The impact of a history of Specific Language Impairment on the production of written text during adolescence

Julie E. Dockrell

Institute of Education, University of London

Geoff Lindsay

University of Warwick

Vincent Connelly

Oxford Brookes University

Corresponding author:

Julie E. Dockrell

Institute of Education, University of London

20 Bedford Way

London WC1H OAL

Email: j.dockrell@ioe.ac.uk

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Abstract

The writing performance of 58 pupils with a history of specific language impairment was examined to evaluate the longitudinal trajectories of the pupils' writing performance and relationships with oral language, reading and handwriting fluency. Children were assessed at ages 8, 11, 12, 14 and 16. At 16 participants continued to experience problems with oral language and literacy. Writing was characterized by short texts, poor sentence structure, and difficulties with ideas and organization. Concurrent measures of vocabulary and spelling were significant factors in explaining writing performance. Handwriting fluency remained a particular difficulty for the current cohort and directly affected writing performance. Path analysis indicated that the impact of participants' oral language skills on writing was mediated by previous levels of literacy.

Background

Creating written text is a major challenge for children who experience difficulties with the cognitive processes that underpin writing (Dockrell, in press); texts are shorter, more error prone and poorly organized in comparison to those of typically developing peers of the same age (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002; McArthur & Graham, 1987). These difficulties often continue to challenge young people through their school career and beyond (Connelly, Campbell, MacLean, & Barnes, 2006; Riddick, Farmer, & Sterling, 1997). Establishing the ways in which barriers and mediators interact over time to influence the production of written text for specific profiles of learning difficulties is a prerequisite to the development of theory and evidence based interventions. Using a longitudinal data set we examine the relationships of language, literacy and nonverbal ability with the written text productions of a cohort of young people with a history of specific language impairment (SLI) [i] at the end of compulsory education in the UK (age 16).

Children with SLI experience problems with the acquisition and processing of oral language skills. The most commonly used core criterion to identify children with SLI is that their language problems cannot be explained in terms of other cognitive, neurological or perceptual deficits (Leonard, 1998). Language problems are evident by a protracted rate of language development as well as difficulties with subcomponents of the language system (Leonard, 1998). Measurements that tap into children's proficiencies with phonological processing, sentence recall, nonword repetition and tense marking have all demonstrated high levels of specificity and sensitivity in differentiating children with SLI from their typically developing peers (Conti-Ramsden, Botting, & Faragher,

2001; Ellis Weismer et al., 2000; Rice, 2000). Although conventionally identified by discrepancy criteria, children with SLI are heterogeneous in their profile of language impairments and in terms of nonverbal ability (Botting, Faragher, Simkin, Knox, & Conti-Ramsden, 2001). Patterns of performance also vary over time (Botting, 2005; Conti-Ramsden & Botting, 1999). For many of the young people with SLI, difficulties with spoken communication skills persist into adolescence (Beitchman, Wilson, Brownlie, Walters, & Lancee, 1996; Botting et al., 2001; Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998) and adulthood (Johnson et al., 1999; Clegg, Hollis, Mawhood, & Rutter, 2005). Older pupils continue to experience difficulties with reduced vocabulary levels (Johnson et al., 1999), accurate use of verb morphology (Clahsen, Bartke, & Göllner, 1997) and some syntactic structures (Norbury, Bishop, & Briscoe, 2001).

These linguistic deficits have marked effects on the processing of written text (Bishop & Snowling, 2004). Difficulties are evident in both word reading and comprehension (Catts, Fey, Tomblin, & Zhang, 2002; Stothard et al., 1998). As with linguistic performance there is considerable variability within the population on these measures, only some of which is explained by language competence and cognitive skills (Young et al., 2002). Variations in phonological and nonphonological language skills relate to different patterns of reading behavior (Bishop & Snowling, 2004). Phonological processing skills are closely related to reading decoding (Castles & Coltheart, 2004) and spelling (Caravolas, Hulme, & Snowling, 2001) while measures of receptive language have been associated with poor reading comprehension (Nation, Clarke, Marshall, & Durand, 2004). Both receptive and expressive vocabulary are related to reading

performance (Ouellette, 2006; Tannenbaum, Torgesen, & Wagner, 2006; Wise, Sevcik, Morris, Lovett, & Wolf, 2007).

Specific relationships between oral language competence and the production of written text have been reported both for children with continuing and those with resolved language problems, leading to the hypothesis that written language can be conceptualized as a window into residual language problems (Bishop & Clarkson, 2003; Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004). Phonological processes impact directly on children's spelling, a prerequisite to extended text generation (Berninger, Abbott, Whitaker, Sylvester, & Nolen, 1995). Wider oral language comprehension skills have been implicated as important factors in the children's text production (Bishop & Clarkson, 2003; Cragg & Nation, 2006; Dockrell, Lindsay, Connelly & Mackie, 2007a). Vocabulary appears to provide a building block for written language (see also Green et al., 2003). A range of lexical items provides children with the ability to build a text and provide the basic infrastructure of text meaning (see also Berninger et al., 1992).

A recent comparative study of dyslexic, language impaired and typically developing matched adolescents demonstrated the ways in which different profiles of language skills can impact on writing performance (Puranik, Lombardino, & Altman, 2007). Language impaired participants, but not dyslexic participants, produced fewer words and numbers of ideas than typically developing matched peers. In contrast both dyslexic pupils and language-impaired pupils produced more spelling and grammatical errors than their matched peers. It was argued that the difference between the performance of the two impaired groups was due to the difficulties experienced by the language impaired group in the nonphonological dimensions of text production.

Difficulties with literacy compromise the developmental trajectories of children with SLI in the school years. The combined effect of language and literacy difficulties typically results in reduced educational attainments (Dockrell, Lindsay, Palikara & Cullen, 2007b). However, the ways in which language and literacy interact to support writing requires further clarification if theoretical models are to address the nature and extent of the children's difficulties and appropriately targeted interventions are to be developed.

Compared to the studies examining the reading profiles of children with SLI (Kelso, Fletcher, Lee & Kelso, 2007; McArthur, Hogben, Edwards, Heath, & Mengler, 2000) investigations into their difficulties with writing are relatively recent. The few published studies that have examined the written texts of children with SLI provide a mixed picture of the factors that limit the production of written text. Between the ages of seven and 11 children with SLI produce a high number of spelling errors (Bishop & Clarkson, 2003) particularly phonological errors (Mackie & Dockrell, 2004) and error patterns deviate from those of chronological age but not language matched peers (Mackie & Dockrell, 2004). Children with SLI also show an increased level of grammatical errors in the written form (Gillam & Johnston, 1992; Scott & Windsor, 2000; Windsor, Scott, & Street, 2000). However, the most common associated problems are not grammatical difficulties but problems with spelling and punctuation, as well as poorer semantic content (Bishop & Clarkson, 2003).

To date, studies of language impaired populations point to a delay in patterns of writing development; where the factors that constrain text production are similar to those experienced by younger typically developing children. Over time, for typically

developing children, idea generation and the translation of those ideas into written text production become more automatic, allowing children time for the cognitively demanding processes of planning and revision. In addition, the relationships between reading and writing change. Studies of the writing skills of language impaired populations have failed to examine developmental changes. Important gaps remain in our understanding of the writing profiles of children with SLI and the factors that underpin difficulties in text production. Specifically, evidence examining the writing performance of adolescents with a history of SLI is missing and the ways in which earlier language and literacy skills contribute to the development of text production overtime is unexplored. A further major omission, given the motor incoordination difficulties experienced by many children with SLI (Hill, 2004), is the lack of measures of handwriting fluency. Transcription skills uniquely predict compositional fluency throughout the elementary grades (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997) and motor incoordination can impact on handwriting fluency (Graham, Struck, Richardson, & Berninger, 2006). Thus pupils with a history of SLI may be disadvantaged in written text production by transcription skills, their semantic competence, and their literacy levels

Purpose

The current study aims to address the ways in which measures of language, literacy, and processing limitations are related to writing in a sample of adolescent pupils with a history of SLI. No longitudinal data about the writing skills of pupils with SLI at this phase of education have been published to date. It is predicted that, similar to other groups of children with learning disabilities, pupils with a history of SLI will continue to

exhibit difficulties in the production of written text in late adolescence. Given the processing demands of producing written text, performance will be differentially impaired in relation to oral language and reading. Texts are predicted to be short and marred by both spelling and grammatical errors. Some relative growth in writing skills may be predicted given that previous studies have found a relative improvement in the production of written story composition towards the end of elementary school (Fey et al., 2004). This slow growth may continue into the secondary school years. However, performance is still predicted to be influenced both by previous levels of written language and by concurrent language abilities as well as limitations in transcription skills. In addition, the relationships between oral language and reading (Wise et al., 2007) leads us to predict that over time pupils' writing performance will be mediated by their levels of reading.

