Effectiveness of vocabulary intervention for older children with (developmental) language disorder

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Abstract

Background: Children with Developmental Language Disorder (DLD) frequently have difficulties with word learning and understanding vocabulary. For these children this can significantly impact on social interactions, daily activities and academic progress. Although there is literature providing a rationale for targeting word learning in such children, there is little evidence for the effectiveness of specific interventions in this area for children with identified DLD.

Aims: To establish whether direct 1:1 intervention for children with DLD over 9 years of age leads to improved abilities to identify, comprehend, define and use nouns and verbs targeted in intervention as compared to non-targeted control items and whether the participants' rating of their own knowledge of the words changes with intervention.

Methods and procedures: Twenty-five children and young people with language disorder (aged 9;4-16;1) participated in the study: eighteen with DLD and seven with a language disorder associated with autism spectrum disorder (ASD). Two assessments of different levels were created: a higher ability (less frequent words) and a lower ability level (more frequent words). Participants' Speech and Language Therapists (SLTs) decided which level would be the most appropriate for each participant. Four tasks were carried out as part of the assessment and the scores were used to identify which words each participant worked on. Participants received one thirty minute session per week 1:1 with their own SLT for seven weeks, plus a five minute revision session in between each main session. During each of the first five sessions, participants learned two new words; the two final sessions were spent revising the ten words which had been targeted.

Outcomes and Results: Post intervention assessment showed an increase in scores for both treated and control words. However, progress on treated words was significantly greater than on control words (d=1.07), indicating effectiveness of intervention. The difference between progress on targeted and control words was found both for nouns (d=1.29) and verbs (d=0.64), but the effect size was larger for nouns. Whether or not the participants had an associated ASD did not affect the

results. The children's self-rating of their knowledge of the targeted words was also significantly higher than for control words post-intervention.

Conclusions and Implications: The intervention, delivered 1:1 by the participants' usual SLT was effective in teaching new vocabulary to older children with language disorders. This shows that older children with language disorders can make progress with direct 1:1 intervention focused on vocabulary.

What this paper adds

What we already know

Many children with language disorders struggle to learn new words. This leads to a limited vocabulary which can affect their full participation in social situations and the academic curriculum. Previous studies have examined interventions to increase the vocabulary of children with low vocabulary levels but only a few have included children of secondary-school age and these children did not have identified language disorders.

What this paper adds to existing knowledge

The participants (aged 9-16 years) with language disorder in this study showed significant progress in their knowledge of nouns and verbs targeted in a short intervention (approximately 3-4 hours), delivered 1:1 by an SLT. This progress was greater than for control words. The children's self-rating of their knowledge of the targeted words was also significantly higher than that for control words post-intervention.

Clinical implications of this study

Direct work focused on learning new nouns and verbs can improve the knowledge of these words of children with language disorders. A combination of intervention with careful choices of which words to teach (taking into account the functional usefulness of each word in different situations) has the potential to improve children's vocabulary and thus their access to social situations and the academic curriculum.

Typically developing (TD) children learn vocabulary incidentally through exposure to language and this learning is reinforced through practice and corrective feedback (Bloom, 2000). For some children with language difficulties, however, it is a different story. Such children have previously been referred to as having Specific Language Impairment (SLI), but following a recent period of debate, a consensus has now been reached (at least in the English-speaking world, Bishop et al., 2017) that this term be replaced with Developmental Language Disorder (DLD). The criteria for DLD are less restrictive than those for SLI (Bishop et al., 2016) and thus, in addition to those who previously met SLI criteria, a wider range of children would also be included in the DLD diagnosis. Throughout this paper, when referring to previous studies of children with SLI, we use the term DLD. A broader term, Language Disorder was also proposed by Bishop et al. (2017) to include children with other diagnoses which are often associated with language disorder, such as Autism Spectrum Disorder (ASD).

Learning new vocabulary and being able to use it in context is a common area of difficulty encountered by many people with DLD (Gray, 2005, Kan and Windsor, 2010). This can impact significantly on understanding the everyday concepts required to make sense of the world, engagement in social situations and access to education (Dockrell and Lindsay, 1998, Nippold, 2010). Indeed, vocabulary difficulties at primary age (aged 5) are associated with poorer literacy, mental health and employment outcomes in adulthood (aged 34, Law et al., 2009) and vocabulary assessment scores in teenagers (aged 13-14) are related to academic attainment in mathematics and English at age 16 (Spencer et al., 2017). Thus, targeting vocabulary in secondary-aged children with vocabulary difficulties could potentially help their access to the curriculum and hence their future academic attainment, employment prospects and mental health.

Word learning in DLD

Children with DLD have been consistently found to learn fewer novel words compared to TD children of the same age (e.g., Nash and Donaldson, 2005, Ellis Weismer and Hesketh, 1996, Rice et al., 1992). Studies find children with DLD have particular difficulties on naming tasks (Nash and Donaldson, 2005), especially if words are presented at a fast rate (Ellis Weismer and Hesketh, 1996) or if a delay occurs between learning and testing, particularly for verbs (Riches et al., 2005). When learning new words, children with DLD require more presentations of new words (Gray, 2005, Zens et al., 2009, Riches et al., 2005) and more distributed presentations, where spreading presentations spread over several days is more effective than providing them all on the same day (Riches et al., 2005). Their reduced word learning efficiency could be due to difficulties identifying and storing new phonological and semantic representations in long-term memory (Chiat, 2000). Children with DLD are also less able to derive meanings from context (Mckeown et al., 1985, Cain et al., 2004) and thus may require explicit teaching of vocabulary. This reduced ability to use context could be due to phonological and/or semantic difficulties (Chiat, 2000) and/or syntactic difficulties (van der Lely, 1994). The word learning difficulties of children with DLD also seem to be dependent on word class, as studies have found that they have particular difficulty learning and retaining verbs (Oetting et al., 1995, Riches et al., 2005, Rice et al., 1994).

