THE JOURNAL OF
CHILD PSYCHOLOGY AND PSYCHIATRY

Journal of Child Psychology and Psychiatry 49:4 (2008), pp 422–432 doi:10.1111/j.1469-7610.2007.01849.x

Improving early language and literacy skills: differential effects of an oral language versus a phonology with reading intervention

Claudine Bowyer-Crane,[1] Margaret J. Snowling,[1] Fiona J. Duff,[1] Elizabeth Fieldsend,[1] Julia M. Carroll,[2] Jeremy Miles,[3] Kristina Götz[1] and Charles Hulme[1]

[1]Department of Psychology, University of York; [2]Department of Psychology, University of Warwick; [3]Department of Health Sciences, University of York

Background: This study compares the efficacy of two school-based intervention programmes (Phonology with Reading (P + R) and Oral Language (OL)) for children with poor oral language at school entry. **Methods:** Following screening of 960 children, 152 children (mean age 4;09) were selected from 19 schools on the basis of poor vocabulary and verbal reasoning skills and randomly allocated to either the P + R programme or the OL programme. Both groups of children received 20 weeks of daily intervention alternating between small group and individual sessions, delivered by trained teaching assistants. Children in the P + R group received training in letter-sound knowledge, phonological awareness and book level reading skills. Children in the OL group received instruction in vocabulary, comprehension, inference generation and narrative skills. The children's progress was monitored at four time points: pre-, mid- and post-intervention, and after a 5-month delay, using measures of literacy, language and phonological awareness. **Results:** The data are clustered (children within schools) and robust confidence intervals are reported. At the end of the 20-week intervention programme, children in the P + R group showed an advantage over the OL group on literacy and phonological measures, while children in the OL group showed an advantage over the P + R group on measures of vocabulary and grammatical skills. These gains were maintained over a 5-month period. **Conclusions:** Intervention programmes designed to develop oral language skills can be delivered successfully by trained teaching assistants to children at school entry. Training using P + R fostered decoding ability whereas the OL programme improved vocabulary and grammatical skills that are foundations for reading comprehension. However, at the end of the intervention, more than 50% of at-risk children remain in need of literacy support. **Keywords:** Early intervention, oral language, phonological awareness, early literacy, RCT.

It is well established that phonological skills are fundamental to alphabetic literacy (Goswami & Bryant, 1990; Byrne, 1998). However, aspects of oral language ability beyond phonology provide the foundation for reading comprehension (Oakhill, Cain, & Bryant, 2003; Muter, Hulme, Snowling, & Stevenson, 2004). The Simple View of Reading (Gough & Tunmer, 1986) captures this differential role of different language skills in reading development. Within this framework, reading comprehension depends upon the interaction of decoding skill and linguistic comprehension. Individual differences in decoding ability are predicted by variations in letter knowledge and phoneme awareness (Bowey, 2005, for a review). In contrast, variations in linguistic comprehension depend upon a range of factors including vocabulary and grammatical abilities and resources such as attention. A similar distinction has been drawn by Whitehurst and Lonigan (1998) who differentiated two domains of emergent literacy: 'inside-out' skills (e.g., letter knowledge and phoneme awareness) and 'outside-in' skills (e.g., vocabulary and grammatical skills).

Building on the Simple View, Bishop and Snowling (2004) proposed a two-dimensional model of reading impairment with phonological skills lying on one dimension, and non-phonological skills (e.g., semantics and syntax) lying on the other. According to this model, the risk of word-level decoding difficulties in reading is carried by phonological deficits, whereas the risk of reading comprehension difficulties is associated with deficits in non-phonological language skills. Thus, there is a strong theoretical rationale for early years teaching to foster good speaking and listening skills (Rose, 2006) and, more specifically, for intervention programmes to target oral language skills in language-delayed children who are likely to be at risk of literacy problems.

The majority of research on reading intervention has been concerned with ameliorating word-level reading difficulties (Torgesen, 2005; Troia, 1999). Evidence indicates that interventions combining phonological training with reading are successful in facilitating reading development in poor readers (Gillon, 2000, 2002; Hatcher et al., 2006a; Hatcher,

Conflict of interest statement: No conflicts declared.

Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA

Hulme, & Ellis, 1994; Lovett, Warren-Chaplin, Ransby, & Borden, 1990; Iverson & Tunmer, 1993). In addition, studies aiming to prevent reading difficulties in at-risk groups have reported that training in phoneme level skills is effective (Borstrom & Elbro, 1997; Elbro & Peterson, 2004; Lundberg, 1994; Torgesen et al., 1999), though perhaps less so for children who carry a family risk of dyslexia (Hindson et al., 2005).

In contrast, there is a dearth of evidence regarding interventions for children at risk of reading comprehension difficulties because of delays and difficulties in vocabulary and grammatical processes, and little is known about preventing reading comprehension failure. A prediction that follows from the Simple View is that children who have oral language difficulties should benefit from interventions that promote linguistic comprehension as a foundation for reading comprehension. Such interventions might include training in receptive and expressive language skills.

The aim of the current study was to develop and evaluate the efficacy of two early intervention programmes to promote skills that underlie reading development: a phonology with reading programme (P + R which aimed to foster basic decoding competence) and an oral language programme (OL which aimed to strengthen the foundations of reading comprehension).

Following from the work of Hatcher et al. (1994), the P + R programme contained three key elements known to be robust early predictors of reading development: letter knowledge, phoneme awareness and reading practice. Direct teaching in sight word recognition was also included. In the absence of a significant evidence base regarding early intervention to foster the linguistic skills that underpin reading comprehension, the OL programme was designed to incorporate four key elements: vocabulary training, independent speaking, listening skills and narrative. The programme took account of the objectives for oral work in the UK National Literacy Strategy (DfES, 2001), and drew upon accepted good practice (Beck, McKeown, & Kucan, 2002; Fey & Proctor-Williams, 2000; Fey, Long, & Finestack, 2003; Weismer, 2000).

Given the contrasting content of the two intervention programmes, it was expected they would have differential effects, at least in the short term. By boosting letter knowledge and phoneme awareness, we predicted that the P + R programme would facilitate the development of word-level decoding skills in reading. In contrast, the aim of the OL programme was to enhance vocabulary and grammatical skills as precursors of reading comprehension.

