

Response to Early Intervention of Children with Specific and General Language Impairment

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The present paper reports a secondary analysis of data from a published randomised controlled trial. This paper compares the outcomes of children with specific language impairment (SLI) and those with a general delay (GD) following participation in either an oral language intervention or a phonology with reading intervention. Sixty-eight children were included in the analysis, 29 with SLI and 39 with a general delay. The interventions were delivered by trained teaching assistants on a daily basis during a twenty-week period for small group and individual work. Performance on measures of language and literacy at the end of the intervention period and after a 5-month delay indicated better response to the phonology with reading intervention for the SLI group. There was no difference between the SLI and GD groups in response to oral language intervention. Findings are discussed with reference to the role of non-verbal IQ in literacy development.

Keywords: SLI, General Delay, Non-Verbal IQ, Oral Language, Phonology, Intervention

Specific language impairment (SLI) is a relatively common neurodevelopmental disorder affecting some 3-7% of children (Hulme & Snowling, 2009). It is characterised by delayed language development and persistent difficulties with lexical learning and grammar (Bishop, 1997). Since oral language skills underpin the development of both phonological awareness (Burgess & Lonigan, 1998; Carroll, Snowling, Hulme, & Stevenson, 2003; Storch & Whitehurst, 2002) and reading comprehension (Muter, Hulme, Snowling & Stevenson, 2004; Oakhill, Cain & Bryant, 2003) it is not surprising that many children with SLI go on to experience literacy difficulties (Catts, Bridges, Little & Tomblin, 2008; Nathan, Stackhouse, Goulandris & Snowling, 2004; Snowling, Bishop & Stothard, 2000). Indeed such children continue to be at high-risk of reading difficulties even if their primary language difficulties have resolved (Scarborough & Dobrich, 1990) though the prognosis for those with isolated speech difficulties is better (Raitano, Pennington, Tunick, Boada & Shriberg, 2004; Stothard, Snowling, Bishop, Chipchase & Kaplan, 1998).

In recent years, the use of IQ in the definition of learning disorders (Stanovich, 1994) and more specifically in the “diagnosis” of language impairment has become controversial (e.g., Botting, 2005). Bishop, North and Donlan (1995) were among the first to argue that the underlying phenotype of language impairment is

continuous and the use of non-verbal IQ in the diagnostic criteria is not well founded. Using data from a twin study of children with speech and language impairments, they reported that when IQ criteria were relaxed, the similarity in the language profiles of co-twins was high even when only one of them fulfilled diagnostic criteria for SLI. Second, the findings of a number of studies now suggest there is a decline in non-verbal IQ among children with SLI such that the specificity of their disorder reduces over time (Botting, 2005; Mawhood, Howlin & Rutter, 2000; Stothard et al., 1998). Together such findings suggest that it is not useful to take account of IQ when diagnosing language impairment.

In contrast, support for the utility of the discrepancy definition comes from findings that children with general delay encompassing language impairment appear to have less good outcomes than children with SLI. Bishop and Adams (1990), following a sample of children identified as having pre-school language impairment (Bishop & Edmundson, 1987), found that a higher percentage of children with general delay showed continuing impairments in language and reading at the age of 8 ½ years than those with non-verbal IQs in the normal range. Similarly, Catts, Fey, Tomblin and Zhang (2002) found a greater risk of reading difficulties at grades 2 and 4 for children identified as having a general delay in Kindergarten than for children with SLI. A corollary of this is the suggestion that non-verbal IQ may operate as a protective factor, such that children with higher non-verbal abilities are more likely to resolve their language difficulties and to have better reading outcomes (Snowling et al., 2000).