There are a number of possible reasons for increased difficulties with verbs. Verbs are usually less concrete and imageable than nouns (Ma et al., 2009). Consider for example verbs such as ‘deserve’ or ‘confess’ which are difficult to portray in picture form, or to guess from observing a situation which they may describe. When heard in continuous speech, verbs are also often less stressed than nouns, making it more difficult for their phonological sequence to be identified and stored. Verbs are also more complex in terms of inflectional morphology: many nouns have singular versus plural forms, but verbs have a much greater variety of inflectional suffixes. Thus, the phonological form a child hears relating to a particular concept will be more variable for verbs than for nouns, increasing

the complexity of extracting the phonological form for verbs. This could be a particular challenge for children who have difficulties with phonology and/or morphosyntax.

Verbs' semantics also interact with syntax, through "verb argument structure". This means that certain verbs appear only in certain sentence structures and that a child can use the sentence structure a verb appears in to aid their hypotheses regarding the meaning of a new verb (van der Lely, 1994). However, children with DLD have more difficulties than TD children in using this process (van der Lely, 1994). Thus, compared with noun learning, verb learning may require stronger abilities with phonology, semantics and syntax and greater awareness of the links between these for effective learning. Thus, the phonological, semantic and/or syntactic difficulties of many children with DLD could impair their abilities to learn new words in general, but also lead to particular difficulties learning verbs.

Intervention strategies and studies on teaching vocabulary to children with DLD

The findings reviewed above indicate strategies which may help children with word learning (especially for verbs). These could include: providing more presentations of new words (Gray, 2005, Riches et al., 2005) at a slower presentation rate (Ellis Weismer and Hesketh, 1996), providing more distributed presentations of new words, e.g., spread over several days (Riches et al., 2005), increasing the saliency of verbs (by giving them more stress, or producing them in isolation) (Chiat, 2000), teaching the different morphological endings for different words and highlighting the common root word (Good et al., 2015) and explicitly teaching the meanings of words (Nash and Donaldson, 2005) and how to use them in sentences (Ebbels et al., 2007, Nash and Donaldson, 2005).

Most intervention studies which have a main focus on vocabulary include children with mild language delays or difficulties, or children in schools in areas of socio-economic disadvantage who

do not have identified language difficulties, at primary (e.g., Lubliner and Smetana, 2005, Nash and Snowling, 2006, Clarke et al., 2010, Fricke et al., 2013) and secondary age (Snow et al., 2009, Spencer et al., in press, Lesaux et al., 2010, Murphy et al., in press). These children may have different strengths and weaknesses with regard to word learning compared to children with DLD. However, it is important to note that the number of words learned may nevertheless be low (e.g., 1-2 words after 10 hours in Spencer et al. (in press); 2 after 18 hours in Lubliner & Smetana (2005); 4 after 30 hours in Snow et al.(2009)).

Very few studies exist which aim to improve the vocabulary of school-aged children with identified DLD. The few studies which do exist are only with primary-aged children and show that intervention is effective for children with DLD (Throneburg et al., 2000, Parsons et al., 2005, Good et al., 2015) or groups of children which include some with DLD (St. John and Vance, 2014). These studies all involved explicit teaching of vocabulary, with much repetition and all showed more progress on targeted than control words. The studies by Parsons et al. (2005) and St. John and Vance (2014) focused primarily on the semantic and phonological aspects of the taught curriculum words (of a range of parts of speech), while Good et al. (2015) focused predominantly on morphological awareness (targeting morphologically complex words). We know of no studies specifically aiming to improve receptive vocabulary in secondary-aged children with identified DLD. However, a couple of studies including secondary-aged children with DLD have focused on an aspect of vocabulary: word finding (Hyde-Wright et al., 1993, Ebbels et al., 2012). These showed that improving the semantic representations of words already in the children's vocabularies improved their retrieval on a naming task.

Summary

A number of studies have explored and compared vocabulary learning for children with DLD and TD children and indicate strategies which may help children with DLD learn new vocabulary. However,

the evidence for specific interventions to target this area for children with identified DLD is very limited (Steele and Mills, 2011), especially at secondary age. This is surprising given the effects difficulties in this area can have. The few small-scale studies that have been carried out indicate vocabulary intervention involving semantic and phonological approaches with explicit definitions may be effective for improving vocabulary in children with DLD, but the effects do not generalise to control words (e.g., St John & Vance, 2014; Parsons et al., 2005). No studies have involved older students of secondary-school age with identified DLD (although several have been carried out in areas of socio-economic disadvantage which may have included some children with unidentified DLD) and none have specifically investigated any differences between the effectiveness of intervention for nouns versus verbs.