To test these predictions a cohort of adolescents that had been identified with SLI at 8 years 3 months, and followed for the subsequent 8 years, completed a battery of language and literacy tests, cognitive measures and a handwriting fluency measure at age 16. Writing skill was assessed through the analytic scoring scale for the writing measure of the WOLD (Wechsler Objective Language Dimensions; Rust, 1996) and measures of text length were computed given the relationships between text length and quality for elementary school pupils (Gansle, et al., 2002; Graham et al., 1997). We predicted that limited expressive language would reduce text length and thereby reduce the performance of older pupils with a history of SLI. Hierarchical regression and path analysis were used to examine the pattern of relationships among language, literacy and writing measures

both concurrently and over time to produce a model of the factors supporting text production.

Method

Participants

Sixty-nine children (17 girls and 52 boys) were identified as having SLI when they were at a mean age of 8-3 (*SD* = 4 months). All participants had English as their only language and were of white English background. Eleven per cent of the total sample was eligible for free school meals, a measure of disadvantage in England (Strand & Lindsay, in press). This is comparable to the national school average of 14.3 per cent. Pupils were assessed an additional four times. Mean age at assessment and skills assessed are provided in Table 1. Pupils were taking part in a wider longitudinal government funded study charting the educational and social needs of children with SLI (Dockrell et al., 2007b). Within this study pupils' production of written text was initially studied at age 11 (Dockrell et al., 2007a) and then again at 14 and finally at 16, data which are reported here.

As Table 1 shows, at the end of formal education the pupils continued to experience difficulties with oral language and literacy. The continued specificity of their difficulty is evident from the statistically significant differences with nonverbal ability reported in the Table 2.

Initial Identification and Follow up. At age 8 all children required additional learning support to access the curriculum, and 54 per cent had a Statement of special educational needs under the UK Education Act 1996. The statement specifies the provision that must by law be made to meet the child's special educational needs. This

status is applied to about 3 per cent of school pupils in the UK, over half of whom attend mainstream schools.

Initial identification of participants was completed following a survey of educational provision in two local education authorities (LAs) in the UK. Professionals (speech and language therapists, educational psychologists and special educational needs coordinators) were asked to identify children who had a discrepancy between their level of functioning in the area of speech and language and that which would be expected given the child's functioning in other areas, and who were also experiencing significant language based learning needs. A total of 133 children were identified (Dockrell & Lindsay, 2000) from which a subsample from each LA was derived ($N = 59$). Children with any additional complicating factors which would preclude the diagnosis of SLI were excluded. In addition, children of the same age in two special schools for children with SLI were included in the study ($N = 10$). Only the children who at age 8 were experiencing a specific language impairment were included in the longitudinal study.

Attempts were made to contact all participants in their final year of compulsory education (age 16). Sixty-two pupils out of the original 69 agreed to complete formal assessments of whom 58 agreed to complete the writing task (15 girls and 43 boys). Of the pupils who refused to write, three completed reading and language measures. Refusers typically achieved lower scores on language and literacy measures, but there were no statistically significant differences between the two groups.

The children who completed writing assessments were being educated in a variety of ways: 35 in mainstream classes, 8 in special units within mainstream schools and 15 in special schools including residential special schools for children with SLI. Over the

previous 8 years a significant proportion of pupils had moved between different types of provision. As was the case at previous points in the study (Dockrell & Lindsay, in press) there were few differences between participants in different settings on the psychometric measures. Pupils in specialist settings scored significantly lower on measures of reading comprehension, $F(1, 57) = 6.112$, $p = .02$, $\eta p^2 = .10$, formulated sentences , $F(1, 57) = 4.498$, $p = .04$, $\eta p^2 = .08$, and nonverbal ability, $F(1, 57) = 4.995$, $p = .03$, $\eta p^2 = .08$) but not on any other language (vocabulary, receptive grammar, listening to paragraphs) or literacy (single word reading, fluency or spelling) measures.

Materials

Measures were identified to tap oral language skills, literacy, nonverbal ability and written language. Tests were identified to be age and culturally appropriate, and standardized with measures of reliability and validity. All measures are used for the identification and assessment of children with SLI in the UK. Measures of reliability and validity are reported for each scale on first mention, and unless otherwise stated information was gained from technical manuals and refers to the overall reliability and validity.

Nonverbal ability. British Ability Scales II (BAS II) Matrices subtest (Elliot, Murray, & Pearson, 1997). Children are presented with a set of patterns where one pattern is incomplete. There is a choice of six responses and children are required to point to the missing piece: reliability .85; validity with the WISC-III Performance scale .47.

Receptive Vocabulary. British Picture Vocabulary Scale (BPVS; Dunn, Dunn, Whetton, & Burley, 1997): Children are shown four line drawings and asked to point to

the one that best illustrates a word spoken by the investigator: reliability .89; validity with the Expressive One-word Vocabulary test .72.

Grammar. Test of Reception of Grammar (TROG; Bishop, 1983). Children are shown four pictures and the investigator reads a sentence. The child is required to select a picture that matches the sentence structure: reliability .88; validity with the Clinical Evaluation of Language Fundamentals: Revised UK Edition (CELF-R^{UK}; Peers, Lloyd, & Foster, 1999) .53.

CELF-R^{UK} (Peers et al., 1999) – Formulated Sentences and Listening to Paragraphs. Formulated sentences requires a child to produce a sentence in response to an orally presented single word or two word combination: reliability .82; validity with other CELF-R^{UK} expressive subscales .43 - .49. Listening to paragraphs requires the child to attend to a short paragraph and answer specific questions related to the content: reliability .74; validity with other receptive scales .30 - .43

Reading decoding. BAS II Word Reading Scale. This scale assesses recognition and oral reading of single words: reliability .93; validity with WORD reading scale .71 (Wechsler Objective Reading Dimensions; Wechsler, 1993).

Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999). This contains two subtests. The Sight Word Efficiency (SWE) subtest assesses the number of real printed words that can be accurately read within 45 seconds, and the Phonetic Decoding Efficiency (PDE) subtest measures the number of pronounceable printed nonwords that can be accurately decoded within 45 seconds: Inter scorer reliability .99 and test-retest reliability .90 and above, validity .92-.94 SWE and .89-.91 PWE (Woodcock reading mastery scales-revised, Woodcock, 1987).

Reading comprehension scale. Wechsler Objective Reading Dimensions (WORD; Wechsler, 1993). The reading comprehension scale measures the pupil's understanding of short written passages of text. With this test, the child reads a passage out loud or silently and then answers comprehension questions posed orally by the examiner. The measure has a split-half reliability for children age 15 to 16 of .82

Spelling. British Abilities Scales II (BAS II); Spelling Scale: This scale provides a number of phonetically regular and irregular words to assess the child's ability to produce correct spellings. Each item is first presented in isolation, then within the context of a sentence, and finally in isolation. The child has to respond by writing the word: reliability .91; validity with Weschler Objective Reading Dimension (WORD) spelling .63.

Written Language. The Wechsler Objective Language Dimensions (WOLD): Writing Expression (Rust, 1996). The child is asked to write a letter describing their ideal house. Children are allowed 15 minutes to complete the task. The written output can be scored either holistically or analytically: reliability .89, correlation with Woodcock-Johnson Psycho-Educational Battery-Revised (Mather & Jaffe, 1996) Dictation = 0.72. The analytic scale comprises six dimensions, each rated on a four point scale, which are scored independently of each other: Ideas and development; Organization, unity and coherence; Vocabulary; Sentence structure and variety; Grammar and usage; Capitalization and punctuation.

Writing fluency: Handwriting fluency task (based on Berninger, Mizokawa, & Bragg, 1991). This task involves pupils writing out the letters of the alphabet, in lower case, in order, as quickly as possible in one minute. Letters are only counted towards a total number of letters per minute if the letters are in the correct order and legible. The

task has an inter-rater reliability of $r = 0.97$ (Berninger et al., 1997). It has been incorporated into the PAL test battery (Berninger, 2001) where it has been shown to conform fully with psychometric standards of reliability and validity.

Procedure

All pupils were assessed individually in a quiet room at school by a qualified educational psychologist. Informed consent from schools, parents and children was provided prior to any testing. Testing occurred over three days. The first session involved a familiarization with the assessor and a discussion about the longitudinal study. Pupils were allowed to terminate the session or opt out of a test if they wished. All tests were administered using the standard procedures in the manuals. Pupils were presented with a certificate of merit for participation in the study.

For the writing measure (WOLD) the time taken to produce the written text was noted in seconds and pupils were asked to read back their written texts to prevent penalizing children who were poor spellers. Unclear words were noted on a separate sheet. Analytic scoring was used and reliability checks were performed for the six dimensions of the analytical scoring of the WOLD by the two research assistants. In the case of an inter-rater disagreement the scores were further discussed with the research team and informed the final scoring of the texts. Mean inter-rater reliability for a randomly selected 36 ratings was 80 per cent with a Kappa score of .66. Spelling errors and the total number of words, excluding numerals, produced were counted. There was 100 per cent agreement between raters for these measures.