Given the educational implications of poor literacy for children with oral language difficulties (Knox, Botting, Simkin & Conti-Ramsden, 2002; Snowling, Adams, Bishop & Stothard, 2001), it is important to establish effective means of intervention for this group of children. Against a backdrop of effective interventions for poor or at-risk readers (Torgesen, 2005, for a review), interventions combining training in phonological awareness with reading instruction have been shown to be successful for children with poor oral language skills (Bowyer-Crane et al., 2008; Duff et al., 2008; Gillon, 2000, 2002). However a recent review by Law, Garret and Nye (2004) highlights the need for further investigation of what works for children with SLI in particular. The present paper presents a secondary analysis of data from a randomized controlled trial in which we showed that for children who entered school with poor speech and language development, a phonologically based intervention (P+R) was effective for promoting basic literacy skills, whereas an oral language intervention was effective for promoting vocabulary and grammatical skills (Bowyer-Crane et al., 2008). Here we compare the outcomes of those children in our sample who could be classified as SLI versus those with equally poor language in the context of general cognitive difficulties (low IQ). We show that while both interventions were effective for children with clinically significant language impairments, the P+R intervention was more effective for children with SLI than for those with global developmental delay.

In summary, the main purpose of this study was to investigate the response to intervention of children with language impairments. The questions we addressed were:

1. Is there a difference in progress made in literacy and/or language skills for children with SLI compared to those with a general delay (GD)?

2. Do children in either group show different patterns of response as a function of the intervention they received?

For present purposes, we focused on the outcome measures that showed the strongest training effects (Bowyer-Crane et al., 2008). These were measures of segmenting and blending, letter knowledge, spelling, vocabulary and expressive grammar. We also included two measures that had shown marginally significant gains—early word recognition and narrative skill. We predicted that children in the SLI group would show better response to intervention than children in the GD group. More generally, we expected to replicate the findings of the initial study; we predicted the P+R programme would facilitate word level reading skills while the OL programme would facilitate the development of vocabulary and grammar.

METHOD

Participants

Nineteen schools were recruited to take part in the study. Participants were selected from a sample of 960 children on the basis of their performance on the Picture Naming, Vocabulary and Word Reasoning subtests from the Wechsler Preschool and Primary Scale of Intelligence III^{UK} (WPPSI-III^{UK}) (Wechsler, 2003). One hundred and fifty-two children were recruited to receive the intervention with informed parental consent, on the basis of demonstrated difficulties in one or more areas of language. Full details of the screening and selection procedures can be found in Bowyer-Crane et al., (2008).

The pre-intervention performance of the 152 participating children across key language and cognitive measures was examined to identify children within the sample who met the criteria for either Specific Language Impairment (SLI) or General Delay (GD). Here we were guided by the conventions used in an earlier study (e.g., Bishop et al., 1999). Children were initially classified on the basis of their language performance: any child who met at least 2 of the following 5 criteria were considered to be language impaired: WPPSI III^{UK} Picture Naming (scaled score ≤ 6); WPPSI III^{UK} Vocabulary (scaled score ≤ 6); Action Picture Test Grammar (score $< 10^{\text{th}}$ percentile); Bus Story Information (score $< 10^{\text{th}}$ percentile); and Non-Word Repetition (standard score $< 80^{\text{th}}$) (Gathercole & Baddeley, 1996). Sixty eight of the original 152 children were identified in this way. Next we examined performance on the WPPSI III^{UK} Block Design task as a proxy for non-verbal IQ: children with a Block Design scaled score ≥ 7 were classified as SLI and children with Block Design ≤ 6 were classified as showing evidence of a General Delay (GD). Using this selection procedure, 29 children (16 boys) met the criteria for SLI (10 of these had received the OL and 19 the P+R programme). Thirty nine children (21 boys) met the criteria for GD (21 of these had received the OL and 18 the P+R programme). Details of the participants are given in Table 2.

Tests and Procedures

Children were tested at screening (t_0), pre-intervention (t_1), mid-intervention (t_2 ; after 10 weeks), post-intervention (t_3 ; after 20 weeks), and follow-up (t_4 ; 5 months after the intervention). Here we focus on the outcome measures that were

given after the end of the intervention (*t3*, *t4*). Table 1 provides a summary of tests given at each time point.