Aims of current study

Our study aims to establish whether for older children with identified language disorder (including those of secondary age), direct 1:1 intervention leads to improved abilities to identify, comprehend, define and use nouns and verbs targeted in intervention as compared to non-targeted control items and whether the participants' rating of their own knowledge of the words changes with intervention. We aimed to improve knowledge of taught nouns and verbs, but given previous findings, we predicted that nouns may be learned more easily than verbs.

Method

Study Design

The study employed a within participants design. Each participant was treated on one set of words, while a further set of words acted as controls. The groups of words were matched and counterbalanced across participants. This design could be used because it was expected that learning would be specific to the individual words treated, as found in previous studies. Since limited

generalisation was expected to untreated words, these could be used as controls. Our analysis therefore compared each participant's scores for treated and control words and between participants variance was eliminated.

The study was conducted within a school attended by the participants where they received regular speech and language therapy and intervention was delivered by their usual SLT in their usual therapy sessions. It was therefore an effectiveness study. Prior to the intervention, the first author devised a uniform approach to the therapy, based on the SLTs' current practice and all SLTs identified students for whom the intervention was appropriate at that time.

Participants

This effectiveness study was carried out at a specialist educational setting for pupils with language disorder aged 7 to 19 years, the majority of whom meet the criteria for DLD, but some of whom have a language disorder associated with other diagnoses such as ASD. It was part of a bigger study investigating the effectiveness of all intervention provided 1:1 within the school during one school term (Ebbels et al., 2017).

Twenty-five participants aged between 9;4 and 16;1 (mean 12;5) at the time of initial assessment took part. Seventeen were male and eight female. As this was an effectiveness study carried out in an educational setting, participation was not restricted to those with DLD, but any students whom the SLTs judged may benefit from vocabulary intervention and for whom it was appropriate at that time were included. Therefore, while all participants had language disorder and the majority (eighteen) had DLD, seven had language disorder associated with ASD. We therefore refer to the whole group as having (D)LD, as all have language disorder (LD) and the majority have DLD. Other students were not selected for vocabulary intervention if they had recently worked on a vocabulary target (i.e. the term before) and/or had other targets to prioritise for that term (targets were determined by those identified in Annual Reviews and therefore SLTs were required to work on each

target area during at least one term of the year). Therefore spending two terms on one target area may be inappropriate for some students. Students at the school are routinely assessed with the Clinical Evaluation of Language Fundamentals 4 (CELF-4) (Semel et al., 2006) and the British Picture Vocabulary Scales (BPVSII) (Dunn, et al., 1997) at age 11, 14 and 16 years to monitor their progress. Table 1 gives the standard scores on these assessments at their most recent assessment point.

BPVSII	CELF Core Language	CELF Receptive language	CELF Expressive language
75.9 *(15.1)*	58.9 *(15.6)*	63.7 *(11.7)*	60.0 *(14.4)*

Table 1: Mean standard scores (and standard deviations) on the BPVSII and CELF-4 assessments.

Procedure

Words were taken from Bauman and Culligan's (1995) General Service List (GSL, the later version was not available at the start of this study) of two thousand words deemed to be of the most use to people speaking and learning English. The rationale for using this list for the project was the fact that it includes frequency ratings for words thus enabling us to ensure there was no significant difference between the 'difficulty' (i.e. frequency) of target and control words. Two lists of words were used: labelled 'higher level' and 'lower level' respectively. The words were selected for the two levels using the frequency rating (i.e. less frequent words for the higher level, more frequent words for the lower). Words were selected by the first author's judgement on their functionality, but words directly related to curriculum subjects were omitted. Each participant's SLT judged which level would be most appropriate for them. This judgement was formed from standardised assessment results and observation both in the classroom and 1:1 SLT sessions. The hypothesis was that children with limited vocabulary (naturally including the younger participants in the study) would benefit from learning and consolidating more frequently used vocabulary due to the functionality of the words,

whereas those who were able to use and understand the lower level words in context would benefit from focusing on higher level vocabulary rather than relearning words they already know. Nine participants were assigned to the higher level and sixteen to the lower level.

The lower and higher level lists each consisted of 40 words (20 nouns and 20 verbs). Each list was divided into two sets (A and B) with ten nouns and ten verbs each (see Figure 1). Frequency values provided by the GSL were used to match words in set A and set B at each level of difficulty and to match the difficulty of nouns and verbs in each set. There was unsurprisingly a significant difference in the frequency of the higher level compared with the lower level words. The words are listed in Appendix A.

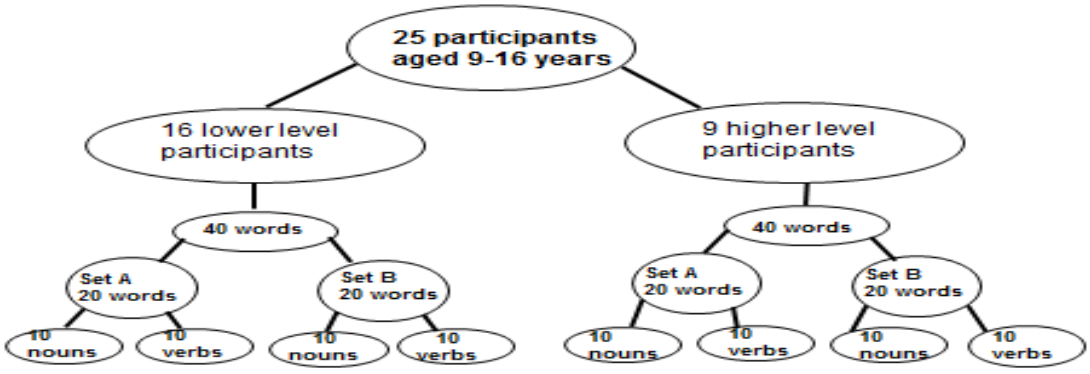

Figure 1: structure of word lists for the lower and higher level words.