Results

Only data for children completing the writing measure at 16 are reported ($N = 58$). To normalize performance on the test each standard score, centile or T score was transformed to a *z* score to provide a common metric for analysis. The results are presented in three parts. Part 1 examines pupils' performance in written text production, both on the total analytic score of the WOLD and in terms of words written and errors produced. Part 2 describes the relationships between language and literacy and the total analytic score on the WOLD. To consider further the different relationships between the variables Part 3 presents two path analysis models to examine the magnitude and significance of the relationships between literacy, language and written text production concurrently and over time.

Part 1 Pupils' performance in written language at 16

As a group, the children performed poorly on the total analytic scale of the WOLD with a mean *z* score of -2.20 ($SD = 1.14$) and this pattern of performance did not vary by gender (girls $M = -2.34$, $SD = .89$; boys $M = -2.15$, $SD = 1.21$; $t = 0.58$, $df = 56$, *ns*) or special and mainstream settings (mainstream $M = -2.00$, $SD = 1.21$; special $M = -2.50$, $SD = .98$; $t = 1.6$ $df = 56$, *ns*). As such, all further analyses treat the participants as one group.

Performance on the written language measure was significantly poorer than their nonverbal ability scores ($t = 9.12$, $df = 56$, $p < .0005$, Cohen's $d = 1.31$). The extent to which pupils' performance in writing was commensurate with their language and literacy assessments was examined through a series of repeated measures ANOVAs. Performance on the written language measure was poorer than performance on the oral language

measures, $F(3, 168) = 51.89$, $p < .0005$, $\eta p^2 = .48$. Post hoc comparisons, adjusting for multiple comparisons, indicated that children's performance on the written language measure was significantly poorer than both vocabulary and listening to paragraphs ($p < .0005$), but did not differ significantly from the expressive language measure, recalling sentences. The literacy measures of spelling, reading decoding, and reading comprehension were also considered in relation to writing. There was a significant effect of literacy measure, $F(3, 159) = 8.336$, $p < .0005$, $\eta p^2 = .14$. Post hoc comparisons adjusting for multiple comparisons indicated that children's performance on the written language measure was significantly poorer than spelling ($p = .001$), reading decoding ($p = .005$) and reading comprehension ($p < .0005$). Participants, thus, experienced significant difficulties in the production of written text and the degree of impairment for writing, as measured by norm referenced tests, was significantly greater than their difficulties with receptive oral language and other aspects of literacy.

Written texts were examined in terms of text length, writing time and spelling errors. Participants produced short texts; the mean length of texts produced was 86 words (range 12-182). Of the 15 minutes allocated for the task, pupils wrote for an average of 10 minutes (range 2-15). There were high and statistically significant relationships between text length and writing time ($r = .55$, $p < .0005$) and between text length and the WOLD *z* score ($r = .66$, $p < .0005$). On average pupils were producing 9 words a minute ($SD = 4.5$). Spelling errors in the text were frequent ($M = 5.5$, $SD = 4.2$; range 0-17) but there were no significant correlations between the numbers of spelling errors and the numbers of words written ($r = -.10$, *ns*) or WOLD total score ($r = .04$, *ns*).

Participants produced a mean rate of 53.75 (*SD* = 27.61) letters a minute for the handwriting fluency measure. The mean number of letters per minute produced was equivalent to that of children aged between 8 and 9 years (grade 3 *M* = 47.3; grade 4 *M* = 63.26; Graham, Berninger, Weintraub, & Schafer, 1998). Handwriting fluency at 16 years was significantly and positively correlated (*r* = .54, *p* = .002) with the WOLD *z* score, reading and spelling at 16 and reading, spelling and nonverbal ability at 14. Writing fluency was significantly correlated with both the numbers of words written (*r* = .54, *p* <.0005) and WOLD *z* score (*r* = .42, *p* < .0005) but there was no relationship with the numbers of spelling errors produced *(r* = .18, *ns*).

Analytic scores on the WOLD. To identify specific patterns of difficulties the analytic scores of WOLD subtests were examined. The children's best performances were on measures of grammar (*M* = 1.71, *SD* = .88) and capitalization (*M* = 1.67, *SD* = .85), although both means were still at the lower end of the scale. The poorest performance was evident on the measure of sentence structure (*M* = 1.45, *SD* = .73), a score that is indicative of poor sentence structure containing many errors that inhibits clarity or fluency (WOLD manual, Rust, 1996). Measures of ideas and development (*M* = 1.5, *SD* = .73), vocabulary (*M* = 1.47, *SD* = .73), and organization and coherence (*M* = 1.57, *SD* = .79) were also in the low range. A Freidman's Analysis indicated that the scores differed statistically significantly across the subtests (X^2 = 25.86, *df* = 5, *p* < .0005). Measures of grammar and capitalization did not differ from each other (*z* = .564, *ns)*. There were significant differences between grammar compared with organization and coherence (*z* = -2.138, *p* = .03), ideas and development (*z* = -2.558, *p* = .01), vocabulary (*z* = -3.500, *p* < .0005) and sentence structure (*z* = -3.638, *p* < .0005). Scores for

capitalization were significantly better than vocabulary (z = -2.683, p = .007) and sentence structure (z = -3.153, p = .002), but did not differ statistically from the measures of ideas and development (z = -1.908, *ns*) or organization and coherence (z = -1.414, *ns*). The measure of organization and coherence was significantly better than vocabulary (z = -2.121, p = .03) but did not differ from ideas and development (z = -1.00, *ns*) or sentence structure (z = -1.748, *ns*). Ideas and development, vocabulary and sentence structure did not differ significantly from each other (z = -.577, *ns*; z = -.832, *ns*; z = -.302 *ns*).

To investigate further the pattern of subtest relationships a factor analysis was computed. The factor analysis met all the necessary statistical assumptions and only those factors with eigen values greater than 1.0 were considered. The analysis generated a single factor solution accounting for 83 per cent of the variance. There were large and significant loadings (.87) for all of the WOLD subtests.

Writing trajectories over time. Data for the total analytic score of the WOLD were available for 51 pupils at four time points (11, 12, 14 and 16). Four pupils had refused to write at 11, and data were missing for one pupil at 12 and two pupils at 14. There was no significant difference between writing scores at 16 for pupils with missing data (M = -2.66) and those with data for all four time points (M = -2.14), t = 1.159, df = 56, ns. As shown in Figure 1 there was a significant decrease in relative performance as measured by z scores, $F(3, 150) = 23.888$, $p < .0005$, $\eta p^2 = .32$. Post hoc comparisons of z scores adjusting for multiple comparisons indicated that the participant's writing performance at age 11 was significantly better than their performance at 12 (p = .002), 14 (p = .002) and 16 ($p < .0005$). Performance at age 12 and age 14 did not differ whereas there was a significant decline in performance again at age 16 ($p < .0005$ for both ages 12 and 14).

Although the mean drop between ages 11 and 16 was one *SD* (*M* = 1.0) patterns of change varied across pupils. A change score was computed where the *z* score at 11 was subtracted from the *z* score at 16, thereby providing a pattern of change across five years, where positive scores would indicate a relative increase in writing performance. The relationships between literacy, language and nonverbal abilities and change scores are presented in Table 3. Using a Bonferroni correction of .004 for multiple correlations there were significant relationships between WOLD change score handwriting fluency ($r = .54$, $p < .0005$) and spelling ($r = .38$, $p = .006$). There were no significant relationships with nonverbal ability, vocabulary, reading decoding and reading comprehension. We examined this pattern of relationship using multiple regression. In all cases residuals were normally distributed. The extent of the relationship between gain score and handwriting fluency was confirmed with a multiple regression controlling for nonverbal ability which revealed a significant model, $F(2, 49) = 9.689$, $p < .0005$) accounting for 29 per cent of the variance. Fluency was the only significant predictor in the model ($\beta = .479$), thus the less fluent pupils were in producing the alphabet the more likely were their writing scores to decrease (in relation to their peers) over time.

Part 2 Relationships between language, literacy and the WOLD

There were statistically significant correlations for the WOLD *z* score at 16 and all the predictor variables apart from the TROG. As expected, the literacy measures of spelling, reading decoding and reading comprehension were significantly related to writing. In addition the language measures of vocabulary (BPVS) and formulated sentences were statistically significantly related and each correlated with reading decoding and comprehension.