Method

We conducted a randomised controlled trial (RCT) in which children were randomly allocated by the York Trials Unit to one of two 20-week intervention programmes: a Phonology with Reading Intervention (P + R), or an Oral Language Intervention (OL). Assessments were made at pre-test (*t1*), mid-test after 10 weeks (*t2*), post-test at the end of the 20-week intervention (*t3*) and five months after the intervention had ceased (*t4*). At *t4*, a sample of 564 children, drawn from 18 of the schools originally screened, were assessed on tests of single word reading. Ethical approval was obtained from the Ethics Committee, Department of Psychology, University of York and all assessments were carried out with informed consent from headteachers and parents where appropriate.

Participants

Details of the recruitment, selection, and allocation of the participants are summarised in Figure 1, in accordance with the CONSORT statement (Moher, Schulz, & Altman, 2001). Twenty-three mainstream schools were involved at the outset of the study. From these schools, every child was screened at school entry, in autumn 2004 (in the UK children enter school in the academic year in which they turn five).

Following screening, three schools were deemed unsuitable for continued involvement given the relatively high performance of their children on our language measures. In each of the remaining 20 schools, the 10 children with the lowest age-residualised scores on the Picture Naming sub-test from the *Wechsler Pre-School and Primary Scale of Intelligence-III^{UK} (WPPSI-III^{UK}*; Wechsler, 2003) were selected as possible candidates for intervention. To validate this initial selection, more extensive individual assessments were conducted with each of these children using further language measures, and each child's WPPSI Vocabulary and Word Reasoning scaled scores were averaged to form a verbal composite measure. The 8 children with the lowest scores on this verbal composite measure in each school were selected to receive intervention. Cut-points varied by school and ranged from a mean scaled score of 5.56 to 8.75. One school then withdrew, leaving a total of 152 children in 19 schools. The 8 children in each school were randomly allocated without restriction to the P + R or OL Intervention (Table 1). Gender was equivalent across groups (P + R = 52.6% male, OL = 47.4% male). In addition, the participants were rated on the *Strengths and Difficulties Questionnaire* (*SDQ*; Goodman, 1997): significant behavioural problems were reported for 21.6% of the P + R group and 22.4% of the OL group. Attrition rates differed between groups; 9 children were lost from the P + R group compared to 1 child from the OL group.

Tests and procedures

Testing was carried out by two members of the research team (CC, FD) with assistance from students from the Department of Psychology, University of York when necessary. All testers were trained in the administration of the tests prior to delivering the assessments. To ensure that investigators were blind to group membership when

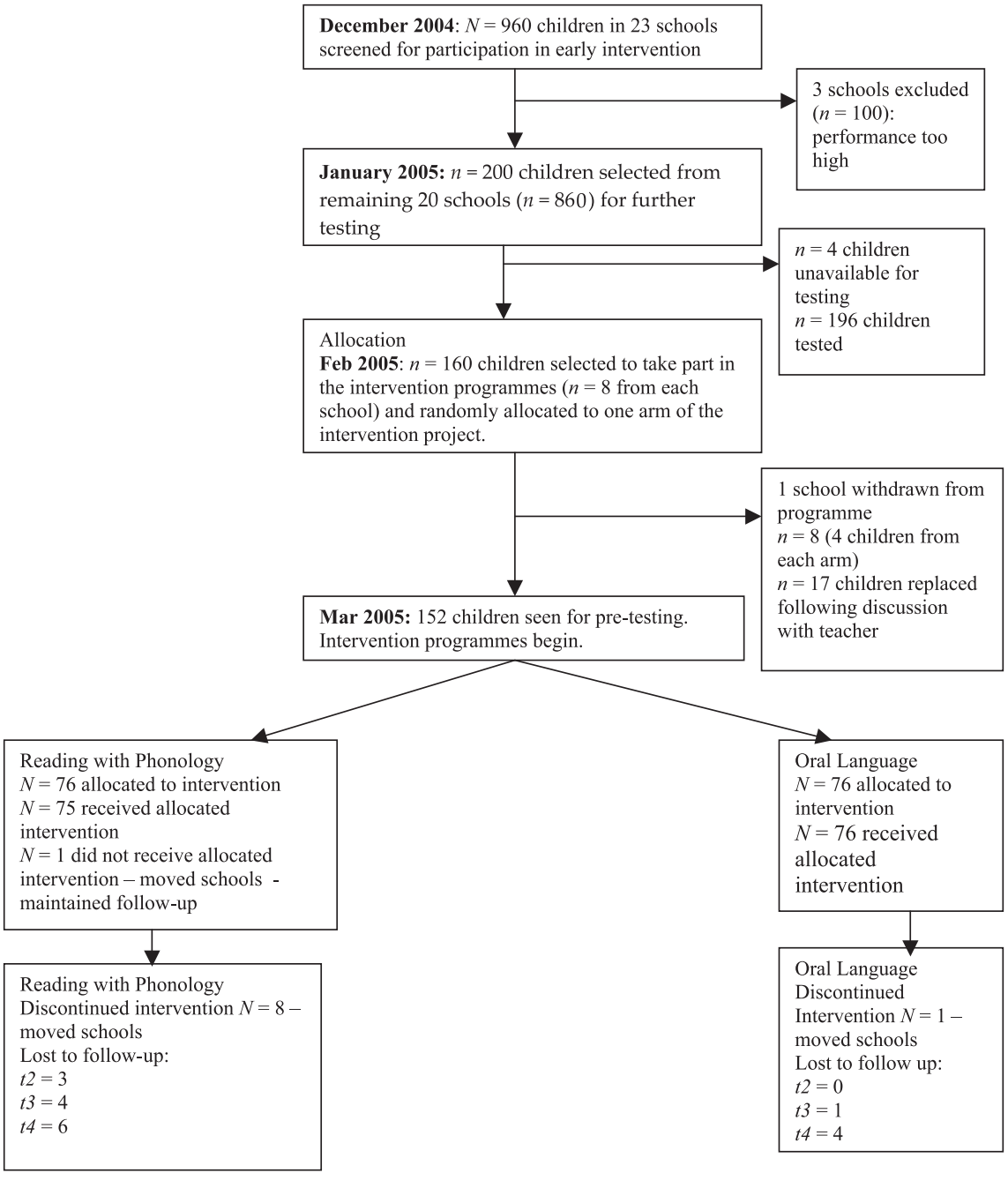

Figure 1 Flowchart showing selection and attrition of participants in accordance with the Consort guidelines

testing, the research team was not involved in the allocation of children to the interventions. In the event of schools needing to contact the research team to talk about the programme, each school was allocated one member of the team as their contact. The other member of the team was assigned to carry out the assessments in that school. As far as was practicable, tests were presented in a fixed order to all participants. All tests had good reliability (ranging from .84 to .98).