The sets were counterbalanced across participants, eliminating any effects that might result if they differed in difficulty. This also meant that the assessors were unaware which words had been treated.

The study was carried out during a single eleven week school term. The pre-intervention assessment was carried out in the first two weeks by Speech and Language Therapy Assistants (SLTAs) who had no knowledge of the words a participant would work on. The intervention lasted

seven weeks. The post intervention assessment was carried out by the same SLTAs in the remaining two weeks at the end of the term. All assessments were conducted blind.

The intervention began the week after the pre-intervention assessment and consisted of one thirty minute session per week for seven weeks, with a five minute revision slot between each session (see below for more details).

Assessment tasks

Four assessment tasks of varying levels of difficulty (lexical decision/multiple choice/sentence production/ definition) were used to obtain an understanding of each participant's word knowledge across a range of areas and to measure change in participants who varied in their initial knowledge of the words. This is similar to the assessment method utilised by Throneburg et al. (2000) which included all except the lexical decision task. Lexical decision was expected to be the easiest task and was conducted first. Although a picture recognition task, such as the BPVSII (Dunn et al., 1997) can assess understanding of a word, a test of this kind was not included, largely because many of the words would be difficult to portray in a picture. A written multiple-choice test of the words' definitions was included instead, which was read aloud to the participants. Definition production and sentence production were expected to be more difficult due to their higher linguistic demands. They were used to further assess pupils' understanding of the meaning of each word and their ability to use the word in a semantically and syntactically correct form.

Task 1: Lexical decision

For this task, the assessor read a list of forty words and forty non-words aloud in a random order (the same order for each participant and at each testing point). Participants were asked to say if each was a real word or a not (participants did not see the written form of the word). The forty real words were set A and set B from either the higher or lower level. The forty non-words were derived from the real words by changing a vowel or consonant in each syllable of the word. These are listed in Appendix B.

Two scores were recorded for this task: the total items identified correctly as real versus non-words (possible total of 80 points) and the number of real words identified correctly (possible total of 40 points).

Task 2: Multiple choice

Participants were presented with a word and a choice of three possible definitions (verbally and in writing). They were allowed repetitions of each question and were asked to say 'a,' 'b' or 'c' or point to one of these as their response. The incorrect options for definitions were identified by using words close to the target word on the GSL. Definitions were taken from Oxford Junior Dictionary (Dignen, 2007).

Participants achieved one mark for each correct response; therefore the maximum possible total for this task was 40 points.

Task 3: Definition production

The assessor was provided with a recording sheet which consisted of three columns: the target word, the child- friendly definition (from the Oxford Junior Dictionary, 2007), and a blank column to record pupil's responses. Participants were asked to give the meaning of each word. Words were presented verbally and in written form. The following scoring system was used for the definition production task.

- All key concepts of word definition: 1 point.
- Partial knowledge of word: 0.5.
- Incorrect or no response: 0 points.

Two examples are given in Appendix C. The maximum possible score was 40 points.

Task 4: Sentence production

Participants were asked to use each word within a sentence. Words were presented verbally and in written form and responses were recorded as in the definition production task. The following scoring system was used:

- Semantically and syntactically correct sentence= 1 point.
- Partially correct or semantically correct but syntactically incorrect= 0.5.
- Completely incorrect or no response= 0 points.

Examples are given in Appendix C. The maximum possible score for this task was 40 points.

Assessment instructions were provided for the SLTAs to ensure consistency of presentation and scoring. Meetings were held to discuss the instructions and administration of assessments. An SLT not involved in the study reviewed and discussed scoring with the SLTAs so that this was accurate and consistent.

Self-evaluation of word knowledge

Prior to giving a definition, participants rated their knowledge of each word using a symbolised traffic light system (similar to that used by Lubliner and Smetana, 2005) which requires participants to rate their own knowledge of each word as red, amber or green. These were converted to a score of 1, 2 or 3 for each word. These scores were used to assess the participant's perception of their word knowledge and to monitor change in this for treated and control words after intervention.

Delivery of assessment tasks

Assessments were carried out over two consecutive days. The same format was followed for all participants. The lexical decision task was completed first so that performance on it was not affected by the other tasks. This was followed by the definition task in which participants were first asked to give their self-rating of their knowledge of the words and then to define them. The sentence production task was then carried out. Short breaks were allowed between the tasks. The multiple

choice task was performed on the following day as it was likely to affect participants' performance on the definitions task.

Scoring and identifying words for intervention

Each participant was randomly assigned to have intervention on either set A or set B words. This was carried out by the first author. The assessors sent the data on the participants to the first author who recorded these for analysis (the words then became treated or control words rather than sets A and B). The first author selected for each participant: five nouns and five verbs from the set assigned to be treated. These were the words on which the participant had the lowest scores across the four tasks. This procedure was used to avoid treating words that participants already knew well.