We predicted that the most significant influence on pupils' writing would be previous levels of writing but in addition vocabulary and reading levels would account for additional variance (Dockrell et al., 2007a). Three sequential multiple regression analyses were conducted to examine prediction of WOLD writing at 16. In the first analysis writing at age 14 was entered into the model as the first step to control for previous written language performance. On the second step vocabulary was entered resulting in a significant increase in R^2 (significant F Change, $p = .001$) and on the third step single word reading again resulted in a significant increase in R^2 (significant F Change, $p = .005$). The full model R^2 is shown in Table 4 and was significant, $F(3, 57) = 20.624$, $p < .0005$, adj $R^2 = .53$.

The second sequential multiple regression used word reading efficiency (TOWRE) as the predicting literacy variable. We reasoned that for later literacy, fluency in word reading and phonological decoding were likely to have greater impacts on the production of written text than untimed measures of single word reading. There was no statistically significant difference between the pupils' performance on single word reading efficiency and phonemic decoding efficiency (reading efficiency $M = 69$, $SD = 27$; phonemic decoding efficiency $M = 71$, $SD = 30$, $t = -1.871$, $df = 58$, *ns*). As in the previous analysis writing at age 14 was entered into the model to control for previous written language performance followed by vocabulary. In this case entering the TOWRE as the third step resulted in a significant increase in R^2 (significant F Change, $p = .003$). The full model R^2 is shown in Table 5 and was significant, $F(3, 57) = 21.624$, $p < .0005$, adj $R^2 = .52$ with all variables having significant effects. Thus, the impact on writing of both reading fluency and single word decoding reading measures was similar.

Both the differential correlations between spelling and the other variables, and analyses highlighting the importance of writing fluency, indicated that their relative role in writing performance should be considered. Thus, a third sequential multiple regression analysis was employed to examine the impact of these variables. As in the previous models, WOLD writing at age 14 was entered into the model followed by vocabulary and reading. On the fourth step, writing fluency was added but this did not significantly change the model R^2 (F Change, $p = .24$). On the fifth and final step spelling was entered, resulting in significant increase in R^2 (significant F Change, $p = .001$). The full model R^2 was significant, $F(5, 58) = 18.891$, $p < .0005$, adj $R^2 = .61$. As shown in Table 6 reading efficiency and writing fluency did not have a significant partial effect in the full model, but previous WOLD score, vocabulary and spelling did have significant partial effects.

Part 3 Path Analyses

The regression analyses clarified the relationships between language, literacy and writing. In order to examine the relative importance of oral language and literacy on the pupils' writing scores two path analysis models were tested. The regression analyses had indicated that large effect sizes were to be predicted and, therefore with appropriate parameter estimates and tests of alternative models the small sample could be used to build an exploratory path model, using maximum likelihood estimation (Ullman, 1996). The stronger the correlations, the more power there is to detect an incorrect model and this would reduce Type 1 errors in the models.

AMOS 7 was used to test the models. Model 1 examined concurrently the relative contribution of language, literacy and writing speed at 16. Model 2 examined the longitudinal effects of language and literacy from age 8 to age 16. A variety of fit indices

are available with AMOS. The overall fit of the final model was assessed by χ^2 and by root mean square error of approximation (RMSEA). Following Hu and Bentler (1999) who recommend joint criteria to retain a model, models were only considered a good fit if the χ^2 was not significant, RMSEA < .06 and CFI > .96, RMSEA and CFI being a more sensitive fit index with small sample sizes (Fan, Thompson, & Wang, 1999).

For the concurrent model we predicted that spelling, vocabulary and speed of writing would have direct effects on writing at age 16 with reading revealing an indirect effect at this point through spelling. It was also predicted that both vocabulary and reading would be associated. As predicted the path analysis in Figure 2 indicates a direct relationship between vocabulary and writing (β = .32), speed of writing (β = .21) and spelling (β = .47). Reading fluency revealed an indirect effect on writing through both spelling (β = .58) and speed of writing (β = .57). The goodness of fit measures indicated a good fit: $X^2(4) = 3.602$, $p = .46$, RMSEA = .00, $CFI = 1.000$. Models including nonverbal ability and reading comprehension were also tested to eliminate potentially relevant factors. These models failed to provide a fit with the data.

For the exploratory predictive path analysis, we considered measures assessed at 8, 11, and 14 and writing at 16. We predicted that vocabulary and reading at age 8 would be significant factors in supporting writing at age 11 and that from age 11 writing, itself, would show the strongest relationships with subsequent writing performance. No model including reading at age 8 or reading at age 11 fit the data. However a longitudinal model including vocabulary at 8 having an indirect effect on writing provided a good fit with the data. The path analysis in Figure 3 indicates direct effects of reading (β = .27), spelling (β = .34) and writing (β = .32) at age 14 with writing at 16. Oral language skills had an

indirect effect through reading at 14 (β = .34) and writing at 14 (β =.25). Vocabulary at age 8 revealed indirect effects on writing through vocabulary at age 11 (β = .75). Moreover vocabulary at age 11 revealed indirect effects on writing at 16 through oral language at 14 (β = .51). Importantly the indirect effect of writing at age 11 was evident through spelling at age 14 (β = .55) but not, as predicted, writing at age 14 (β = .16). The goodness of fit measures indicated a good fit: X^2 (16) = 11.350, p = .79, RMSEA= .00, *CF1* = 1.000. Models examining alternative directions of effect and models including nonverbal ability and reading comprehension were also tested to explore models with a better fit. These alternative models did not provide a fit with the data.

Discussion

The writing skills of a cohort of pupils with a history of specific language impairment (SLI) were examined longitudinally to the age of 16. Measures of language and literacy assessed both longitudinally and concurrently were examined to establish their relative contribution to written text production. The pupils in this study continued to experience specific difficulties with language and literacy. The production of written text continued to be an area of marked vulnerability, with writing scores being the lowest standardized score of the receptive language and literacy measures. Moreover, during their teenage years the pupils' writing skills decreased relative to standardized norms. Thus, the current data contrast with data in the elementary years for children with SLI where a relative improvement in the production of written story composition has been noted (Fey et al., 2004). These differences are important to address. The decreases in pupils' performance on written measures may reflect their specific language difficulties. For typically developing children their increasing language and literacy skills support

later development of writing; for those with continued difficulties these resources are not available. In conjunction it is important to consider the specific support provided to children when developing their written language skills, an issue we return to later. This decrease in writing skills occurred at the time when, in the UK, it is expected that by the age of 11 pupils have mastered the basic skills in reading and writing, have moved towards the analysis of genres, are writing with technical accuracy and organizing text into planned and coherent sequences (www.standards.dfes.gov.uk/keystage3/) – a major challenge for the pupils in this study.

The WOLD provided the tool for comparing performance on writing dimensions over time. Examination of the WOLD subscales at 16 was consistent with assessments at previous points in development (Dockrell et al., 2007a, Mackie, 2007). Performance was reduced across all subscales, but the poorest performance was evident in measures of sentence structure, ideas and development, and vocabulary. The factor analysis of the WOLD subscales provided evidence that, at this point in development, the pupils' written productions could be captured by a single dimension. This differs from the patterns at age 11 (Dockrell et al., 2007a) and age 14 (Dockrell & Connelly, 2007), where two different dimensions underpinned performance on the WOLD: semantics and rules. This single factor for the WOLD is, however, consistent with data for younger (age 11) typically developing children (Connelly & Dockrell, in preparation) and suggests that for pupils with a history of SLI the coordination of idea generation and sentence production and grammar is an extended developmental process.

Despite the apparent co-ordination of the two dimensions, difficulties in relation to form (spelling and handwriting) and content generation still posed major difficulties

for these pupils. Texts produced were short with frequent spelling errors. Previous research has failed to consider writing fluency for pupils with SLI and the current data indicated that shorter texts were associated with reduced levels of handwriting fluency. Indeed the cohort's handwriting fluency was equivalent to the average obtained for pupils some seven years younger (Graham et al., 1998). This was consistent with slow production of text, as evidenced by words produced per minute. The less fluent pupils were also more likely to show decreases in their writing standard scores over time.

Regression analyses revealed that at age 16 the significant concurrent predictors of text production were spelling and vocabulary. The importance of vocabulary as a key predictor of text production at this age extends work with younger pupils which has identified pupils' limitations in text generation and reduced levels of word use and lexical diversity (Fey et al., 2004; Scott & Windsor, 2000) and semantic content (Bishop & Clarkson, 2003) as critical limiting factors for children with language impairments. The continuity of the importance of vocabulary as a determinant of text quality for this cohort of children (Dockrell et al., 2007a) adds further weight to the view that vocabulary provides a building block for written language.