Table 1. Key Measures Given to All Children and Timepoints Administered

Measure	Testing Phase			
	Time 0	Time 1	Time 3	Time 4
WPPSI-III ^{UK} Block Design	✓			
WPPSI-III ^{UK} Vocabulary	✓			
WPPSI-III ^{UK} Picture Naming	✓			
NWRStd	✓			
Action Picture Test (Grammar)		✓	✓	✓
Bus Story (Narrative Skills)		✓	✓	
Phonological Awareness (Segmenting and Blending)			✓	
Phoneme Awareness (Sound Isolation)		✓		
Letter Knowledge		✓	✓	✓
Spelling		✓	✓	✓
Early Word Reading		✓	✓	✓
Specific Vocabulary			✓	✓

Note. WPPSI-III^{UK} = Wechsler Preschool and Primary Scale of Intelligence (3rd ed.). NWRStd = Nonword Repetition standard score.

Language

Expressive grammar. This was measured using the Action Picture Test (Renfrew, 2003). Children are asked questions about a series of pictures that elicit different grammatical constructs in response; for example, “What is the girl doing?” “What is the mother going to do?” “What has the cat just done?”

Specific vocabulary. Words specifically taught in the Oral Language programme were tested using picture naming and question forms (e.g. “What is the opposite of back?”) (*maximum 25*).

Narrative Skill (t3 only). This was measured using the Bus Story, a test requiring children to retell a story using picture prompts (Renfrew, 1991).

Literacy

Letter identification. Children were asked to identify the sounds represented by letters of the English alphabet.

Early word reading. Single word reading was assessed using the Early Word Reading Test (Hatcher, Hulme, & Ellis, 1994) with an added discontinuation rule of five consecutive errors.

Spelling. Five simple line drawings were shown and children were required to name and spell each one. At the final test session (t4), five more complex items were added. Responses were scored both as items correct and as percentage consonants correct. Only items correct scores were included in this analysis.

Phonological Awareness

Phoneme blending, segmentation and deletion (t3 only). This was measured using the Test of Phonological Awareness (Hatcher, 2000a).

Phoneme awareness (t3 only). This was measured using the initial phoneme detection component of the Sound Isolation Task (Hulme, Caravolas, Malkova & Brigstocke, 2005).

The Intervention Programmes

The present data set was drawn from a randomised controlled trial carried out to evaluate the effects of two intervention programmes—a Phonology with Reading programme (P+R) and an Oral Language programme (OL). Children were randomly allocated to receive one of the two programmes administered over a twenty-week period, during which time children received 30 minute group sessions and 20 minute individual sessions alternating on a daily basis. The programmes varied in content but both used multi-sensory activities to support the development of key skills underlying either word reading or reading comprehension. In each school, the interventions were delivered by a teaching assistant (TA) who received training and regular support from the research team over the course of the programme. A brief overview of each intervention programme is given below. Full details can be found in Bowyer-Crane et al. (2008).

Phonology With Reading Programme

The Phonology with Reading programme has three key elements: letter-sound knowledge, oral phonological awareness and book reading. The letter-sound knowledge component was carried out using the Jolly Phonics programme (Lloyd, 1992) which teaches phonemes and diagraphs in a pre-determined sequence. Oral phonological awareness activities at the phoneme level, that is segmenting and blending, were carried out in every session, with TAs determining the complexity of words used and the level of scaffolding required. For the book reading component, children read two books aloud in each individual session, one book at the easy level and one at the instructional level, as advocated by Hatcher et al., (2006). Additionally, the programme included activities for teaching sight words and encouraging letter formation.

Oral Language Programme

The Oral Language programme had four key components: vocabulary, expressive language, narrative skills and active listening. Each group session involved the teaching of new vocabulary and the revision of vocabulary previously taught.