Intervention method

Intervention was delivered by each participant's usual SLT. All SLTs were provided with materials, instructions and an intervention plan, in addition to meetings to discuss the intervention. A more detailed description is provided in Appendix D. Participants received seven intervention sessions; one thirty-minute session per week, with one additional five minute revision session between each main session (a total of four hours and five minutes of intervention time). The intervention method used the majority of strategies likely to help children with DLD with word learning discussed above: repeated presentations, distributed presentations, words presented in isolation and in context with explicit discussion of the word meaning, phonology, part of speech and use in sentences. The SLTs were provided with a list of words for each child to work on; they were requested to cover all the words during the intervention block and were able to choose which words they targeted in each session. The content of the sessions is described below.

Sessions 1-5:

Two target words were introduced in each of the sessions. The SLT presented the word in isolation in spoken and written form and the participant recorded the word on a 'new word poster'.

Phonological features were discussed and recorded. The participant predicted if the word was a noun or a verb (symbolised cards were used to facilitate this and terminology was changed accordingly, e.g. 'naming word' and 'doing word') and used any prior knowledge of it to predict its meaning. The SLT gave its definition in verbal and written form, discussed this with the participant and reviewed their prediction of word class and definition. The participant then recorded the word meaning on the 'new word poster'. The meaning of the word and examples of when it may be used (in a context relevant to the participant) were discussed. The participant made two cue cards: on one they wrote the target word and on the other they drew a picture to help them remember the word and its meaning. This process was repeated with the second target word.

During the final ten minutes of the session, a game activity was used to reinforce the phonological, orthographic, semantic and syntactic features of each word. The cue cards with the written words were displayed and labelled as word one and word two. The picture cards were placed face down on the table. A set of 'instruction' cards were introduced and the participant selected a card and followed the instruction. The types of instruction were as follows:

- Definition cards: there were two definitions for each word (in attempt to avoid rote learning of definitions). The participant was asked to match the definitions to the appropriate word.
- Definition production: the participant was asked to produce a definition for one of the words.
- Sentence starters: the card showed the beginning of a sentence containing one of the target words, the participant was asked to complete the sentence.
- Sentence production: the participant was asked to generate their own sentence containing one of the words.
- Spelling: the participant was asked to spell one of the words.

The format and activities within the sessions remained the same for each participant. The level of facilitation provided was determined by the SLT's judgement of each participant's strengths and needs. At the end of the session, the SLT asked the participant to recall the two new words and their meanings and summarised what they had achieved.

Revision of words between sessions:

A five minute revision session was carried out with each participant between intervention sessions (with the same SLT). This consisted of a game of matching pairs using the participant's cue cards of all the words they had learned to date. All of the cue cards were placed face down on a table; the participant and SLT took turns in selecting a card and would then try to find the picture or word card that matched to make a pair. For each card selected the participant was asked to recall the word and its meaning. This was repeated each time they found a matching pair, providing them with multiple exposures and repetitions during this short session.

Sessions 6 and 7:

The two final sessions were used to revise the ten target words. The matching pairs game was carried out with all ten words (20 cue cards- one written card and one picture card for each word). This was followed by a game where a participant's picture cards were placed face down on the table (word cards were discarded). The participant selected one at random and selected and carried out an instruction or question drawn from a box. This process was repeated until they had completed the activity for all target words.

The instructions/questions used for this activity were as follows:

- Try to spell the word.
- Can you make a sentence using your word?
- Can you explain the meaning of your word?

- Is the word a noun or a verb?
- How many syllables are in the word?
- What sounds are in the word?
- If your word is a noun, what does it look like?
- If your word is a verb, when might someone do this? (All were something a person could do).

Attendance and treatment fidelity

The SLTs kept records of the sessions attended and of the total intervention time each participant received. They also video recorded one of their sessions to ensure consistency and fidelity of the intervention approach (these were watched by the first author). Due to absences and school trips, intervention time varied between the participants and therefore some did not receive the specified amount. The mean intervention time received was three hours and fourteen minutes; the minimum received was two hours. Six participants received less than three hours of input; seventeen received between three and four hours and two received more than four hours.

Results

The data were converted to percentage accuracy scores for analysis. Scores on the lexical decision and multiple-choice tasks were adjusted for the effects of chance responding.[1] Two initial analyses were carried out to see whether the level of difficulty to which participants were assigned and their diagnoses were affecting the results. The percentage accuracy of participants assigned to the higher

[1.] The corrected score is obtained by the formula Corrected score = number of items correct – (number of items incorrect/n-1), where n is number of possible choices. For lexical decision this reduces to number right – number wrong but for multiple choice it is number right – (number wrong/2).

level of difficulty was significantly greater than for those at the lower level ($F(1, 23) = 8.34$, $p < .01$; higher level mean = 71.89; std. dev. = 15.39; lower level mean = 53.54; std. dev. = 15.40). No difference was found between participants diagnosed as DLD or LD associated with ASD. Neither level of difficulty or diagnosis interacted with the other variables in the experiment showing that the pattern of responding was similar across the groups of participants. In view of this the following analyses include data from all the participants.