The poor spelling skills of the participants were evident both in their written text productions and in the assessment of their single word spellings. At age of 11 the participants' writing levels were mediated by their reading levels. The point of fracture has moved, and on the surface appears similar to difficulties exhibited by young adults with dyslexia (Connelly et al., 2006), where writing was constrained by their transcription skills in the form of poor spelling and slow handwriting. However, the dyslexic population was different from the current cohort in that they could produce compositions

that were age appropriate in terms of the ideas and development, sentence structure and the organization, unity and coherence scales of the WOLD, all areas of weakness for the pupils described here. As shown by Puranik et al. (2007), with a younger cohort, problems with spelling and transcription combined with wider problems with language led to very poor performance in writing

Given the relationships between the different variables and the predictions derived from previous studies, path analysis was used to provide estimates of the magnitude and significance of hypothesized causal connections between sets of variables. Our first model explored the potential interactions between concurrent measures. The best fit model included direct effects of vocabulary, spelling and writing fluency, with reading fluency (a timed measure of reading decoding) having an indirect effect through spelling and writing fluency. The concurrent model confirms both the effects of semantic factors, as measured by vocabulary, and phonological factors, as measured by spelling, and suggests an independent contribution of writing fluency.

There has been a longstanding concern about the information processing constraints experienced by children with SLI (Ellis Weismer & Hesketh, 1996; Montgomery, 2000) and reduced performance on tasks which require quick and accurate performance (Leonard et al., 2007). Measures of speed of writing and reading fluency are both significantly related, either directly or indirectly, to text production. These deficits may reflect reduced performance in both verbal working memory (reading fluency) and processing speed (speed of writing) (see Leonard et al., 2007). Yet the highly significant relationship in the current study between the two (.57) suggests that the underlying factor may be the ability to coordinate and efficiently manage different information and this

limits children's text production. This interpretation would also be consistent with the difficulties experienced by children with language impairment in monitoring and editing their written productions (Scott, 1999). As long as translating continues to place heavy cognitive demands on writing, the management of planning will be impaired.

In our second model we explored the longitudinal predictors for the pupils' writing performance at 16. This model identified direct effects of reading, spelling and writing at age 14 on writing at age 16. These data demonstrate the ways in which both phonological and morphological literacy measures come to the fore in the writing performance for these pupils. As in the regression models, nonphonological factors were also evident and, unlike the literacy measures, their impact was traced back to age 8. Vocabulary appears to provide an indication of semantic knowledge which supports both writing at age 11 and sentence formulation at age 14. Over time the impact of oral language is mediated by both the pupils' reading skills and their writing skills.

Both the concurrent and the longitudinal models provide evidence to support specific pupil based factors that impinge on the production of written text, and offer scope for targeted and strategic interventions (Troia, 2006) and interventions which could compensate for text production difficulties (MacArthur, in press). It is unlikely that these factors alone explain the relative decline in writing performance. As the change scores demonstrated it is was only writing fluency that predicted change and this factor accounted for 29 per cent of the variance. An important question remains about the support in writing that is provided once students enter secondary school both to maintain current levels of text production and enhance their capacity to produce texts which are closer to expected targets. Support for those who struggle at this phase of education in

England is ‘uneven’ (Ofsted, 2007, para 31) and differentiation of the curriculum often involves simplifying activities (Dockrell & Lindsay, 2007). Government initiatives to improve skills at this stage have not been successful, with less able pupils being left behind and catch-up classes for those who struggled in primary school failing to bring pupils up to the expected standard (Ofsted, 2007). Typically these interventions focus on word reading and are provided for most pupils at ages 12-14.Thus, given evidence from both the school reports for these pupils (Dockrell et al., 2007b) and the current educational context it is unlikely that the pupils are receiving the support they require to develop their writing skills. A lack of appropriate interventions and support resources further disadvantages these struggling writers. This lack of support has been highlighted in other educational systems (see Moni et al., 2007; Troia & Maddox, 2004).

Study limitations

Investigations of written language are complex and subject to a number of limitations. The current study is limited by the small sample, the use of a single writing measure and the lack of information on the children’s wider information processing skills. Given the purported importance of vocabulary a more detailed examination of the pupils’ competence in this area is needed. It is not clear the extent to which the vocabulary measure is tapping the breadth of the children’s knowledge, the depth of their semantic representations or the efficiency of lexical retrieval. There is increasing evidence that measures of depth and breadth of vocabulary may have differential effects on reading and we expect similar patterns to be evident in writing (see for example Ouellette, 2006; Tannenbaum et al., 2006). Future work should pay specific attention to the nature of the evidence for the interventions provided to support writing including the

skills which underpin performance in writing and the strategies provided for co-ordination of these skills.

Care also needs to be taken in generalizing performance on our writing task. The decline in writing scores could be explained by a lack of emphasis on this kind of writing in secondary school. Studies of more complex writing tasks demanded by the secondary school system might lead to fewer problems. However, the very poor level of the pupils' performance in English exams suggests that this is unlikely to be the case (Dockrell et al., 2007b). While the data suggest widespread failure with writing tasks in relation to peers the importance of examining writing profiles and predictors of writing performance across genres remains an important avenue of further research.

Educational implications

The current study highlights the importance of phonological and nonphonological dimensions of oral language as important factors in supporting (or limiting) the production of written text. In addition, writing fluency has been identified as a particular problem for these pupils. Further automating the processes involved in transcription is an important consideration for these pupils. A recent UK-based intervention to improve the spelling of subject-specific words by students with dyslexia seems a step in the right direction (Sterling, Ertubey, Brownfield, O'Reilly, & Noyce, 2004). Other schemes that have been used successfully with other children could also be potentially adapted for use with these pupils (see Berninger et al., 1997). These schemes are useful since they do not advocate lower level writing instruction at the expense of higher level writing skills. Because we have shown that the writing produced by the students is related directly to literacy level, schemes to improve literacy levels, particularly spelling, should also have a

long-term benefit on the writing produced by these students provided they are embedded within interventions that support the co-ordination of text production and meaning generation.

In addition there is a need to consider the vocabulary that these pupils possess to support idea generation. Previously we have argued that the development of semantic skills may be seen as a compensatory mechanism to support the writing for pupils with language impairments. The data presented confirm that this is a continuing issue as they become older. Pupils with poor vocabulary skills will need explicit support with vocabulary to generate ideas; this dimension is particularly important since we identified no changes in the participants' relative vocabulary across their education (Dockrell et al., 2007a).

Finally, an important consideration for pupils who have experienced such a history of failure to write will be motivation. Interventions will need to be developed which both address the major limitations with basic skills while motivating the young people within an empowering educational environment. This remains a major challenge.

References

Beitchman, J. H., Wilson, B., Brownlie, E. B., Walters, H., & Lancee, W. (1996). Long-term consistency in speech/language profiles: I. Developmental and academic outcomes. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*(6), 804-824.

Berninger, V. (2001). Process assessment of the Learner (PAL) Test battery for reading and writing. San Antonio, TX: The Psychological Corporation.

Berninger, V. W., Mizokawa, D., & Bragg, R. (1991). Theory based diagnosis and remediation of writing disabilities. *Journal of School Psychology*, *29*, 57-79.

Berninger,V., Abbott, R., Whitaker, D., Sylvester, L., & Nolen, S. (1995). Integrating low-level skills and high-level skills in treatment protocol for writing disabilities. *Learning Disability Quarterly, 18,* 293–309.

Berninger, V., Vaughn, K., Abbott, R., Abbott, S., Rogan, L., Brooks, A., Reed, E., & Berninger, V. W. (1999). Coordinating transcription and text generation in working memory during composing: Automatic and constructive processes. *Learning Disability Quarterly*, *22*, 99-112.

Bishop, D. V. M. (1983). *Test of reception of grammar.* Manchester, England: University of Manchester, the Author, Age and Cognitive Performance Research Centre.

Bishop, D. V. M., & Clarkson, B. (2003). Written language as a window into residual language deficits: a study of children with persistent and residual speech and language impairments. *Cortex, 39,* 215-237.

Bishop, D. V. M., & Snowling, M. (2004). Developmental Dyslexia and Specific Language Impairment: Same or Different? *Psychological Bulletin, 130,* 858-886.

Botting, N. (2005). Non-verbal cognitive development and language impairment. *Journal of Child Psychology and Psychiatry, 46*(3), 317-326.

Botting, N., Faragher, B., Simkin, Z., Knox, E., & Conti-Ramsden G. (2001). Predicting Pathways of Specific Language Impairment: What Differentiates Good and Poor Outcome? *Journal of Child Psychology and Psychiatry and Allied Disciplines, 42*(8), 1013-1020.

Caravolas, M**.**, Hulme, C., & Snowling, M. (2001). The foundations of spelling ability: Evidence from a three-year longitudinal study. *Journal of Memory and Language, 45,* 751-774.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91,* 77-111.

Catts, H. W., Fey, M. E., Tomblin, J.B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of Speech, Language, and Hearing Research, 45,* 1142-1157.