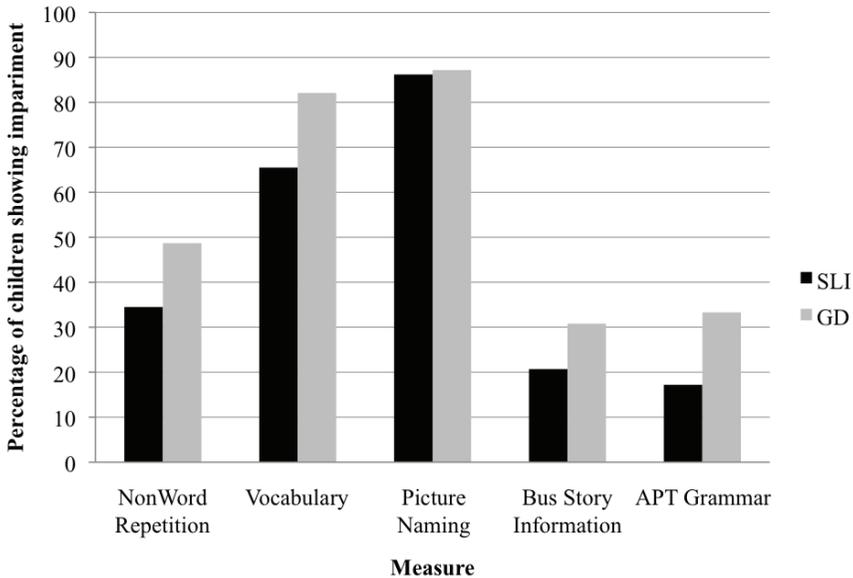
Vocabulary teaching was based on the work of Beck and colleagues (Beck, McKeown & Kucan, 2002) encouraging frequent encounters with words in different contexts. Group sessions also included activities that encouraged independent speaking (e.g. show and tell activities), and active listening. Narrative activities were carried out both in groups (i.e. making up a story altogether using picture cards) and in the individual sessions (i.e. using picture sequences to generate a new story).

RESULTS

Pre-Intervention Assessments (Specific Language Impairment vs General Delay)

Using the criteria outlined above, 3% of the 961 children originally screened met the criteria for SLI. In terms of level of impairment, more children in the GD group showed pervasive language impairment than children in the SLI group: 5.1% of the children in the GD group had impairments on 5 measures, 17.9% had impairments on 4 measures, 30.8% had impairments on 3 measures and 46.2% had impairments on 2 measures. In contrast, 24.1% of children in the SLI group had impairments on 3 measures and 75.9% had impairments on 2 measures. The percentage of children in each group with impairments on each of the key measures can be seen in Figure 1.

Figure 1: Percentage of children in the SLI and GD groups showing impairment on key measures before the intervention



As shown in Table 2, before the intervention (*t1*), the subsample of children with SLI were well matched to those with GD in terms of language measures with the exception of narrative skill (Bus Story Information), indicating that the GD group

provided less information when re-telling a story. At t_1 however, the SLI group scored significantly higher on measures of phoneme awareness and letter knowledge. Baseline differences (at t_0 and t_1) in performance were taken into account in all analyses of outcomes at the end of the intervention (t_3) and after a 5-month delay (t_4). Analysis of each variable included the autoregressor as a covariate with the exception of specific vocabulary for which the baseline measure was taken at t_2 and segmenting and blending for which no autoregressor was available.