Screening phase

The screening battery consisted of an expressive language test and a test of nonword repetition. In addition, short assessments of letter knowledge, reading, and writing were given but data were not analysed because of floor effects.

Nonword repetition: 30 items from the Children's Test of Nonword Repetition (Gathercole & Baddeley, 1996) were administered. Following piloting, the full version of this test was judged to be too demanding for children of this age.

Picture Naming (also given at t4) from the Wechsler Preschool and Primary Scale of Intelligence (*WPPSI-III*^{UK}) was administered as a test of expressive vocabulary.

Pre-, mid-, post- and maintenance tests

Primary outcomes were word-level reading skills, vocabulary and grammar. The assessment measures used for the pre-, mid-, post- and maintenance test phases were selected to assess children's progress in the intervention towards these outcomes, and included

Table 1 Characteristics of children in each arm of the intervention at *t0* (screening): Mean scores with standard deviations in parentheses

	Phonology with Reading ($n = 76$)	Oral Language ($n = 76$)
Gender M:F	40:36	36:40
Age (months)[a]	57.53 (3.51)	56.83 (3.22)
Letter Knowledge (max 14)	4.34 (3.64)	3.78 (3.16)
Early Word Recognition (max 6)	.83 (.84)	.76 (.87)
Non-word repetition (max 30)	12.30 (7.21)	13.58 (6.82)
WPPSI-III		
Picture Naming[b]	6.01 (1.49)	6.33 (1.25)
Word Reasoning[b]	7.67 (2.54)	7.65 (2.09)
Vocabulary[b]	6.21 (2.13)	6.67 (2.26)
Block Design[b]	6.92 (2.98)	6.86 (3.23)
SDQ Total Deviance score (max = 20)	9.45 (6.12)	10.54 (6.43)
Free school meals[c]	28.9%	18.4%

[a]Age months = mean age of children collapsed across screening and administration of cognitive battery; [b]scaled scores where population mean = 10, SD = 15; [c]P + R group $n = 65$; OL group $n = 68$.

measures tapping skills directly targeted by the interventions. Owing to limited access to children during the school day, and to avoid placing unreasonable demands on them, not all tests were given on each occasion. Brief details of the test battery are provided below, grouped according to construct (full details at http://www.york.ac.uk/res/crl/crl_Nuffield.html). At least one measure of each construct was given at each time point, except at *t4* when phonological skills were not directly assessed, though indirect tests tapping phonological reading and spelling strategies were given.

General cognitive ability was assessed at *t1* with *WPPSI-III*^{UK} Block Design, Vocabulary, Word Reasoning. The Matrix Reasoning scale was given at *t4*.

Phonological measures

Phoneme awareness (t1, t2, t3) was assessed with the initial phoneme detection component of the *Sound Isolation Task* (Hulme, Caravolas, Málková, & Brigstocke, 2005).

Phoneme Completion (t3) from the *Phonological Abilities Test* (*PAT*; Muter, Hulme, & Snowling, 1997) also measured phoneme awareness.

Phoneme Blending, Segmentation and Deletion (t3) tasks from the Test of Phonological Awareness (Hatcher, 2000) were used to assess children's ability to segment and blend words.

Language measures

Expressive grammar (t1, t3, t4) was assessed using *The Action Picture Test* (Renfrew, 2003).

Narrative skill (t1, t2, t3) was measured using *The Bus Story* (Renfrew, 1991). According to the manual, this test measures 'the ability to give a coherent description of a continuous series of events'. A score was calculated for both information given and average sentence length.

Specific vocabulary (t2, t3, t4): knowledge of words taught directly in the OL programme was measured using a combination of picture naming and questions requiring one-word answers (e.g., *what is the opposite of back?*) (maximum = 25).

Listening comprehension (t1, t3) was assessed using recordings of stories taken from the *Neale Analysis of Reading Ability II* (*NARA II*; Neale, 1997) (Levels 1 and 2; Form 2). A point was awarded for each correct answer (maximum = 12).

Literacy measures

Letter identification (t1, t2, t3, t4): Children were asked to identify by sound 24 of the 26 letters in the English alphabet (t1 and t2) or all 26 letters (t3 and t2).

Single word reading (t1, t2, t3, t4): Single word reading ability was assessed using the *Early Word Recognition Test* (EWR; Hatcher et al., 1994), with testing being discontinued after 5 consecutive errors. The British Ability Scales II (BAS II; Elliott, Smith, & McCulloch, 1997) Word Reading scale was given to those children who read 30 or more items on the EWR test.

Reading comprehension (t3): Children read two short stories: the Level 1 passage taken from Form 1 of the *NARA II*, and Passage 1, Form 1 from the *Gray Oral Reading Tests 4* (*GORT 4*; Wiederholdt & Bryant, 2001). A point was awarded for each correct answer (maximum = 9).

Prose reading accuracy (t3): A measure of reading accuracy was taken during administration of the reading comprehension test (maximum = 46).

Nonword Reading (t4): The *Graded Nonword Reading Test* (*GNWRT*; Snowling, Stothard, & McLean, 1996) was given at *t4* as a measure of decoding.

Spelling (t1, t2, t3, t4): Five words were presented as pictures to be named and spelled. They were scored for items correct and percentage consonants correct. At *t4*, five more complex items were added to the spelling test.

Behavioural assessment

Strengths and Difficulties Questionnaire (t1, t3) (Goodman, 1997) was completed by class teachers and teaching assistants for each child.