The data were analysed with a four factor within participant analysis of variance. Factors were the type of task (lexical decision/multiple choice/sentence production/definition), time of assessment (pre/post intervention), part of speech (nouns/verbs) and type of item (treated/control). Three main effects were significant. Participants increased their scores over time ($F(1, 24) = 49.24$, $p < .001$; pre intervention 46.0% std. dev. 18.8, post intervention 59.6% std. dev. 17.2) and their responses to nouns were more accurate than for verbs ($F(1, 24) = 79.64$, $p < .001$; nouns 59.8% std. dev. 15.1, verbs 45.8% std. dev. 19.5). The assessment tasks also differed significantly ($F(2.32, 55.57) = 83.28$, $p < .001$, Greenhouse-Geisser correction applied due to lack of sphericity). The task means are shown in Table 2 in order of difficulty. Pairwise comparisons found that all tasks differed from one another ($p < .001$).

	lexical decision	multiple choice	sentence production	definition
mean	79.15	63.00	45.17	23.95
std. dev.	20.63	27.70	17.65	14.52

Table 2 Mean percentage accuracy on the assessment tasks.

The crucial interaction between target and control items and time of assessment was highly significant ($F(1, 24) = 41.55$, $p < .001$, $\eta p^2 = .63$) with a very large effect size. Table 3 gives the mean pre and post intervention scores and change in score on each assessment task and for the

participants' overall performance. The overall scores show that correct responses to treated items increased by 19% while those to controls only improved by 8% (*d*=1.07). The three way interaction between target and control items, assessment task and time was not significant (F < 1) indicating that the differences between improvement on target and control items were similar in each task.

		lexical decision	multiple choice	sentence production	definition	all
targets	pre intervention	69.20 (32.35)	54.20 (31.75)	39.00 (21.10)	16.70 (10.80)	44.77 (19.55)
	post intervention	91.20 (16.66)	75.30 (25.15)	54.20 (18.75)	34.60 (21.10)	63.82 (16.70)
	change	22.00 (25.76)	21.10 (17.15)	15.20 (19.22)	17.90 (14.96)	19.05 (10.46)
controls	pre intervention	72.40 (29.45)	56.90 (31.20)	43.00 (22.35)	16.90 (12.90)	47.30 (19.45)
	post intervention	83.80 (21.55)	65.60 (29.70)	44.50 (20.55)	27.60 (20.00)	55.37 (18.60)
	change	11.40 (26.84)	8.70 (18.28)	1.50 (17.72)	10.70 (17.09)	8.07 (10.64)

Table 3 Mean percentage (SD) scores for target and control items pre and post intervention for each assessment task.

Three other interactions were significant, each involving differences related to nouns and verbs. There was an interaction between the assessment task and nouns and verbs ($F(3, 72) = 4.52$, $p < .01$). This shows that on the easiest task, lexical decision, there was a smaller difference in correct

responses to nouns and verbs than on the other three assessment tasks. This in part reflects a near ceiling effect on lexical decision for some of the participants.

The interaction between the assessment tasks, nouns/verbs and time of assessment was also significant ($F(3, 72) = 3.70$, $p < .02$). This reflects the changes in responses to nouns and verbs (both targets and controls) over the course of the intervention. On lexical decision, the easiest task, verbs improved more than nouns (the latter already being at a high level of accuracy). On the more difficult tasks (sentence production and definition) the improvement for nouns was greater than for verbs.

A more interesting interaction is that between nouns/verbs, target/control items and time of assessment ($F(1, 24) = 4.67$, $p < .05$). The means for this are given in table 4. They show that the overall improvement for nouns and verbs was quite similar. However, while the improvement in nouns was mainly due to those directly targeted by the treatment, improvement in verbs was more evenly divided between treated and control items. Indeed, Cohen's d effect sizes show that the difference between progress on targeted and control words was greater for nouns (d=1.29) than verbs (d=0.64). This may suggest that the treatment leads to greater generalisation in the case of verbs than nouns.

		pre intervention	post intervention	change
nouns	targets	49.65 (19.25)	71.80 (13.90)	22.15 (12.66)
	controls	55.75 (20.65)	62.05 (18.80)	6.30 (13.17)
verbs	targets	39.90 (21.55)	55.85 (21.65)	15.95 (8.73)
	controls	38.85	48.70	9.85

		(20.55)	(19.75)	(11.34)

Table 4 Mean percentage (SD) accuracy for treated and control nouns and verbs as a result of the intervention.

The self-rating scores for the words are shown in Table 5. These show that no difference existed between target and control words prior to the intervention, t (23) = 0.02; p=0.98; d=0.00. Post intervention, participants' self-rating of their own knowledge of words was significantly higher for targeted than control words, t (23) = 2.63; p=0.01; d=0.74.

		Pre intervention	Post intervention
Target words	mean	42.5	48.9
	std. dev.	8.4	7.9
Control words	mean	42.5	43.0
	std. dev.	10.3	8.4

Table 5 Mean self-evaluation scores pre and post intervention on target and control words. Maximum score = 60, minimum score = 20.

Individual Variation

Individual participants varied in the gains that they made on the treated words. Five were found to have gains of less than 5%. The reasons for their poor performance were explored. Neither their ages nor their performance on the BPVSII and CELF-4 assessments appeared to explain their performance. However, four of the participants with limited progress were among the six who had

attended for less than three hours of the intervention. It appears likely that their absences influenced their progress.