Post-Intervention Assessments

Table 2. Descriptive Statistics Including Level of Impairment (Percentage of Children With Impairments on 2-5 Measures), No. of Children in Receipt of Free School Meals and Means (Standard Deviations) on Baseline and Screening Measures for the SLI and GD Groups With Results of a One-Way ANOVA Comparing Performance Across Groups

	SLI (n = 29)	GenDelay (n=39)	F	Sig	η^2
No of Impairments	2 = 75.9% 3 = 24.1%	2 = 46.2% 3 = 30.8% 4 = 17.9% 5 = 5.1%	- - - -	- - - -	- - - -
Age(mths)	56.17 (3.16)	55.33 (3.25)	1.14	n.s	0.02
Block Design (t0)	8.55 (1.97)	3.97 (1.87)	94.98	$p < .001$	0.59
NWRStd (t0)	88.42 (17.17)	81.27 (14.91)	3.36	n.s	0.05
Vocab Scaled (t0)	5.83 (2.41)	5.13 (1.70)	1.97	n.s	0.03
PicNam Scaled (t0)	5.55 (1.27)	5.26 (1.43)	0.78	n.s	0.01
Bus Story Info (t1)	11.86 (6.97)	8.69 (5.68)	4.08	$p < .05$	0.06
APT Grammar (t1)	15.0 (5.69)	12.51 (5.85)	3.07	n.s	0.04
PhonAwareness (t1)	7.93 (7.53)	3.62 (6.11)	6.81	$p < .02$	0.93
Letter Knowledge (t1)	14.79 (6.34)	11.41 (7.05)	4.17	$p < .05$	0.06
Spelling (t1)	0.28(0.80)	0 (0)	4.57	$p < .05$	0.07
Free School Meals	n= 9 (31%)	n=10 (25.6%)	$\chi^2 = .035$	$p = 0.85$	-

Note. NWRStd = Non Word Repetition standard score; Vocab Scaled = Vocabulary scaled score; PicNam Scaled = Picture Naming scaled score; Bus Story Info = Bus Story Information score; APT Grammar = Action Picture Test Grammar; PhonAwareness = Phonological Awareness.

Table 3. Means (sd) for SLI and GD Groups in Each Intervention on Outcomes at t3 and t4 and ANCOVA Results Comparing Performance Across Group

Group	SLI		GD		Group F(1,60)	Intervention F(1,60)	Group X Intervention F(1,60)
	OL (n=10)	P+R (n=19)	OL (n=21)	P+R (n=18)			
Intervention							
Literacy							
Letter Sound Knowledge t3	24.00 (2.4)	24.21 (2.9)	20.00 (6.19)	22.29 (4.49)	2.80	0.84	0.71
Letter Sound Knowledge t4	24.40 (2.3)	25.18 (1.7)	22.76 (4.0)	23.56 (3.2)	1.85	0.76	0.29
Early Word Reading t3	15.1 (8.9)	26.78 (13.5)	12.38 (7.8)	11.88 (11.5)	6.73, p<.025, $\eta^2=0.10$	0.60	1.14
Early Word Reading t4	21.8 (11.4)	32.77 (11.3)	18.81 (10.2)	17.38 (13.0)	5.54, p<.025, $\eta^2=.09$	0.22	1.16
Spelling raw t3	0.70 (1.1)	2.11 (1.4)	0.50 (0.8)	0.47 (0.6)	8.00, p<.01, $\eta^2=.13$	4.67, p<.05, $\eta^2=.08$	6.52, p<.025, $\eta^2=.10$
Spelling raw t4	1.22 (1.2)	4.36 (2.9)	1.74 (1.4)	1.36 (1.1)	3.92, p=.053, $\eta^2=.07$	6.62, p<.025, $\eta^2=.11$	8.89, p<.01, $\eta^2=.15$
Phonological Awareness t3 ^a	3.10 (3.8)	8.76 (5.3)	2.71 (2.2)	3.44 (3.2)	7.63, p<.01, $\eta^2=.12$	10.16, p<.01, $\eta^2=.15$	6.05, p<.025, $\eta^2=.09$

Table 3. Means (sd) for SLI and GD Groups in Each Intervention on Outcomes at t3 and t4 and ANCOVA Results Comparing Performance Across Group