Socioeconomic status

Post-codes for 133 children were obtained from their schools and used to derive an estimate of socioeconomic deprivation: [http://www.neighbourhood.gov.uk/page.asp?id=1057]. We also obtained data from schools on whether each child was in receipt of free school meals.

Intervention programmes

The two intervention programmes shared the same structure and were designed to run over two 10-week periods. Children received alternating daily one-to-one (20 minute) and group (30 minute) lessons. A manual was written for each programme documenting activities and procedures. Each 10-week period was divided into an initial introduction week followed by three 3-week

teaching blocks, each further divided into a 2-week instruction period and a third consolidation week. Each programme was run to a fixed time schedule (see Table 2).

Phonology with Reading (P + R) programme

The P + R programme had three main components: letter-sound knowledge, phonological awareness (including articulatory awareness) and reading books at the instructional level. Direct teaching in sight word recognition was also included in order to build up children's reading vocabulary.

Children were trained in letter-sound knowledge using the Jolly Phonics programme (Lloyd, 1998). Letter-sound knowledge was reinforced through reading, writing, and phonological awareness activities including blending and segmenting.

Phoneme awareness was taught for approximately 5 minutes in each session through blending and segmenting exercises in line with guidelines provided by the National Reading Panel (NICHHD, 2000) on phonemic awareness instruction. This work was done using multi-sensory techniques using a scaffolding approach to ensure that children were working at a suitable level. For those children not yet able to pronounce specific phonemes, work on articulatory awareness and phoneme production was included in the individual sessions.

Children interacted with books on a regular basis and were encouraged to link letter-sound knowledge and phoneme awareness in the context of listening to storybooks (Ukrainetz, Cooney, Dyer, Kysar, & Harris, 2000). In each individual teaching session, the child read two books to the teaching assistant (TA) who took a running record when the child read the first book in order to assess the level at which the child was reading (Hatcher, 2000). The TA then introduced a new book, which the child read alone first, and then again with the TA to encourage fluency. In the case of children who could not yet read at all, the 'cut-up' story activity was substituted (Clay 1985; Hatcher et al., 2006b).

Oral Language programme

The Oral Language (OL) programme included direct instruction to develop vocabulary, inferencing, expressive language and listening skills. Activities were adapted from a number of sources, including Rhodes to Language (Rhodes, 2001), Time to Talk (Schroeder, 2001), and materials from Black Sheep Press (e.g., Rippon, 2002).

Since listening skills are fundamental to language development, specifically targeted activities required children to listen to and retain information in order to complete a task. Vocabulary to be taught was selected according to two criteria; (i) that it was age-appropriate and instructional, and (ii) that it was related to one of the selected topics. The vocabulary to be taught included a selection of nouns, verbs, comparatives and spatial terms, as well as question words. All words were taught using methods that encouraged children to use them in different contexts (Beck, McKeown, & Kucan, 2002). New vocabulary was introduced every group session, and reinforced in the following group session and in individual sessions.

Narrative work was included to encourage expressive language development and grammatical competence. In the group sessions, many activities revolved around creating stories (e.g., 'washing line' activity from Time to Talk; Schroeder, 2001). A specially designed narrative task in which children told a story from cartoon sequences was used in individual sessions. TAs transcribed these narratives and used them as a basis for elaborating the story in the next session.

Independent speaking was encouraged in all sessions through the interactive nature of the programme. Specific activities included 'show and tell' sessions, and 'magic sack' activities (describing an object to the rest of the group). TAs were taught to monitor children's grammatical errors and to model the correct forms when errors occurred. Question words were taught throughout the programme and, as well as answering questions, children were encouraged to seek information by generating their own questions.

Teaching assistants were nominated by their schools; they received 4 days' training before the intervention began and one day mid-way through. In addition, they were supported in fortnightly group tutorials by the research team and observed once teaching to assess treatment fidelity, when they also received feedback.

Results

We wished to compare the mean difference between groups on several outcome variables at the end of the intervention (*t3*) and six months after the intervention had finished (*t4*). The data from the 152 participants were clustered within 19 schools; within each school the same teaching assistant taught in both arms. The data were therefore analysed using complex samples analyses (SPSS 15.0) giving robust standard errors that take account of the non-independence of observations within clusters. Group differences at *t3*, at the end of the intervention, and at *t4*, six months after the intervention, were assessed using dummy coding of group in a regression model after controlling for differences associated with gender, chronological age and pre-intervention levels of performance on the same task (the autoregressor) when this was available. These analyses are equivalent to performing analyses of covariance controlling for gender, age and the autoregressor.

Table 3 shows the means and standard deviations for all measures at *times 1, 2, 3* and *4* grouped according to intervention programme. Cell sizes (*t1, t2, t3, t4*) varied from 67 to 76 owing to variations in pupil attendance and cooperation.

For ease of interpretation Figures 2a and 2b show the differences between the two groups in *z*-score units. A difference of 1.0 in these figures represents a difference of 1 SD between the groups (equivalent to an effect size (Cohen's *d*) of 1.0). The error bars represent robust 95% confidence intervals (CIs);

Table 2 Group and individual session schedule for P + R and OL programmes

Phonology with Reading		Oral Language	
Group session (30 minutes)	Individual session (20 minutes)	Group session (30 minutes)	Individual session (20 minutes)
Ice Breaker – Revision of letter – 4 minutes	Revision – Revise/reinforce sounds learnt so far – 2 minutes	Introduction – Introduce day of the week – Talk about best listener – 2 minutes	Introduction – Settle child into session – 2 minutes
Sound of the day – Story and action – Writing letter – 8 minutes	Phonological awareness – Segmenting or blending activities AND Making sounds – sound production exercises if necessary – 3 minutes	Multi-sensory learning – Teach new vocabulary – 5 minutes	Vocabulary revision – Revise vocabulary from last group session – Concentrate on difficult vocabulary – 5 minutes
Book work – Book for the sound of the day – Teacher-led 'shared' reading – 8 minutes		Reinforcement – Reinforce vocabulary introduced in last session – 7 minutes	Narrative task – Child to produce story to sequence of pictures – Revisit story targeting areas for improvement – 5 minutes
Phonological awareness – Segmenting or blending activities – 5 minutes	Sight word work – Work on sight word vocabulary – 5 minutes	Speaking/listening/inferencing – One or two group activities targeting specific skills – 7 minutes	Speaking/listening/inferencing – One or two activities to target specific skills – 5 minutes
Plenary – Revise sound of the day – Word sticker – 5 minutes	Reading books – Re-reading a book at the instructional level – Reading a new book – 10 minutes	Plenary – Best listener chosen – Revise work completed in session – Encourage sequencing – Word sticker – 3 minutes	Plenary – Go over session with child – Encourage sequencing – Give child word sticker and reward sticker – 3 minutes