Clahsen, H., Bartke, S., & Göllner, S. (1997). Formal Features in Impaired Grammars: A Comparison of English and German Children. *Journal of Neurolinguistics, 10*(2/3), 151-171.

Clegg, J., Hollis, C., Mawhood, L., & Rutter, M. (2005). Developmental language disorders – a follow up in later adult life. Cognitive, language and psychosocial outcomes. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 46*, 128-149.

Connelly, V., & Dockrell, J. E. (in preparation) The role of vocabulary in the production of written text: development and delay.

Connelly, V., Campbell, S., MacLean, M., & Barnes, J. (2006). Contribution of lower order skills to the written composition of college students with and without dyslexia. *Developmental Neuropsychology, 29,* 175-196.

Conti-Ramsden, G., & Botting, N. (1999). Classification of children with specific language impairment: longitudinal considerations. *Journal of Speech, Language and Hearing Research, 42*, 1195-1204.

Conti-Ramsden, G., Botting, N., & Faragher, B. (2001). Psycholinguistic markers for specific language impairment (SLI). *Journal of Child Psychology, Psychiatry, and Allied Disciplines, 42,* 741-748.

Cragg, L., & Nation, K. (2006). Exploring written narrative in children with poor reading comprehension. *Educational Psychology, 26,* 55-72.

Department for Children, Schools and Families (n.d.) *English Curriculum Standards,* accessed September 10, 2007 from www.standards.dfes.gov.uk/keystage3/

Dockrell, J.E (in press). Causes of delays and difficulties in writing development. In R. Beard, D. Myhill, M. Nystrand, and J. Riley (Eds.) *Sage Handbook of Writing Development.*

Dockrell, J. E., & Connelly, V. (2007). *SLI, language skills and writing. Paper presented at Learning & Teaching Writing*. British Journal of Educational Psychology Current Trends Conference 28-29 June, 2007. Oxford Brookes University.

Dockrell, J. E., & Lindsay, G. A. (2000). Meeting the needs of children with specific speech and language difficulties. *European Journal of Special Needs Education*, *15*, 24-41.

Dockrell, J. E., & Lindsay, G. A. (in press). Inclusion versus specialist provision: Ideology versus evidence based practice for children with language and communication difficulties. In C. Norbury, B. Tomblin & D.V.M. Bishop (Eds.) *Understanding Developmental Language Disorders* Psychology Press.

Dockrell, J. E., & Lindsay, G. A. (2007). Identifying the educational and social needs of children with specific speech and language difficulties on entry to secondary school. *Educational and Child Psychology. 24,* 100-114.

Dockrell, J. E., Lindsay, G. A., Connelly, V., & Mackie, C., (2007a). Constraints in the production of written text in children with specific language impairments *Exceptional Children, 73,* 147-164

Dockrell, J. E., Lindsay, G., Palikara, O., & Cullen, M. A. (2007b). Raising the achievements of children and young people with specific language and communication needs and other special educational needs through school, to work and college. Nottingham: DfES.

Dunn, L. M., Dunn, L. M., Whetton, C., & Burley, J. (1997). *British Picture Vocabulary Scale* (Rev. ed.). Windsor, England: NFER-Nelson.

Elliott, C. D., Murray, D. J., & Pearson, L. S. (1997). *British Abilities Scales II: Matrices*. Windsor, England: NFER-Nelson.

Ellis Weismer, S., & Hesketh, L. (1996). Lexical learning by children with specific language impairment: Effects of linguistic input presented at varying speaking rates. *Journal of Speech Language and Hearing Research, 39,* 177-190.

Fan, X., Thompson, B., & Wang, L. (1999). The Effects of Sample Size, Estimation Methods, and Model Specification on SEM Fit Indices. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 56-83.

Fey, M. E., Catts, H. W., Proctor-Williams, K., Tomblin, J., Zhang, X. Y. (2004). Oral and written story composition skills of children with language impairment. *Journal of Speech Language and Hearing Research, 47*(6), 1301-1318.

Gansle, K., Noell, G., VanDerHeyden, A. Naquin, G. & Slider, N. (2002). Moving beyond total words written: the reliability, criterion validity and time cost of alternative measures for curriculum based measurement in writing. *School Psychology Review, 31,* 477-497.

Gillam, R., & Johnston, J. (1992). Spoken and written language relationships in language learning impaired and normally achieving school-age children. *Journal of Speech and Hearing Research, 35,* 1303-1315.

Graham, S., Berninger, V. W., Weintraub, N., & Schafer, W. (1998). Development of handwriting speed and legibility in grades 1–9. *Journal of Educational Research*, *92*, 42–56.

Graham, S., Struck, M., Richardson, J., & Berninger, V. (2006). Dimensions of good and poor handwriting legibility in first and second graders: Motor programs, visual-spatial arrangement, and letter formation parameter setting. *Developmental Neuropsychology, 29,* 43-60.

Graham, S., Berninger, V., Abbott, R., Abbott, S., & Whitaker, D. (1997). The role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*(1), 170-182.

Hill, E. (2004). Non-specific nature of specific language impairment: a review of the literature with regard to concomitant motor impairments. *International Journal of Language and Communication Disorders, 36*, 149-171.

Hooper, S., Swartz, C., Wakely W., de Kruif R., & Montgomery, J. (2002). Executive Functions in Elementary School Children With and Without Problems in Written Expression. *Journal of Learning Disabilities, 35,* 57-68.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6 ,* 1-55

Johnson, C., Beitchman, J., Young, A., Escobar, M., Atkinson, L., Wilson, B., Brownlie, E.B., Douglas, L., Taback, N., Lam, I., & Wang, M. (1999). Fourteen-year follow-up of children with and without speech/language impairments: Speech/Language stability and Outcomes. *Journal of Speech, Language and Hearing Research*, *42*, 744-760.

Kelso, K., Fletcher, J., Lee, P., & Kelso, A. (2007). Reading comprehension in children with specific language impairment: an examination of two subgroups. *International Journal of Language & Communication Disorders, 42,* 39-57.

Leonard, L. B. (1998). *Children with SLI*. Cambridge, MA: MIT Press.

Leonard, L. B., Ellis Weismer, S., Miller, C., Francis, D., Tomblin, B., & Kail, R. (2007). Speed of processing, working memory and language impairment. *Journal of Speech Language and Hearing Research, 50,* 408-428.

Mackie, C. (2007). The written language of children with specific speech and language difficulties. Unpublished Doctoral Dissertation. University of Warwick.

Mackie, C., & Dockrell, J. E. (2004). The writing skills of children with SLI. *Journal of Speech Language and Hearing Research, 47*, 1469-1483.

Mather, N. & Jaffe, L. (1996). *Woodcock-Johnson Psycho-educational Battery – Revised.* Oxford: John Wiley and Sons Ltd.

McArthur, C. A., & Graham, S. (1987). Learning disabled students composing with three methods: Handwriting, dictation and word processing. *Journal of Special Education, 21*, 22-42.

McArthur, G. M., Hogben, J. H., Edwards, V. T., Heath, S. M., & Mengler, E. D. (2000). On the 'specifics' of specific reading disability and specific language impairment. *Journal of Child Psychology and Psychiatry, 41,* 869-874.

Moni, K., Jobling, A., van Kraayenoord, C., Elkins, J., Miller, R., & Koppenhaven, D. (2007). Teachers' knowledge attitudes and the implementation of practices around the teaching of writing in inclusive middle years' classrooms: No quick fix. *Education and Child Psychology, 24,* 18-35.

Montgomery, J. (2000). Verbal working memory and sentence comprehension in children with specific language impairment. The role of phonological working memory. *Journal of Speech Language and Hearing Research, 43,* 293-308.

Nation, K., Clarke, P., Marshall, C. M., & Durand, M. (2004). Hidden language impairments in children: parallels between poor reading comprehension and specific language impairment. *Journal of Speech Language and Hearing Research, 47*, 199-211.

Norbury, C. F., Bishop, D. V. M., & Briscoe, J. (2001). Production of English finite verb morphology: A comparison of mild-moderate hearing impairment and specific language impairment. *Journal of Speech, Language and Hearing Research, 44,* 165-178.

Ofsted (2007). The annual report of Her Majesty's Chief Inspector of Education Children's Services and Skills 2006/07. London: The Stationary Office.

Ouellette, G. (2006). What's Meaning Got to Do With It: The Role of Vocabulary in Word Reading and Reading Comprehension. *Journal of Educational Psychology, 98*(3), 554-566.

Peers, I. S., Lloyd, P., & Foster, C. (1999). *British Standardisation of the CELF.* The Psychological Corporation's Speech and Language Assessment. http://www.tpcweb.com.

Puranik, C., Lombardino, L., & Altman, L. (2007). Writing through retellings: an exploratory study of language impaired and dyslexic populations. *Reading and Writing, 20,* 251-272.