Language									
Specific Vocabulary t3	14.80 (2.3)	11.11 (2.9)	13.10 (3.5)	9.29 (3.1)	4.23, $p < .05$, $\eta^2 = .07$	35.10, $p < .001$, $\eta^2 = .37$	0.83		
Specific Vocabulary t4	14.50 (2.9)	12.76 (2.7)	12.38 (2.5)	10.94 (3.3)	6.29, $p < .025$, $\eta^2 = .10$	11.24, $p < .01$, $\eta^2 = .17$	2.94		
Expressive Grammar t3	23.10 (2.8)	20.81 (5.5)	20.71 (5.5)	18.24 (4.8)	1.59	7.35, $p < .01$, $\eta^2 = .11$	0.07		
Expressive Grammar t4	22.25 (4.01)	20.47 (3.45)	20.24 (4.37)	18.84 (5.83)	0.86	2.56	0.19		
Narrative Skill t3	20.1 (6.40)	18.56 (4.80)	15.58 (4.98)	14.71 (9.27)	1.89	2.22	0.29		

Note. Phonological Awareness measured by Segmenting and Blending at t3.

Table 3 shows the performance of the SLI and GD groups on the key outcome measures separately for each Intervention. These were letter knowledge (*t3*, *t4*), early word reading (*t3*, *t4*), spelling (*t3*, *t4*), phonological awareness (*t3*), specific vocabulary (*t3*, *t4*), narrative skills (*t3*) and expressive grammar (*t3*, *t4*). Data were analysed using an analysis of covariance with the between subjects factors of Group (SLI vs GD) and Intervention (P+R vs OL). Performance on key outcome measures was compared across Group and Intervention with age, gender and the autoregressor entered as covariates.

As shown in Table 3, there were significant group effects in favour of the SLI group on three measures of literacy skill: early word reading (*t3* $F=6.73$, $p<.025$, $\eta^2=0.10$, *t4* $F=5.54$, $p<.025$, $\eta^2=.0$); spelling (*t3* $F=8.00$, $p<.01$, $\eta^2=.13$, *t4* $F=3.92$, $p=.053$, $\eta^2=.07$); and phonological awareness ($F=7.63$, $p<.01$, $\eta^2=.12$). In contrast, the only group difference on the language measures was for vocabulary (*t3* $F=4.23$, $p<.05$, $\eta^2=.07$; *t4* $F=6.29$, $p<.025$, $\eta^2=.10$), with the SLI group performing better overall than the GD group. While overall effects of Intervention were significant for phonological awareness: ($F=10.16$, $p<.01$, $\eta^2=.15$), spelling (*t3* $F=4.67$, $p<.05$, $\eta^2=.08$, *t4* $F=6.62$, $p<.025$, $\eta^2=.11$), specific vocabulary (*t3* $F=35.10$, $p<.001$, $\eta^2=.37$; *t4* $F=11.24$, $p<.01$, $\eta^2=.17$), and expressive grammar at *t3* ($F=7.35$, $p<.01$, $\eta^2=.11$), the key issue we were addressing here was whether the benefits of intervention differed for the two groups. Accordingly we examined the interaction between Group (SLI vs GD) and Intervention Programme (P+R vs OL). This interaction was significant for spelling (*t3* $F=6.52$, $p<.025$, $\eta^2=.10$; *t4* $F=8.89$, $p<.01$, $\eta^2=.15$), and phonological awareness (*t3* $F=6.05$, $p<.025$, $\eta^2=.09$). Importantly, for children in the SLI group, those who received the P+R intervention performed better than those in the OL group on measures of spelling (*t3* $t(26)=-2.75$, $p<.0125$; *t4* $t(24)=-3.09$, $p<.0125$) and phonological awareness (*t3* $t(25)=-2.98$, $p<.0125$). In contrast, children in the GD group showed no effect of intervention on either spelling (*t3* $t(34)=0.26$, $p=0.79$; *t4* $t(32)=-1.08$, $p=0.28$) or phonological awareness (*t3* $t(35)=-0.82$, $p=0.42$).