Discussion

This study examined the effects of an intervention for older students (including those of secondary school age) with (D)LD who had previously shown difficulties in learning new words. The intervention was intensive, targeting only ten words but relatively undemanding of therapy resources (a mean of 3 hours 14 minutes). Learning of nouns and verbs was examined and assessment tasks were designed to range in difficulty and to demonstrate different levels of knowledge of the words. Following intervention (involving a focus on semantics, phonology and sentence production), both treated and control words improved, but improvement in treated items was significantly greater than that for the controls (d=1.07). This result was further supported by the significantly greater self-rated knowledge scores participants gave for targeted words (as compared with control words) post-intervention. These results show that the intervention was effective in improving knowledge of targeted words.

Two levels of test were used to accommodate the range of vocabulary abilities within the participant group. We were not fully successful in equating the performance of the two groups as the lower level group still showed lower performance than the higher level group, despite the easier test. However, the lack of interactions shows that the pattern of performance of the two groups was similar in character.

Participants improved their performance on each of the assessment tasks. These were selected to differ in difficulty and to provide a detailed measure of the participants' ability to both learn and use newly acquired items. It was anticipated that lexical decision would be the easiest task followed by multiple choice, than sentence production and definition. Significant differences in performance were found between each of the tasks confirming this expectation. Use of the different tasks was

valuable as it gave participants with differing knowledge of the words scope to improve. Those with a good level of performance on the easier tasks could still show improvement on the more difficult ones. This allowed us to show that the intervention benefited participants at different levels of knowledge and that it was able to improve different types of word knowledge. Nevertheless the mean improvement of the participants did not differ across the assessment tasks and on each task, treated words improved more than controls.

On average the participants improved their overall score on targeted words by 20%. This translates to approximately four words. This was achieved with a relatively modest amount of intervention (just over three hours). This progress is greater than progress in some other studies with a greater amount of intervention time: 1-2 words after ten hours intervention (Spencer et al., in press) or two words after 18 hours (Lubliner and Smetana , 2005). Our results are similar to the four words progress found by Snow et al. (2009) after almost ten times the amount of intervention. The greater progress found in our study may be due to the 1:1 delivery of intervention, which differs from the other studies which used group (Spencer et al., in press) or whole class delivery (Snow et al., 2009; Lubliner & Smetana, 2005). Alternatively, the difference could be due to the nature of the participants, where those in our study had identified language disorder, whereas those in the other studies had low language or vocabulary, but no identified language disorder.

Five of our participants showed little improvement after the intervention. They appeared similar to those with a better response but four were among those who missed several sessions. Better attendance may have improved their performance. Only one failed to increase her scores despite attending all the sessions.

Participants were selected as having difficulties with vocabulary acquisition and were treated by the SLT who worked regularly with them (assessments were conducted blind by SLT Assistants). It was important, therefore that the SLTs conducted the intervention in a consistent manner. The intervention was similar to that which several of the SLTs use clinically and which has been used in

previous studies. Meetings of the SLT team were held to plan the content and manner of its delivery. Materials, word lists and intervention plans were provided and fidelity was assessed through regular discussions and video recording. A further merit of the procedure was that a number of different SLTs were involved in delivering the intervention. Thus our findings are more likely to be generalizable to a range of settings and SLTs.

Our intervention method focused mainly on the semantic and phonological aspects of the words, along with some work on identifying parts of speech and using targeted words in sentences, and included multiple exposures, repetitions and rehearsals. This approach is in line with the strategies which would be predicted to help children with DLD who have difficulties with word learning and similar to the Parsons et al. (2005) and St. John & Vance (2014) studies. Our results therefore add to the existing limited evidence that intervention that focuses on these aspects assists in the acquisition of new words by children with language disorder. However, our study does not address which aspects of the intervention were the most important in the progress seen and also does not address whether this combined approach is more or less effective than other methods.

Previous studies have found that children with DLD find verbs more difficult to learn and use than nouns (Oetting et al., 1995, Rice et al., 1994). This pattern was found here despite efforts to equate the difficulty of the nouns and verbs used (at least on frequency). The participants showed greater knowledge of nouns before intervention. Both nouns and verbs improved after intervention but the stronger performance on nouns remained. Larger gains were made on verbs than nouns for the less demanding assessment tasks (lexical decision and multiple choice tasks) where the knowledge of nouns was already good before intervention. For the more demanding assessment tasks (sentence production and definition production), where poorer performance prior to the intervention allowed greater scope for improvement, greater gains were made on nouns than verbs.

We did find some progress on control words (particularly verbs), although this was significantly less than for targeted words. There could be a variety of reasons for scores on control words improving

post intervention. These changes could merely reflect maturation or a practice effect (although this would be expected to affect nouns and verbs equally). Another possibility is that participants gained greater familiarity with the assessment tasks. The experience of the pre-intervention assessment and of some of the tasks used during intervention may have helped them gain a more general insight into the demands of the assessment task. For example, it was noticed during assessment and intervention sessions, that providing a definition was particularly demanding for the participants. As they gained greater ability at providing definitions this could improve definition performance on control words despite these not being targeted the intervention.