Table 3 Data from main variables at *beginning (t1) and end (t3) of intervention*, according to intervention programme[a] (*t2 & t4 scores given if measure not tested at these points*). Raw mean scores and standard deviations in parentheses

	P + R programme	OL programme
Literacy		
Letter identification *t1*	13.69 (6.72)	14.12 (6.06)
Letter identification *t3*	23.92 (3.14)	22.19 (4.82)
EWR *t1*	4.88 (7.0)	3.04 (3.55)
EWR *t3*	21.08 (12.71)	16.27 (9.33)
Spelling *t1*	.18 (.58)	.08 (.32)
Spelling *t3*	1.47 (1.27)	.91 (.94)
% Consonants correct *t1*	20.38 (25.77)	19.41 (21.96)
% Consonants correct *t3*	62.19 (28.85	55.41 (25.49)
Nonword reading *t4*	4.26 (5.71)	2.03 (4.07)
Prose reading accuracy *t3*	28.45 (13.02)	23.28 (10.16)
Read comprehension *t3*	5.11 (1.86)	4.72 (1.54)
Phonological awareness		
Phoneme awareness *t1*	7.49 (7.81)	8.30 (7.72)
Phoneme awareness *t3*	20.19 (8.38)	19.31 (8.36)
Phoneme seg/blend/del *t3*	7.48 (4.79)	4.05 (3.53)
Phoneme completion *t3*	5.50 (2.93)	4.89 (2.68)
Language measures		
Picture naming raw *t0*	13.82 (2.87)	14.30 (2.51)
Picture naming raw *t4*	20.36 (2.51)	20.17 (2.41)
Specific vocabulary *t3*	11.04 (3.14)	14.89 (3.47)
Expressive grammar *t1*	15.75 (6.05)	16.70 (5.47)
Expressive grammar *t3*	20.71 (5.12)	22.67 (5.13)
Sentence length *t1*	6.79 (2.27)	7.19 (2.01)
Sentence length *t3*	8.48 (2.59)	9.19 (2.19)
Narrative skill *t1*	12.44 (6.99)	13.69 (6.32)
Narrative skill *t3*	19.09 (7.41)	20.84 (7.29)
Listening comprehension *t1*	1.63 (1.40)	1.70 (1.36)
Listening comprehension *t3*	2.44 (1.63)	2.63 (1.84)

Note. EWR = early word recognition; Phoneme seg/blend/del = phoneme segmenting, blending and deletion; Sentence length was calculated from the narratives produced in the narrative skill task. (a) Complete data set available from author.**

therefore whenever the error bars do not cross zero the difference between the groups is statistically significant. Figure 2a shows the differences between the groups on the reading and phonological measures at *t3* (end of intervention) and *t4* (follow-up) with a positive difference representing a relative advantage for the R + P group. Figure 2b shows the equivalent effects on the language measures, with a positive difference representing a relative advantage for the OL group. It is clear that overall the pattern of differences in the measures follow the pattern expected. The effect sizes and confidence intervals give a direct indication of the relative strength of the different effects obtained. From Figure 2a it can be seen that the P + R group show advantages over the OL group in letter knowledge, spelling, prose reading accuracy and segmenting/blending/deletion at *t3*, and letter knowledge, spelling, and nonword reading at *t4*. Figure 2b indicates that the OL group show advantages over the P + R group in specific vocabulary and expressive grammar at *t3* and *t4* with strong trends towards an advantage on *Bus Story* sentence length and narrative skills at *t3*.

These analyses were repeated, controlling for social class and an index of behaviour (SDQ total deviance) in separate analyses. When controlling for behaviour (in addition to the other covariates) the group difference in Early Word Reading at *t3* was significant (difference = .262, 95% CI: lower = .008, higher = .517, $p < .05$) but the significance levels of other measures remained unchanged. When social class (in addition to the other covariates) was controlled, the group difference in phoneme awareness at *t3* was significant (difference = .284, 95% CI: lower = .053, higher = .514, $p < .05$), while the difference between groups in grammatical skill at *t3* was no longer significant (difference = −297, 95% CI: lower = −649, higher = .054, $p = .092$).

In the absence of an untreated control group it is difficult to gauge the absolute impact of each intervention on literacy and language skills. To provide an estimate of how much each intervention fostered the children's literacy development, their single word reading performance at *t4* was compared with that of a large sample of their peers from the same classes ($n = 564$). A composite score derived from performance on the Early Word Reading and BAS Single Word Reading tests was used as a standard (with mean of 100, SD = 15) against which to describe the performance of the children from the intervention groups.

A standard score below 85 for reading (−1SD) was used to classify children as being 'at risk' of literacy difficulties. At the end of the intervention, 68.1% of the OL group remained at risk on this criterion compared with only 50% of the P + R group. Moreover, 7.1% of children in the P + R group now had above-average reading scores (greater than 115), while none of the OL children had scores in this range.

