

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

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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,

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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 (t_1), mid-test after 10 weeks (t_2), post-test at the end of the 20-week intervention (t_3) and five months after the intervention had ceased (t_4). At t_4 , 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

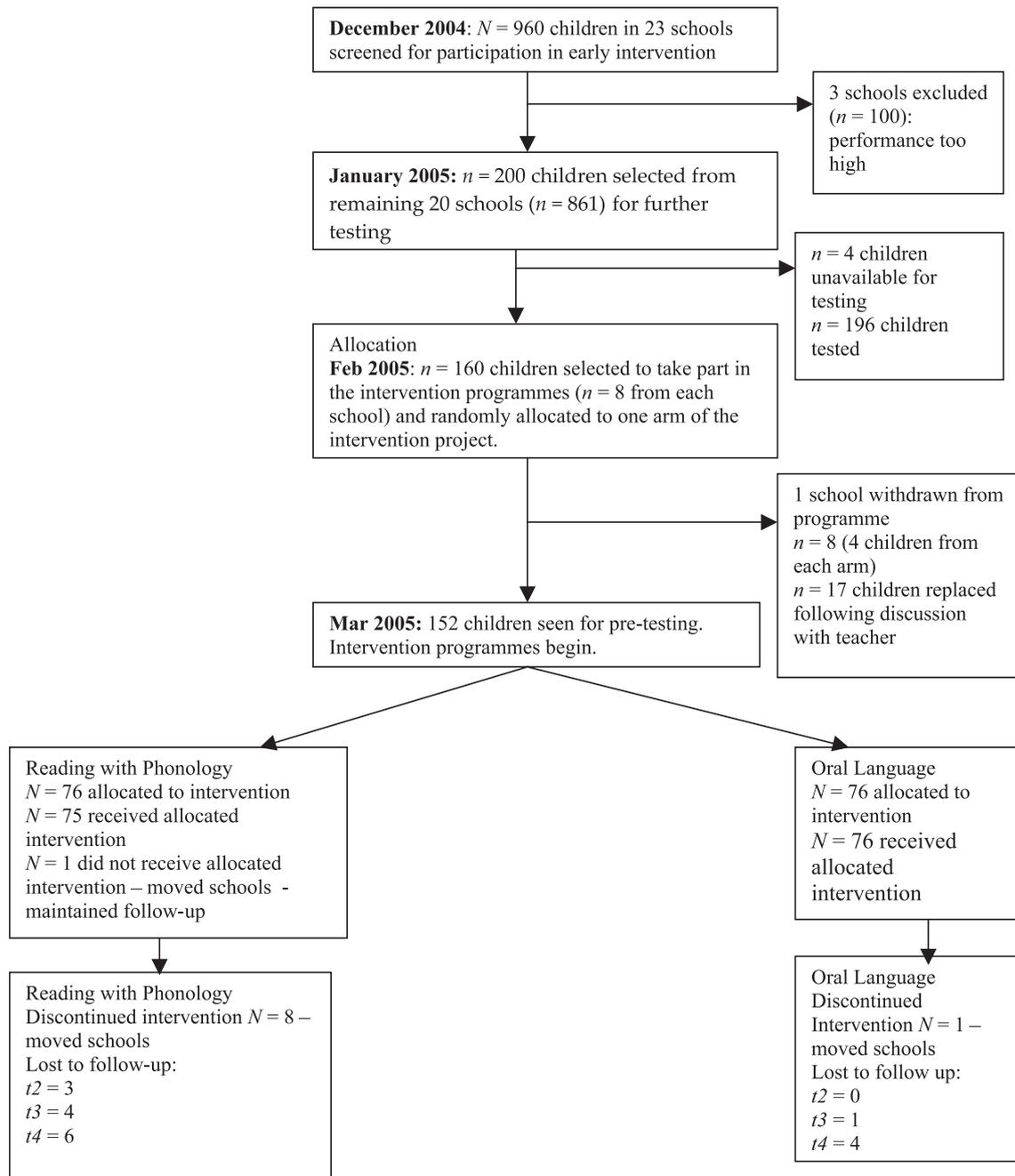


Figure 1 Flowchart showing selection and attrition of participants in accordance with the Consort guidelines

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 (<i>n</i> = 76)	Oral Language (<i>n</i> = 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%

^aAge months = mean age of children collapsed across screening and administration of cognitive battery; ^bscaled scores where population mean = 10, SD = 15; ^cP + 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

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

5 *Phonology with Reading (P + R) programme*

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

12 Children were trained in letter-sound knowledge
13 using the Jolly Phonics programme (Lloyd, 1998). Let-
14 ter-sound knowledge was reinforced through reading,
15 writing, and phonological awareness activities includ-
16 ing blending and segmenting.