DISCUSSION

This paper compares the response of children with SLI and general delay (GD) to a Phonology with Reading programme or an Oral Language programme. All of the children in the initial study (Bowyer-Crane et al., 2008) were selected as having weak oral language skills; scrutiny of their assessment data indicated that 68 of the children fulfilled a working definition of either SLI ($n=29$) or General Delay ($n=39$). The prevalence of SLI in this sample equates to 3% of the sample of 961 children initially screened to take part in the Randomised Controlled Trial, fitting current prevalence rates of between 3% and 7%, although gender differences were not significant. Children in the GD group showed more pervasive language difficulties than those in the SLI group, as indexed by the number of measures on which they were impaired. However, it is important to note that the criteria used to identify the sample in this study did not include a measure of receptive language. We may therefore have excluded some children with receptive language difficulties and underestimated the overall prevalence of language difficulties.

Analysis of the baseline scores for the two groups indicated that they were matched on age and on the majority of language measures. However, children in the

SLI group showed better initial performance on a measure of narrative skill. This finding is consistent with recent research indicating that adolescents with SLI show better narrative performance than children with general delay (Weatherell, Botting, & Conti-Ramsden, 2007). The effect size is moderate ($\eta^2=0.06$); however, group differences were no longer statistically significant after the intervention at *t3*. Similarly, while the groups did not differ significantly on vocabulary, picture naming, grammatical skills or non-word repetition at baseline, group differences for grammatical skill and non-word repetition were approaching moderate effect sizes.

Consistent with the findings of our main study, children who received training in oral language showed better performance on measures of expressive grammar (*t3*) and specific vocabulary (*t3*, *t4*) than those who received the P+R programme. Similarly, children who received the P+R programme performed better than those given the OL programme on measures of phonological awareness and spelling (*t3*, *t4*). Importantly however, the effects of the intervention were moderated by group. Although the SLI group demonstrated more positive outcomes overall, we found a different pattern of results for literacy-related and for language skills; children with SLI benefited more from the P+R intervention in terms of gains in Early Word Reading, Spelling and Phoneme Awareness than children in the GD group. However, following the OL intervention, children in the SLI group made no better gains in specific vocabulary, expressive grammar or narrative skills than those in the GD group.

While the present results partly reflect the differential treatment effects found by Bowyer-Crane et al., (2008), they do not reflect the training effects of the OL programme for specific vocabulary and expressive grammar. Although the SLI group gained higher scores on the specific vocabulary measure after intervention, this was equally true for those children who received the OL as for those who received P+R intervention. These gains cannot therefore be viewed as a result of the specific form of training they received. Similarly, the treatment effect for grammar was short-lived, and no longer significant by *t4*. Arguably, while improvement in constrained skills such as spelling and phonological awareness are relatively straightforward to assess, gains in unconstrained skills such as vocabulary and expressive grammar are more difficult to quantify (see Paris, 2005). It may be the case that the measures used here were not sensitive enough to pick up any treatment effects for the OL intervention, and it should certainly be borne in mind that only 10 children in the OL intervention met the criteria for SLI and therefore the analysis lacked power.

What are the clinical implications of these findings? The measures that we had available were not sufficient to allow us to make judgments as to how many children would continue to fulfill criteria for language impairment at the end of the study. However, compared to a large group of their peers on criterion-referenced tests of expressive grammar and specific vocabulary at *t4*, it is noteworthy that the performance of the SLI children was in the normal range while the GD children were performing in the low- to below-average range. A second marker of improvement in language skill was provided by re-administration of the WPPSI III^{UK} Picture Naming subtest at time 4. For children with SLI, 50% from the OL group and 10.5% from the P+R group showed impairment on this measure at *t4* (i.e., scaled score of 6 or below), compared to 80% and 89.5% respectively at *t1*. For children with GD, 23.8% from the OL group and 33.3% from the P+R group showed impairment compared to 81%

and 94.4% respectively at *t1*. Together these findings suggest that the outcome of the intervention was positive for these children's language skills.