Discussion

This RCT compared two contrasting intervention programmes; one targeting phonological and early reading skills and the other targeting oral language skills. The results show that these programmes were effective in promoting different aspects of literacy and spoken language in children with poor oral language skills at school entry. As expected, the children who received the P + R programme made better progress in literacy skills and in phoneme awareness but somewhat surprisingly not in single word reading where the two groups were comparable. In contrast, the children who received the OL programme made better progress in vocabulary and grammatical skills. The effects obtained were moderate to large in size and were mostly maintained at follow-up 5 months after the intervention ceased,

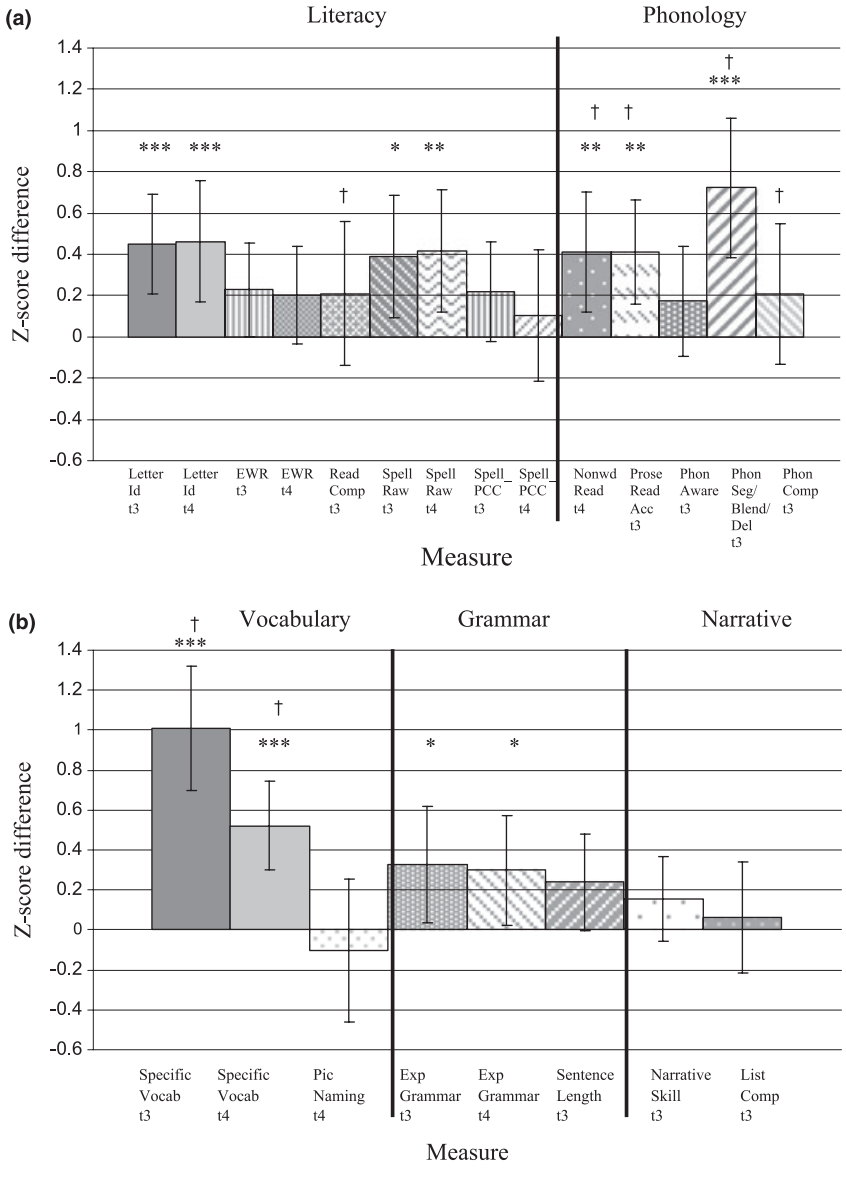

Figure 2 (a) Relative advantage of P + R group on reading and phonology measures at *t3* and *t4* expressed as *z*-score units with 95% Confidence Intervals. (Letter Id = letter identification, EWR = early word recognition, Read Comp = reading comprehension, Spell_PCC = spelling percentage consonants correct, Nonwd Read = nonword reading, Prose Read Acc = prose reading accuracy, Phon Aware = phoneme awareness (sound isolation), Phoneme Seg/Blend/Del = phoneme segmenting, blending and deletion, Phon Comp = phoneme completion. Significant differences marked ***$p < .001$, **$p < .01$, *$p < .05$. † No autoregressor available. Group, Gender and Age in months at *t0* were entered into each analysis as covariates. (b) Relative advantage of OL group on language measures at *t3* and *t4* expressed as *z*-score units with 95% Confidence Intervals. (Specific Vocab = specific vocabulary, Pic Naming = picture naming, Exp Grammar = expressive grammar, List Comp = listening comprehension). Significant differences marked ***$p < .001$, **$p < .01$, *$p < .05$. † No autoregressor available. Group, Gender and Age in months at *t0* were entered into each analysis as covariates

except for phonetic spelling where group differences evened out (although differences in raw spelling score remained significant). A particularly encouraging finding was that gains in reading and phonological skills generalised to the reading of novel words at *t4*.

The failure to find a significant differential effect on certain key measures is disappointing at first sight. However, there are likely to be a number of explanations for these null effects, not least differences in test sensitivity. For example, benefits accrued to the P + R group in phoneme awareness as measured by a test requiring segmentation, blending and deletion but not in tests requiring phoneme isolation (a very difficult test) or phoneme completion (a relatively easy test). In a similar vein, the listening comprehension test suffered from floor effects, being more difficult than anticipated for children of this age group.

Given that much of the variance in reading comprehension in the early school years can be attributed to decoding abilities (Whitehurst & Lonigan,

1998), it was not surprising that the effects of training on this aspect of reading were weak. Nonetheless, the effect of the OL programme on vocabulary and grammatical skills is noteworthy since such skills are reliable predictors of reading comprehension (e.g., Muter et al., 2004). The teaching programme included narrative training, which encouraged children to increase the length of sentences they used and to improve their use of the correct grammatical forms. In addition, one of the teaching principles embodied in the programme was the use of modelling by the teaching assistants. Thus, when a child produced an immature grammatical form the teaching assistant would model a more appropriate version of the sentence. It is possible that these strategies were in some way instrumental in helping to bring about a change in the children's grammatical usage but this aspect of the programme was not directly evaluated in the current study.

The finding that the strongest training effects for the Phonology with Reading programme in the present study were for phonological awareness is consistent with previous research, although a direct comparison of effect sizes is hampered by the use of different measures and the conservative design of the present study which reported differential gains (in relation to treated controls). In a meta-analysis of the effects of phonological awareness training on reading, Bus and van IJzendoorn (1999) demonstrated effect sizes between $d = .01$ and $d = 5.20$ for phonological awareness, with weaker effect sizes in randomised and matched designs ($d = .76$). Our finding of an effect size of $d = .72$ for phoneme segmentation, blending and deletion is in line with this finding. Bus and van IJzendoorn report a greater range of effect sizes for reading outcomes ($d = -012$ to $d = 7.62$), with an overall effect size of $d = .44$; as in the present study, training effects were stronger on tests of pure decoding ($d = .85$; present study $d = .41$) than single word reading ($d = .34$; present study $d = .23$).