17 Phoneme awareness was taught for approximately
18 5 minutes in each session through blending and seg-
19 menting exercises in line with guidelines provided by
20 the National Reading Panel (NICHD, 2000) on pho-
21 nemic awareness instruction. This work was done using
22 multi-sensory techniques using a scaffolding approach
23 to ensure that children were working at a suitable level.
24 For those children not yet able to pronounce specific
25 phonemes, work on articulatory awareness and
26 phoneme production was included in the individual
27 sessions.

28 Children interacted with books on a regular basis
29 and were encouraged to link letter-sound knowledge
30 and phoneme awareness in the context of listening to
31 storybooks (Ukrainetz, Cooney, Dyer, Kysar, & Harris,
32 2000). In each individual teaching session, the child
33 read two books to the teaching assistant (TA) who
34 took a running record when the child read the first
35 book in order to assess the level at which the child
36 was reading (Hatcher, 2000). The TA then introduced
37 a new book, which the child read alone first, and then
38 again with the TA to encourage fluency. In the case of
39 children who could not yet read at all, the 'cut-up'
40 story activity was substituted (Clay 1985; Hatcher
41 et al., 2006b).

42 *Oral Language programme*

43 The Oral Language (OL) programme included direct
44 instruction to develop vocabulary, inferencing, expres-
45 sive language and listening skills. Activities were
46 adapted from a number of sources, including Rhodes to
47 Language (Rhodes, 2001), Time to Talk (Schroeder,
48 2001), and materials from Black Sheep Press (e.g.,
49 Rippon, 2002).

50 Since listening skills are fundamental to language
51 development, specifically targeted activities required
52 children to listen to and retain information in order to
53 complete a task. Vocabulary to be taught was selected
54 according to two criteria; (i) that it was age-appropriate
55 and instructional, and (ii) that it was related to one
56 of the selected topics. The vocabulary to be taught
57 included a selection of nouns, verbs, comparatives and
58 spatial terms, as well as question words. All words were
59 taught using methods that encouraged children to use
60 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 expres-
sive language development and grammatical compe-
tence. 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 ses-
sions. 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. Spe-
cific 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 informa-
tion 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.