The finding that SLI children responded well to the P+R intervention is in line with previous research investigating the response of children with SLI to training in phonological awareness and basic reading skills (Gillon, 2000; 2002). However, it should be noted that the SLI group showed better performance on the initial measures of phonological awareness and letter knowledge, placing them at a potential advantage in the acquisition of literacy skills. It is plausible that the results of this study are driven by the pre-existing advantage in literacy skills shown by the SLI group, though we regard this as unlikely given that the advantage was only found in those children who received the P+R intervention.

Limitations of this study must be borne in mind when interpreting the findings. The children in this study were drawn from 19 different schools and the analyses carried out in the original study (Bowyer-Crane et al., 2008) took account of this clustering. This was not possible in the present study due to the small sample size. Similarly, there was no untreated control group included in the study and therefore the full impact of the interventions on language and literacy skills is difficult to ascertain.

In summary, it would appear that children with SLI show better response to targeted Phonology and Reading intervention than children with general developmental delay. This finding runs counter to evidence from intervention studies of poor readers that did not find that IQ was a moderator of treatment effects (Hatcher, 2000b; Hatcher & Hulme, 1999; Shaywitz, Fletcher, Holahan, & Shaywitz, 1992; Stuebing, Barth, Molfese, Weisse and Fletcher 2009). In contrast, no significant difference was found between SLI and GD groups in response to oral language intervention. Theoretical implications of these findings may touch on the role that non-verbal IQ has to play in the development of early literacy skills. It may be the case that children with oral language impairments are able to use a variety of skills indexed by non-verbal IQ (e.g., attentional resources) to bootstrap their response to literacy intervention. A protective role of non-verbal IQ in the acquisition of literacy skills is not without precedent. For example, Snowling et al., (2000) reported better levels of literacy outcome among adolescents with a pre-school history of speech-language difficulties whose performance IQ was above 100. Similarly, it has been suggested that higher verbal IQ is a good prognostic indicator of reading outcome in children with Down syndrome (Laws & Gunn, 2002), a learning disorder with a similar linguistic profile to SLI (Laws & Bishop, 2003). However, it should be noted that when the analysis was repeated excluding children in the GD group who had impairments on 4 or more language measures, the interaction between Intervention and Group for spelling at time 3 was no longer significant, while the interaction between Intervention and Group for phonological awareness was only marginally significant ($p=.053$). Thus, it may be that the pervasiveness of language impairment also impacts response to intervention.

In order to explain these findings, consideration needs to be given as to why non-verbal skills can support literacy but not language development. We propose that the constrained nature of literacy skills makes them easier to target for training than are the fundamental skills involved in language and communication. Moreover, the context in which phonic skills should be applied is more defined than the context for

language use. In a similar vein, vocabulary acquisition in this study was constrained to the extent that it focused on key words taught over the course of the intervention programme and as such lent itself to training and measurement.

From a clinical perspective, the findings of this study are encouraging for practitioners working with children with SLI. Clearly, targeted intervention programmes combining phonological awareness with reading are successful in developing the literacy skills of children with SLI. Indeed, the results reported here suggest that they can develop skills in the normal range which may ultimately move them toward satisfactory educational outcomes. However, effective oral language intervention for children with SLI requires further research. For children with general delay, the results are less encouraging and the question still remains of how best to help children with pervasive difficulties develop adequate language and literacy skills.

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ENDNOTES

¹ Thirty items from the Nonword Repetition Test were administered at screening. Pilot testing indicated that the full version of this test was too demanding for the children. The scores on the abbreviated test were then standardised on the full sample of 961 children initially screened.

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