There is less evidence regarding the effectiveness of oral language interventions. The present gains in instructed vocabulary are in line with findings reported by Beck and McKeown (2007) Study 1 for rich vocabulary instruction of mean gains of approximately 3 words for children in grade 1 ($d = .74$), and approximately 5 words for children in kindergarten ($d = 1.17$) over a 10-week period. In the present study the mean gain for the Oral Language group in instructed vocabulary at *t3* was approximately 5.23 words ($d = 1.02$). A recent meta-analysis of interventions for children with speech and language difficulties (Law, Garrett, & Nye, 2004) reported effect sizes ranging from .28 to 1.02 for expressive syntax following clinician-led speech and language therapy of more than 8 weeks. However, the present gains in grammar and narrative ability are more directly comparable with those of Davies, Shanks, and Davies (2004), who found significant improvements in both Action Picture Test (Grammar) and Bus Story (Information scores) following a narrative intervention programme run over the course of a school term and delivered by trained learning support assistants (effect sizes adjusted for maturation $d = .74$ and $d = .44$ respectively). The present study reported effect sizes at *t3* of $d = .33$ for Action Picture Test Grammar and $d = .15$ for Bus Story Information. These effects are weaker than the effect sizes reported by Davies et al. (2004) but it must be borne in mind that the current intervention included narrative work only as a component, whereas Davies and colleagues focused exclusively on narrative.

The present findings extend previous research by showing that focused language intervention programmes can be delivered successfully by trained teaching assistants to 4- and 5-year-old children at risk of literacy difficulties. A programme fostering phonological skills and letter knowledge had a positive effect on children's emergent reading (word recognition) skills, whereas a programme focusing on oral language improved aspects of receptive and expressive language, particularly vocabulary and grammatical skills. Our findings suggest that both programmes are valuable interventions for children during the early school years and although we have no direct evidence for this supposition, a promising approach would appear to be to provide children with training in the Oral Language programme before school entry to reduce the numbers of children at risk of reading difficulties, and to provide those with continuing difficulties with an integrated approach combining aspects of the P + R and OL programmes. Further research is required to investigate this hypothesis.

Author note

Jeremy Miles is now at the RAND Corporation, Santa Monica, California.

Acknowledgements

This research was funded by the Nuffield Foundation and supported by North Yorkshire County Council and a British Academy Research Readership to Margaret Snowling. We would like to thank Simon Gibbs and Glynnis Smith for their help with this research. We thank Jolly Phonics and Black Sheep Press for donating materials, and Naomi Meredith, Nicky Vowles, Rachel Harlow, Debbie Gooch, Ros Francis, Dimitra Ionnau, Lisa Henderson, Lizzie Bowen, Natalie Falkinder, Sarah Edwards, Emma Truelove, Kim Manderson, Jodie Unau, Michelle Cargan, Pam Baylis, Rachael McCool, Elisa Romeo, Meesha Warmington, Poppy Nash and Janet Hatcher for their assistance throughout this project. Finally

we would like to thank the pupils, teaching assistants and schools who participated.

Correspondence to

Claudine Crane, Dept of Psychology, University of York, Heslington, York, YO10 5DD, UK; Email: c.crane@psych.york.ac.uk

References

Beck, I.L., & McKeown, M.G. (2007). Increasing young low-income children's oral vocabulary repertoires through rich and focused instruction. *Elementary School Journal*, *107*, 251–271.

Beck, I.L., McKeown, M.G., & Kucan, L. (2002). *Bringing words to life: Robust vocabulary instruction*. New York: The Guildford Press.

Bishop, D.V.M., & Snowling, M.J. (2004). Developmental dyslexia and specific language impairment: Same or different? *Psychological Bulletin*, *130*, 858–888.

Borstrom, I., & Elbro, C. (1997). Prevention of dyslexia in kindergarten: Effects of phoneme awareness training with children of dyslexic parents. In C. Hulme & M.J. Snowling (Eds.), *Dyslexia: Biology, cognition and intervention* (pp. 235–253). London: Whurr.

Bowey, J.A. (2005). Predicting individual differences in learning to read. In M.J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 155–172). Oxford: Blackwell Publishing.

Bus, A.G., & van IJzendoorn, M.H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. *Journal of Educational Psychology*, *91*, 403–414.

Byrne, B. (1998). *The foundation of literacy: The child's acquisition of the alphabetic principle*. Hove: Psychology Press.

Clay, M.M. (1985). *The early detection of reading difficulties*. Portsmouth, NH: Heinemann.

Davies, P., Shanks, B., & Davies, K. (2004). Improving narrative skills in young children with delayed language development. *Educational Review*, *56*, 271–286.

Department for Education and Skills (DfES). (2001). *The National Literacy Strategy Framework for Teaching (DfES Ref 0500/2001)*. London: DfES Publications.

Elbro, C., & Peterson, D.M. (2004). Long-term effects of phoneme awareness and letter sound training: An intervention study with children at risk for dyslexia. *Journal of Educational Psychology*, *96*, 660–670.

Elliott, C.D., Smith, P., & McCulloch, K. (1997). *The British Ability Scales Second Edition (BAS II)*. Windsor, UK: NFER-NELSON.

Fey, M.E., Long, S.H., & Finestack, L.H. (2003). Ten principles of grammar facilitation for children with specific language impairment. *American Journal of Speech-Language Pathology*, *12*, 3–15.

Fey, M.E., & Proctor-Williams, K. (2000). Recasting, elicited imitation and modelling in grammar intervention for children with specific language impairments. In D.V.M Bishop & L.B. Leonard (Eds.), *Speech and language impairments in children* (pp. 177–194). Hove, UK: Psychology Press.

Gathercole, S.E., & Baddeley, A.D. (1996). *The Children's Test of Nonword Repetition*. London: The Psychological Corporation.

Gillon, G. (2000). The efficacy of phonological awareness intervention for children with spoken language impairment. *Language, Speech and Hearing Services in Schools*, *31*, 126–141.