41 **Results**

We wished to compare the mean difference between
groups on several outcome variables at the end of
the intervention (t_3) and six months after the
intervention had finished (t_4). 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 t_3 , at the end
of the intervention, and at t_4 , 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
(t_1, t_2, t_3, t_4) 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	
	Individual session (20 minutes)	Group session (30 minutes)	Individual session (20 minutes)
Group session (30 minutes)			
Ice Breaker	Revision	Introduction	Introduction
- Revision of letter	- Revise/reinforce sounds learnt so far	- Introduce day of the week	- Settle child into session
- 4 minutes	- 2 minutes	- Talk about best listener	- 2 minutes
Sound of the day	Phonological awareness	Multi-sensory learning	Vocabulary revision
- Story and action	- Segmenting or blending activities	- Teach new vocabulary	- Revise vocabulary from last group session
- Writing letter	AND	- 5 minutes	- Concentrate on difficult vocabulary
- 8 minutes	Making sounds		- 5 minutes
	- sound production exercises if necessary		
	- 3 minutes		
Book work		Reinforcement	Narrative task
- Book for the sound of the day		- Reinforce vocabulary introduced in last session	- Child to produce story to sequence of pictures
- Teacher-led 'shared' reading		- 7 minutes	- Revisit story targeting areas for improvement
- 8 minutes		Speaking/listening/inferencing	- 5 minutes
Phonological awareness	Sight word work	- One or two group activities targeting specific skills	Speaking/listening/inferencing
- Segmenting or blending activities	- Work on sight word vocabulary	- 7 minutes	- One or two activities to target specific skills
- 5 minutes		Plenary	- 5 minutes
Plenary	Reading books	- Best listener chosen	Plenary
- Revise sound of the day	- Re-reading a book at the instructional level	- Revise work completed in session	- Go over session with child
- Word sticker	- Reading a new book	- Encourage sequencing	- Encourage sequencing
- 5 minutes	- 10 minutes	- Word sticker	- Give child word sticker and reward sticker
		- 3 minutes	- 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 <i>t1</i>	13.69 (6.72)	14.12 (6.06)
Letter identification <i>t3</i>	23.92 (3.14)	22.19 (4.82)
EWR <i>t1</i>	4.88 (7.0)	3.04 (3.55)
EWR <i>t3</i>	21.08 (12.71)	16.27 (9.33)
Spelling <i>t1</i>	.18 (.58)	.08 (.32)
Spelling <i>t3</i>	1.47 (1.27)	.91 (.94)
% Consonants correct <i>t1</i>	20.38 (25.77)	19.41 (21.96)
% Consonants correct <i>t3</i>	62.19 (28.85)	55.41 (25.49)
Nonword reading <i>t4</i>	4.26 (5.71)	2.03 (4.07)
Prose reading accuracy <i>t3</i>	28.45 (13.02)	23.28 (10.16)
Read comprehension <i>t3</i>	5.11 (1.86)	4.72 (1.54)
Phonological awareness		
Phoneme awareness <i>t1</i>	7.49 (7.81)	8.30 (7.72)
Phoneme awareness <i>t3</i>	20.19 (8.38)	19.31 (8.36)
Phoneme seg/blend/del <i>t3</i>	7.48 (4.79)	4.05 (3.53)
Phoneme completion <i>t3</i>	5.50 (2.93)	4.89 (2.68)
Language measures		
Picture naming raw <i>t0</i>	13.82 (2.87)	14.30 (2.51)
Picture naming raw <i>t4</i>	20.36 (2.51)	20.17 (2.41)
Specific vocabulary <i>t3</i>	11.04 (3.14)	14.89 (3.47)
Expressive grammar <i>t1</i>	15.75 (6.05)	16.70 (5.47)
Expressive grammar <i>t3</i>	20.71 (5.12)	22.67 (5.13)
Sentence length <i>t1</i>	6.79 (2.27)	7.19 (2.01)
Sentence length <i>t3</i>	8.48 (2.59)	9.19 (2.19)
Narrative skill <i>t1</i>	12.44 (6.99)	13.69 (6.32)
Narrative skill <i>t3</i>	19.09 (7.41)	20.84 (7.29)
Listening comprehension <i>t1</i>	1.63 (1.40)	1.70 (1.36)
Listening comprehension <i>t3</i>	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, except for phonetic spelling where group differences evened out (although differences in raw spelling

