* 1983; 25: 783–793.
25. Snow CE, Burns S, Griffin P. Preventing reading difficulties in young children. Washington, DC: National Academy Press, 1998.
26. Stanovich KE, Siegel LS. The phenotypic performance profile of reading-disabled children: a regression-based test of the phonological-core-variable-difference model. *J Educ Psychol* 1994; 86: 24–53.
27. Tallal P, Curtiss S, Kaplan R. The San Diego longitudinal study: evaluating the outcomes of preschool impairment in language development. Final Report. NINCDS; 1989.
28. Tomblin JB, Records NL, Buckwalter P, Zhang X, Smith E, O'Brien M. Prevalence of specific language impairment in kindergarten children. *J Speech Lang Hear Res* 1997; 40: 1245–60.
29. Torgesen J, Wagner R, Rashotte C, Burgess S, Hecht S. Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second- to fifth-grade children. *Sci Stud Read* 1997; 1: 161–85.
30. Vellutino F, Scanlon D, Small S, Tanzman M. The linguistic bases of reading disability: converting written to oral language. *Text* 1991; 11: 99–133.
31. Wagner RK, Torgesen JK, Rashotte CA, Hecht SA, Barker TA, Burgess SR, Donahue J, Garon T. Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: a 5-year longitudinal study. *Dev Psychol* 1997; 33: 468–79.
32. Wechsler D. Wechsler Preschool and Primary Scale of Intelligence—revised. New York: Psychological Corporation, 1989.

## SAMMANFATTNING

### *Samband mellan läsning och språklig förmåga*

En stor grupp förskolebarn med och utan språkstörning följs upp och har nu testats i åk 2 och åk 4. Syftet är att undersöka sambanden mellan läsning (och skrivning) och språklig förmåga. Detta görs utifrån tre olika aspekter;

- läs- och skrivutvecklingen hos barn med diagnostiserad språkstörning
- språklig förmåga i förskoleåldern hos barn som är dåliga läsare i åk 2
- språkutveckling i tal och skrift, dvs. ömsesidig påverkan.

Från förskoletiden fanns data om språklig förmåga och kognitiv nivå. I de uppföljande testningarna i åk 2 och åk 4 prövades språklig förmåga (ordförråd, grammatik och berättande), fonologiskt processande (fonologisk medvetenhet och rapid naming), icke-verbal IQ samt läs- och skrivförmåga.

I både åk 2 och åk 4 var den språkstörda gruppen signifikant sämre både ifråga om ordigenkänning (avkodning) och läsförståelse (tabell 2), framför allt de som hade grammatiska problem i förskoleåldern. Barn med *både* expressiv och impressiv språkstörning hade sämre läsförståelse.

Den språkstörda gruppen delades in i specifikt språkstörda (SLI) och icke-specifikt språkstörda



(NLI). NLI-gruppen läste signifikant sämre i både åk 2 och 4 än SLI-gruppen, vilken i sin tur läste signifikant sämre än en jämnårig grupp utan språkliga problem (tabell 3). Figur 1 visar att SLI-gruppen löper 4–5 ggr större risk och NLI-gruppen 7–8 ggr större risk än normalgruppen att bli dåliga läsare. Att risken för NLI-gruppen är så mycket större beror inte bara på deras ”övriga svårigheter”. Deras språkliga prestationer i förskolan var signifikant sämre än SLI-gruppens.

De språkstörda barn som kommit över sina språkliga problem i åk 2 eller 4 hade signifikant bättre läsresultat än de med kvarstående problem, men läste ändå signifikant sämre än de normal-språkiga (tabell 4).

Utgår man från alla dåliga läsare i åk 2 och undersöker deras språkliga prestationer i förskolan visar de sig inte oväntat ha haft dåliga resultat på både fonologiskt processande och ordförråd, grammatik och berättande (tabell 5, figur 2). Inte förrän i åk 4 kunde man se att barn med övervägande läs-förståelseproblem hade haft signifikant större språkliga problem än de med enbart avkodningsproblem.

När man slutligen försöker förutsäga läsförmåga i åk 2 utifrån förskoledata framstår språklig, framför allt grammatisk, förmåga som den viktigaste prediktorn. Fonologisk medvetenhet bidrar också (tabell 6). Resultaten från den analys som påbörjats i åk 4 pekar i samma riktning. Enda undantaget hittills är att fonologisk medvetenhet i förskolan bäst förutsäger ordigenkänning. Det tycks också som om språklig förmåga i förskolan spelar en viktigare roll för läsförståelsen ju högre upp i skolan man kommer.

## YHTEENVETO

### *Lukemisen ja ymmärtämisen välinen yhteys*

Seurataan esikouluiästä edelleen suurta ryhmää kielihäiriöisiä ja normaalilapsia. Nyt Heidät on testattu toisella ja neljännellä luokalla. Tarkoituksena on selvittää lukemisen ja kielellisen kyvykkyyden yhteyttä. Kysymystä lähestytään kolmesta suunnasta:

- lukemisen ja kirjoittamisen kehittyminen
- esikouluiän kielellinen kyvykkyys toisella luokalla huonoiksi lukijoiksi osoittautuneilla
- kielenkehitys puheessa ja kirjoituksessa

Esikouluiässä oli testattu kielen ja kognitioiden taso. Seurantatutkimuksissa tutkittiin kielen taso (sanavarasto, kielioppi, kertova puhe), fonologinen prosessointi (fonologinen tietoisuus, nopea nimeäminen), ei-kielellinen ÄO sekä lukemis- ja kirjoitustaidot.

Seurannassa kielihäiriöryhmä selviytyi huomommin sanojen tunnistuksessa ja luetun ymmärtämisessä (taulukko 2), näin erityiset ne, joilla oli esikouluiässä kielioppiongelmia. Lapsilla, joilla oli sekä puheen tuottamisen että vastaanoton ongelma, oli huonompi luetun ymmärtäminen.

Kielihäiriöryhmä jaettiin erityis- (SLI) ja ei-erityis-vaikusryhmään (NLI). NLI -ryhmä luki huomommin kuin SLI -ryhmä, joka puolestaan luki huomommin kuin verrokkiryhmä (taulukko 3). Kuvasta 1 nähdään, että SLI ryhmä riski tulla huonoksi lukijaksi on 4–5 -kertainen ja NLI ryhmän 7–8 -kertainen verrokkeihin verrattuna. NLI ryhmän muut ja kielelliset vaikeudet olivat jo esikouluiässä suuremmat kuin SLI -ryhmällä.

Kielihäiriölapset jotka olivat selviytyneet kielellisistä vaikeuksistaan lukivat paremmin kuin huomommin kuntoutuneet, mutta he lukivat edellen huomommin kuin normaaliverrokot.

Seurannassa huonoiksi lukijoiksi osoittautuneilla oli esikouluiässä enemmän fonologian, sanavaraston, kieliopin ja kertovan puheen vaikeuksia (taulukko 5, kuva 2). Vasta neljännellä luokalla erottuivat luetun ymmärtämisvaikeuksien ja esikouluiän suurten kielellisten vaikeuksien yhteydet.

Toisen luokan lukutaidon ennustamisen kannalta on esikouluiäisen kieliopin hallinta merkittävin tekijä. Myös fonologinen tietoisuus myötävaikuttaa ennusteeseen (taulukko 6). Fonologinen tietoisuus ennustaa parhaiten myöhempää sanojen tunnistamisen tasoa. Kielellin kyvykkyys esikouluiässä näyttää olevan sen tärkeämpi lukemisen ymmärtämisen kehitykselle mitä ylemmälle luokka-astelle koulussa tullaan.