Gillon, G. (2002). Follow-up study investigating the benefits of phonological awareness intervention for children with spoken language impairment. *International Journal of Language and Communication Disorders*, *37*, 381–400.

Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology and Psychiatry*, *38*, 581–586.

Goswami, U., & Bryant, P.E. (1990). *Phonological skills and learning to read*. London: Erlbaum.

Gough, P.B., & Tunmer, W.E. (1986). Decoding, reading and reading disability. *Remedial and Special Education*, *7*, 6–10.

Hatcher, P.J. (2000). *Sound linkage*. London: Whurr.

Hatcher, P.J., Goetz, K., Snowling, M.J., Hulme, C., Gibbs, S., & Smith, G. (2006b). Evidence for the effectiveness of the early literacy support programme. *British Journal of Educational Psychology*, *76*, 351–367.

Hatcher, P., Hulme, C., & Ellis, A.W. (1994). Ameliorating early reading failure by integrating the teaching of reading and phonological skills: The phonological linkage hypothesis. *Child Development*, *65*, 41–57.

Hatcher, P.J., Hulme, C., Miles, J.N.V., Carroll, J.M., Hatcher, J., Gibbs, S., Smith, G., Bowyer-Crane, C., & Snowling, M.J. (2006a). Efficacy of small group reading intervention for beginning readers with reading-delay: A randomized controlled trial. *Journal of Child Psychology and Psychiatry*, *47*, 820–827.

Hindson, B., Byrne, B., Fielding-Barnsley, R., Newman, C., Hine, D.W., & Shankweiler, D. (2005). Assessment and early instruction of preschool children at risk of reading disability. *Journal of Educational Psychology*, *97*, 687–704.

Hulme, C., Caravolas, M., Málková, G., & Brigstocke, S. (2005). Phoneme isolation ability is not simply a consequence of letter-sound knowledge. *Cognition*, *97*, B1–B11.

Iverson, S., & Tunmer, W.E. (1993). Phonological processing skills and the reading recovery program. *Journal of Educational Psychology*, *85*, 112–126.

Law, J., Garrett, Z., & Nye, C. (2004). The efficacy of treatment for children with developmental speech and language delay/disorder: A meta-analysis. *Journal of Speech, Language and Hearing Research*, *47*, 924–943.

Lloyd, S. (1998). *The phonics handbook: A handbook for teaching reading, writing and spelling* (3rd edn). Chigwell, UK: Jolly Learning Ltd.

Lovett, M.W., Warren-Chaplin, P.M., Ransby, M.J., & Borden, S.L. (1990). Training the word recognition skills of dyslexic children: Treatment and transfer effects. *Journal of Educational Psychology*, *82*, 769–780.

Lundberg, I. (1994). Reading difficulties can be predicted and prevented: A Scandinavian perspective on

phonological awareness and reading. In C. Hulme & M.J. Snowling (Eds.), *Reading development and dyslexia* (pp. 180–199). London: Whurr.

Moher, D., Schulz, K.F., & Altman, D.G. for the CONSORT Group. (2001). The CONSORT statement: Revised recommendations for improving the quality of reports of parallel-group randomised trials. *Lancet*, *357*, 1191–1194.

Muter, V., Hulme, C., & Snowling, M. (1997). *The Phonological Abilities Test*. London: The Psychological Corporation.

Muter, V., Hulme, C., Snowling, M.J., & Stevenson, J. (2004). Phonemes, rimes, vocabulary and grammatical skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology*, *40*, 665–681.

National Institute of Child Health and Human Development (NICHHD). (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups (NIH Publication No. 00-4754)*. Washington, DC: US Government Printing Office.

Neale, M.D. (1997). *Neale Analysis of Reading Ability – Second Revised British Edition (NARA II)*. Windsor, UK: NFER-NELSON.

Oakhill, J., Cain, K., & Bryant, P.E. (2003). The dissociation of word reading and text comprehension: Evidence from component skills. *Language and Cognitive Processes*, *18*, 443–468.

Renfrew, C. (1991). *The Bus Story* (2nd edn). Oxford: C. Renfrew.

Renfrew, C. (2003). *The Action Picture Test* (4th edn). Brackley, UK: Speechmark Publishing Ltd.

Rhodes, A. (2001). *Rhodes to language*. Ponteland, UK: Stass Publications.

Rippon, H. (2002). *Reception Narrative Pack*. Point Roberts, WA: Black Sheep Press.

Rose, J. (2006). *Independent review of the teaching of early reading*. London: HMSO: Department for Education and Skills.

Schroeder, A. (2001). *Time to talk*. Cambridge: LDA.

Snowling, M.J., Stothard, S.E., & McLean, J. (1996). *Graded Nonword Reading Test*. Bury St Edmunds, UK: Thames Valley Test Company.

Torgesen, J.K. (2005). Recent discoveries on remedial interventions for children with dyslexia. In M.J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 521–537). Oxford: Blackwell Publishing.

Torgesen, J.K., Wagner, R.K., Rashotte, C.A., Rose, E., Lindamood, P., Conway, T., & Garven, C. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology*, *91*, 579–593.

Troia, G.A. (1999). Phonological awareness intervention research: A critical review of the experimental methodology. *Reading Research Quarterly*, *34*, 28–52.

Ukrainetz, T.A., Cooney, M.H., Dyer, S.K., Kysar, A.J., & Harris, T.J. (2000). An investigation into teaching phonemic awareness through shared reading and writing. *Early Childhood Research Quarterly*, *15*, 331–355.

Wechsler, D (2003). *Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III^{UK})*. Oxford: The Psychological Corporation.

Weismer, S.E. (2000). Intervention for children with developmental language delay. In D.V.M Bishop & L.B. Leonard (Eds.), *Speech and language impairments in children* (pp. 157–176). Hove, UK: Psychology Press.

Whitehurst, G.J., & Lonigan, C.J. (1998). Child development and emergent literacy. *Child Development*, *68*, 848–872.

Wiederholdt, J.L, & Bryant, B.R. (2001). *Gray Oral Reading Tests 4 (GORT 4)*. Austin, TX: ProEd.

Manuscript accepted 5 September 2007