Riddick, B., Farmer, M., & Sterling, C. (1997). Students and dyslexia: Growing up with a specific learning difficulty. London: Whurr.

Rust, J. (1996). The manual of the Wechsler Objective Language Dimensions (WOLD): UK Edition. London: The Psychological Corporation.

Scott, C. M. (1999). Learning to write. In H. W. Catts & A. G. Kahmi (Eds.), *Language and reading disabilities* (pp. 224-259). Boston: Allyn & Bacon.

Scott, C. M., & Windsor, J. (2000). General language performance measures in spoken and written narrative and expository discourse of school-age children with language learning disabilities. *Journal of Speech Language and Hearing Research, 43*, 324-339.

Sterling, C., Ertubey, C., Brownfield, K., O'Reilly, S., & Noyce, S. (2004) Helping students with dyslexia learn to read and spell specialist terminology. *Dyslexicon*. http://www.lsbu.ac.uk/psycho/dyslexicon/

Stothard, S. E., Snowling, M., Bishop, D. V. M., Chipchase, B. B., & Kaplan, C. A. (1998). Language-impaired preschoolers: a follow-up into adolescence. *Journal of Speech Language and Hearing, 41,* 407-418.

Strand, S. & Lindsay, G. (in press). Ethnic disproportionality in special education. Evidence from and English Population Study. *Journal of Special Education*

Tannenbaum, K., Torgesen, J., & Wagner, R. (2006). Relationships between word knowledge and reading comprehension in third-grade children. *Scientific Studies of Reading, 10*, 381-398.

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). *Test of Word Reading Efficiency (TOWRE).* Austin, TX: Pro-Ed.

Troia, G. A. (2006). Writing instruction for students with learning disabilities. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of Writing Research* (pp. 324-336). New York: Guilford Press.

Troia, G. A., & Maddox, M. E. (2004). Writing instruction in middle schools: Special and general education teachers share their views and voice their concerns. *Exceptionality, 12,* 19-37.

Ullman, J. (1996). Structural equation modeling. In B. Tabachnick & L. Fidell (Eds.), *Using multivariate statistics*. (4th ed.). Needham Heights, MA: Allyn & Bacon.

Wechsler, D. (1993) *Wechsler Objective Reading Dimensions (WORD).* Sidcup, UK: The Psychological Corporation.

Wechsler, D. (1996). Wechsler Objective Language Dimensions *(WOLD).* Sidcup, UK: The Psychological Corporation.

Windsor, J., Scott, C. M., & Street, C. K. (2000). Verb and noun morphology the spoken and written language of children with language learning disabilities. *Journal of Speech, Language and Hearing Research, 43,* 1322-1336.

Wise, J., Sevcik, R., Morris, R., Lovett, M., & Wolf, M. (2007). The Relationship Among Receptive and Expressive Vocabulary, Listening Comprehension, pre-reading skills, word identification skills, and reading comprehension by children with reading Disabilities. *Journal of Speech, Language, and Hearing Research, 50,* 1093-1109.

Young, A., Beitchman, Y., Johnson, C., Douglas, L., Atkinson, L., Escobar, M., & Wilson, B, (2002). Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. *Journal of Child Psychology and Psychiatry, 43*(5), 635–645.

Table 1

Assessment points and skills assessed

Time	Mean age SD in months	Educational Phase UK	Equivalent phase	Skills assessed
1	8:3 4	Year 3 Key Stage 2	1st year junior school	Language, literacy and nonverbal ability
2	10;8 4	Year 6 Last year primary Key Stage 2()	Elementary school	Language, literacy and writing, nonverbal ability
3	12;1, 4	Year 7 Entry to secondary school () Key Stage 3	High School	Literacy and writing
4	13;11 5	Year 9 End of Key Stage 3 (Key Stage 3)	High School	Language, literacy, writing and nonverbal ability
5	15;10, 4	Year 11 Final Year compulsory education UK (Key Stage 4)	High School	Language, literacy and writing

Note: A Key stage is one of the set stages of the national curriculum in the UK

(www.**qca**.org.uk/)

Table 2

Mean z scores and SDs for language and literacy measures at 14 and 16[1]

Competency assessed	Mean	SD	Difference with nonverbal ability
Nonverbal ability (BAS *z* score)[a]	-.81	.6	
Receptive vocabulary (BPVS *z* score) [b]	-1.23	1.12	$F(1,56) = 9.03$, $p = .004$, $\eta p^2 = .14$;
Formulated sentences (CELF *z* score) [a]	-2.4	.35	$F(1,56) = 174.48$, $p < .0005$, $\eta p^2 = .76$
Listening comprehension (CELF *z* score) [b]	-1.14	.66	$F(1, 56) = 5.90$, $p = .018$, $\eta p^2 = .10$;
Single word reading (BAS *z* score) [b]	-1.79	.99	$F(1, 55) = 60.49$, $p < .0005$, $\eta p^2 = .53$;
Reading comprehension (WORD *z* score) [b]	-1.59	.73	$F(1, 56) = 60.85$, $p < .0005$, $\eta p^2 = .71$
Spelling (BAS *z* score) [b]	-1.69	1.07	$F(1, 53) = 43.70$, $p < .0001$, $\eta p^2 = .45$

[1] All measures are reported in materials

[a] age 14, [b] age 16

Table 3

Correlations between WOLD change score, language, literacy, cognitive measures and writing at Time 4 and Time 5

Variable	1	2	3	4	5	6	7	8	9	10	11
1. WOLD change score											
2. WOLD *z* score (T5)	.81*	-									
3. Nonverbal *z* score (T4)	.23	.42*	-								
4. Formulated sentences *z* score (T4)	.23	.37*	.31*	-							
5. BPVS *z* score (T5)	.25	.55*	.52*	.54*	-						
6. Listening to paragraphs *z* score (T5)	.36	.47*	.25	.40*	.47*	-					
7. TROG *z* score (T5)	.20	.31	.26	.31	.41*	.14	-				
8. BAS word reading *z* score (T5)	.34	59*	.51*	.38*	.51*	.19	.34	-			
9. TOWRE –word reading efficiency *z* score	.35	57*	.44*	.41*	.50*	.28	.29	.55*	-		
10. Word comprehension *z* score (T5)	.23	.45*	.63*	.43*	.56*	.27	.29	.54*	.62*	-	
11. Spelling *z* score T5	.38*	.65*	.46*	.18	.30	.08	.32	.75*	.58*	.41*	-
12. Writing fluency *z* score	.54*	.54*	.47*	.40*	.43*	.23	.32	.41*	.57*	.51*	.41*

* $p = .004$ with Bonferonni correction

Table 4

Predicting WOLD writing at age 16 – the role of word reading accuracy

Predictor	R Square change	β	P
WOLD *z* score age 14	.326	.353	.001
Vocabulary *z* score at 16	.134	.266	.018
Word reading *z* score at 16	.074	.322	.005

Table 5

Predicting WOLD writing at age 16 - the role of word reading efficiency

Predictor	R Square change	β	P
WOLD *z* score age 14	.326	.381	.001
Vocabulary *z* score at 16	.134	.243	.031
Word reading efficiency *z* score at 16	.081	.333	.003

Table 6

Predicting WOLD writing at age 16 – the role of reading, writing and spelling

Predictor	R Square change	β	P
WOLD *z* score age 14	.335	.264	.01
Vocabulary *z* score at 16	.114	.232	.03
Word reading efficiency *z* score at 16	.075	.041	.746
Writing fluency	.024	.154	.167
Spelling *z* score at 16	.093	.395	.001