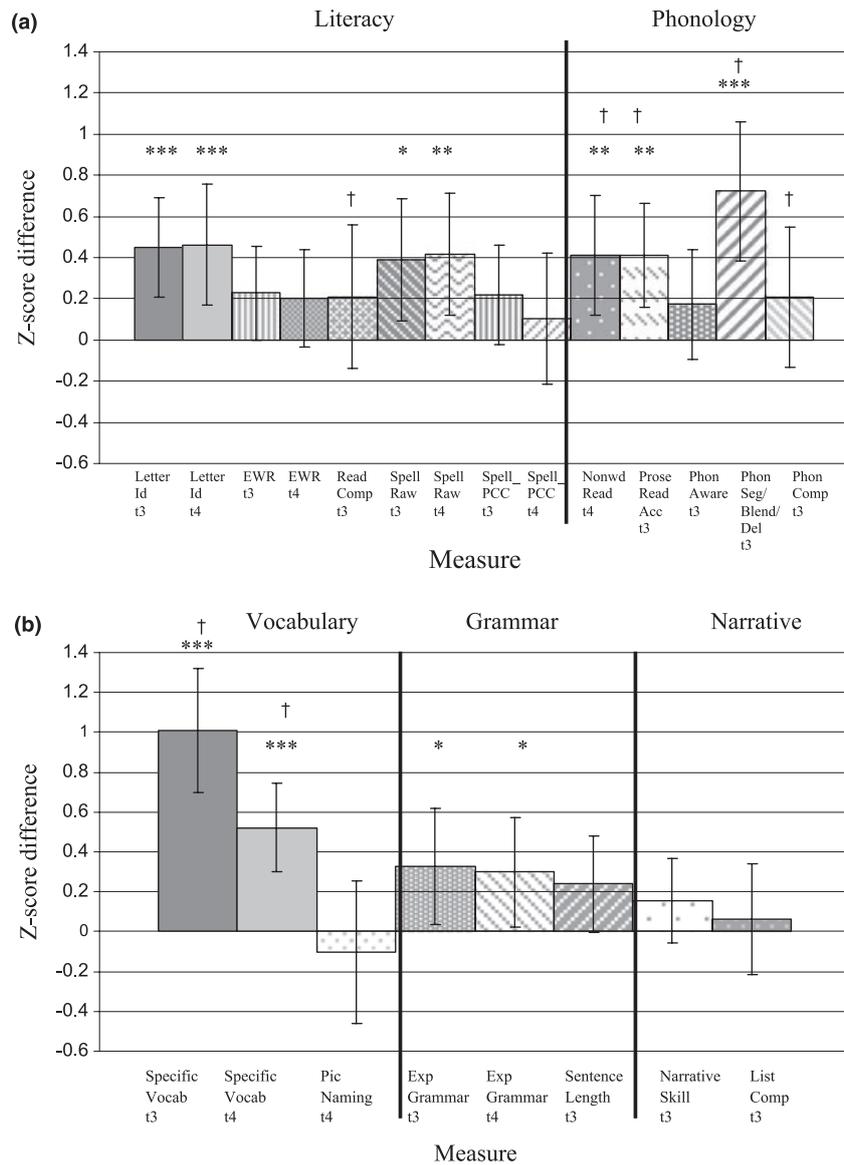


Figure 2 (a) Relative advantage of P + R group on reading and phonology measures at *t3* and *t4* expressed as z-score units with 95% Confidence Intervals. (Letter Id = letter identification, EWR = early word recognition, Read Comp = reading comprehension, Spell_PCC = spelling percentage consonants correct, 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

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.

1 Nonetheless, the effect of the OL programme on
 2 vocabulary and grammatical skills is noteworthy
 3 since such skills are reliable predictors of reading
 4 comprehension (e.g., Muter et al., 2004). The
 5 teaching programme included narrative training,
 6 which encouraged children to increase the length of
 7 sentences they used and to improve their use of the
 8 correct grammatical forms. In addition, one of the
 9 teaching principles embodied in the programme was
 10 the use of modelling by the teaching assistants.
 11 Thus, when a child produced an immature gram-
 12 matical form the teaching assistant would model a
 13 more appropriate version of the sentence. It is pos-
 14 sible that these strategies were in some way instru-
 15 mental in helping to bring about a change in the
 16 children's grammatical usage but this aspect of the
 17 programme was not directly evaluated in the current
 18 study.

19 The finding that the strongest training effects for
 20 the Phonology with Reading programme in the
 21 present study were for phonological awareness is
 22 consistent with previous research, although a direct
 23 comparison of effect sizes is hampered by the use of
 24 different measures and the conservative design of
 25 the present study which reported differential gains
 26 (in relation to treated controls). In a meta-analysis of
 27 the effects of phonological awareness training on
 28 reading, Bus and van IJzendoorn (1999) demon-
 29 strated effect sizes between $d = .01$ and $d = 5.20$ for
 30 phonological awareness, with weaker effect sizes in
 31 randomised and matched designs ($d = .76$). Our
 32 finding of an effect size of $d = .72$ for phoneme seg-
 33 mentation, blending and deletion is in line with this
 34 finding. Bus and van IJzendoorn report a greater
 35 range of effect sizes for reading outcomes ($d = -.012$
 36 to $d = 7.62$), with an overall effect size of $d = .44$; as
 37 in the present study, training effects were stronger
 38 on tests of pure decoding ($d = .85$; present study
 39 $d = .41$) than single word reading ($d = .34$; present
 40 study $d = .23$).

41 There is less evidence regarding the effectiveness
 42 of oral language interventions. The present gains in
 43 instructed vocabulary are in line with findings
 44 reported by Beck and McKeown (2007) Study 1) for
 45 rich vocabulary instruction of mean gains of
 46 approximately 3 words for children in grade 1 ($d =$
 47 $.74$), and approximately 5 words for children in
 48 kindergarten ($d = 1.17$) over a 10-week period. In
 49 the present study the mean gain for the Oral
 50 Language group in instructed vocabulary at $t3$ was
 51 approximately 5.23 words ($d = 1.02$). A recent
 52 meta-analysis of interventions for children with
 53 speech and language difficulties (Law, Garrett, &
 54 Nye, 2004) reported effect sizes ranging from $.28$ to
 55 1.02 for expressive syntax following clinician-led
 56 speech and language therapy of more than
 57 8 weeks. However, the present gains in grammar
 58 and narrative ability are more directly comparable
 59 with those of Davies, Shanks, and Davies (2004),
 60 who found significant improvements in both Action

Picture Test (Grammar) and Bus Story (Information
 scores) following a narrative intervention pro-
 gramme 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 pro-
 grammes 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 posi-
 tive effect on children's emergent reading (word rec-
 ognition) 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 inves-
 tigate this hypothesis.

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