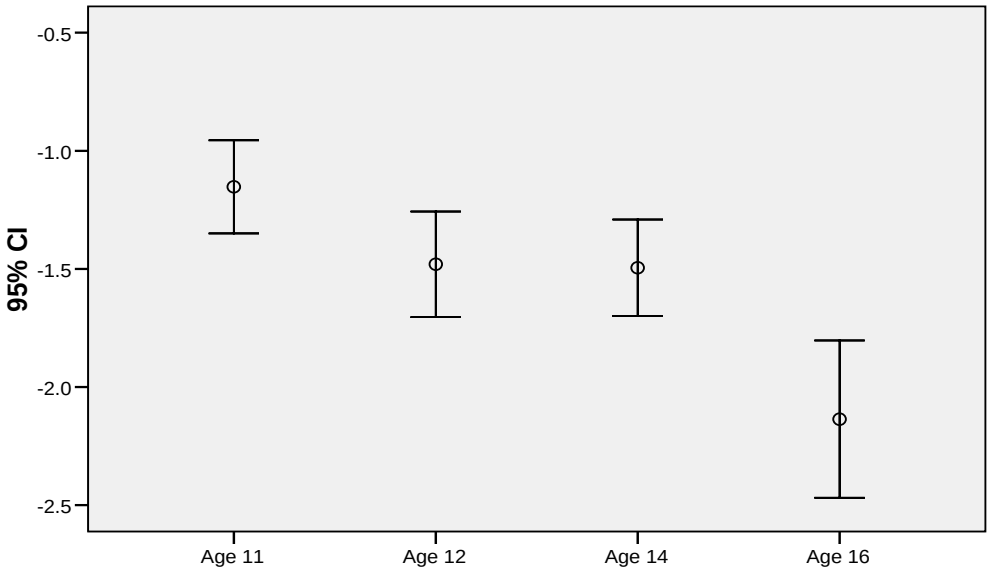
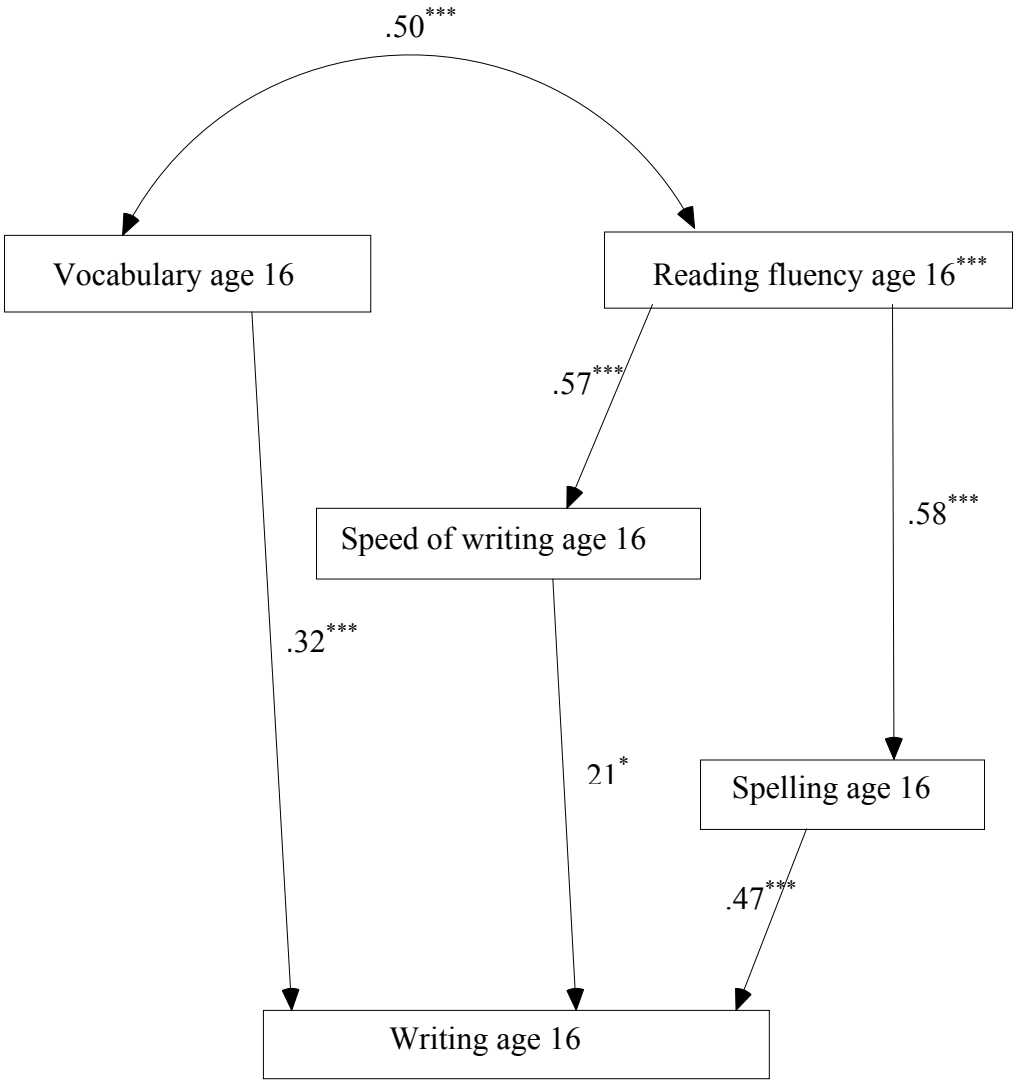
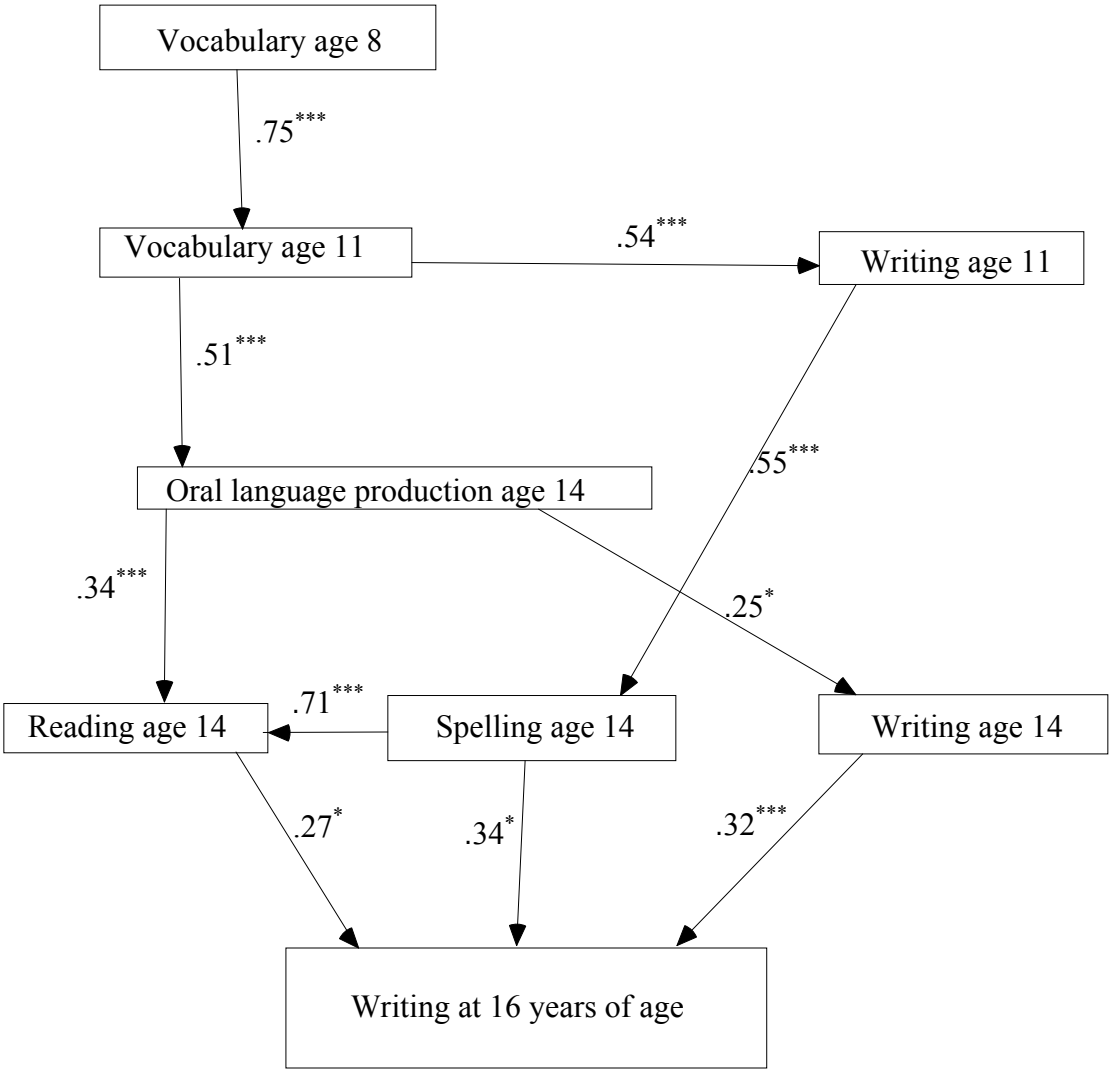


Figure 1. WOLD *z* scores over the four ages.



*** <.001, ** .01, * .05

Figure 2. Path analysis examining concurrent contributions of literacy and language to writing at age 16.



*** <.001, ** .01, * .05

Figure 3. Path analysis examining predictions of literacy and language to writing at age 16.

[i] Practitioners, policy makers and researchers use a range of different terms to describe this population (see Lindsay, Dockrell, Mackie and Letchford, 2002). Moreover, a range of terms are used in Europe (dysphagia) and North America (USA: SLI, or in parts of Canada: dysphagia) and more recently primary language disorder (Tomblin et al., 2003). The population is heterogeneous with the specific nature of their problems residing with one or more subcomponents of the language system. We use the term specific language impairment to reflect the most common usage in the literature.