The words used at each assessment level were randomly allocated to sets (two sets of nouns and two of verbs). The sets of words were then counterbalanced across participants. This feature of the experimental design has the advantage that all participants can receive the intervention but it can only be used if generalisation from treated to the control words is unlikely, or is likely to be less than progress on targeted items. This assumption appears reasonable in view of previous research showing limited generalisation (Parsons et al., 2005; St. John & Vance, 2014) and this design has also previously been used successfully for intervention for word finding difficulties (Wilson et al., 2015). The substantial advantage of treated nouns over control nouns appears consistent with the assumption. This is less convincingly the case for verbs however. Although the improvement with treatment of verbs was less than that for nouns, it was more evenly spread across treated and control words suggesting that some generalisation may have taken place. This is perhaps not unexpected (at least within the sentence production subtest) given that Ebbels et al. (2007) found generalisation from targeted to control verbs in terms of the accuracy of use in sentence production. Thus, the practice in sentence production during our intervention may have contributed to generalisation to control verbs.

Limitations and future directions

The limitations of our study mainly arose due to it being an effectiveness study. The participants were those who attended the specialist education setting and were judged by their SLTs to be likely to benefit from intervention focusing on vocabulary and for whom other areas were lower priority at the time. The resulting participants covered a range of ages and while all had language disorders, some also had a diagnosis of ASD. However, ASD diagnosis did not appear to affect the results. The amount of intervention also varied between participants (as is common in effectiveness studies), reflecting the difficulties of carrying out intervention studies in clinical or educational settings and reduced attendance may have been a factor in the reduced progress of four participants.

Our study had no control group as it was part of a larger study evaluating the effectiveness of a whole service within a particular specialist educational provision (Ebbels et al., 2017). In order to provide experimental control, we used a within-participants design using a control set of vocabulary. Greater progress was seen on targets than controls, indicating the effectiveness of the intervention. However, significant progress was also found on the control sets. Due to the lack of a control group, it is not possible to say whether progress on the controls was due to maturation, practice effects, other intervention received, collaborative teaching in the classroom or indeed generalisation of the intervention. However, we were able to conclude that progress on the targeted words was not due to such factors (as these would have affected both targets and control sets), but that the additional progress shown on the targets when compared with the controls was most likely due to the focus on these areas in 1:1 intervention sessions.

In future studies, the addition of a (waiting) control group would allow conclusions to be drawn regarding possible generalisation. Alternatively, the design could be strengthened by adding a baseline period. Greater progress on control items during the intervention period than during the baseline period would suggest that generalisation was occurring. Generalisation to other settings outside the clinical environment could also be assessed.

Stronger conclusions could be drawn regarding the differences between nouns and verbs if we had matched them on other variables in addition to frequency (such as word length and phonological complexity). Closer matching could therefore be included in future studies. Additionally, further instructions regarding when to teach each word should be provided to SLTs delivering therapy to ensure verbs and nouns receive a similar amount of exposure, as it was possible some SLTs may have targeted one word class earlier than the other leading to increased exposure of one over the other. This would ensure that any difference between the learning of nouns and verbs could only be associated with the difference in word types as opposed to the amount of time children had to learn them.

Clinical implications

Although our results showed a small amount of intervention to be effective, critics may nevertheless argue that it is inefficient if the overall result is better knowledge of only a few words (although the progress was greater than or similar to other studies, but in less time). In the present study, an experimental approach was required to provide evidence that the intervention is effective. For this reason, words which were likely to be taught as part of the curriculum were avoided, as classroom learning might confuse the results. We would not expect this approach to be used clinically. There the treatment could be used to support classroom learning by treating words which were important for the curriculum (Beck et al., 2013). It might also be combined with other forms of intervention. For example, its use with verbs might be combined with Shape Coding by Susan Ebbels® (Ebbels, 2007, Ebbels et al., 2007) or colourful semantics (Bryan, 1997) which focus on the links between verbs and sentence production.

Thus, we argue that our results show targeting specific vocabulary can be effective for school-aged children with DLD and those with language disorder associated with ASD. The effectiveness of this may be increased with careful choice of words and possibly combining the focus on semantics and

phonology with approaches which focus on the links between vocabulary and syntax (Ebbels et al., 2007, Bolderson et al., 2011) and/or morphology (Good et al., 2015).

Conclusions

This study showed 1:1 vocabulary intervention with an SLT to be effective for teaching targeted vocabulary to participants aged between nine and sixteen years with identified (D)LD. We involved a larger number of participants with DLD than other previous studies and included secondary school aged children, for whom the current evidence base is very limited. We conclude that such intervention can be effective, even for adolescents with severe language disorder and intervention approaches such as this could thus be offered to similar children and young people in order to maximise their ability to access social situations and the academic curriculum.

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[redacted]

Declaration of interest

[redacted]

Appendix A: Word lists

Lower level words	
Set A	**Set B**
Friend	Ladder
Customer	Audience
Lawyer	Voyage
Nurse	Thief
Parcel	Proof
Desert	Straw
Supper	Female
Purpose	Party
Furniture	Storm
Avenue	Waiter
Obey	Climb
Produce	Oppose
Compete	Repair
Deliver	Agree
Organise	Punish
Promise	Inform

Wait	Cause
Arrive	Understand
View	Reach
Break	Ruin

Higher level words	
Set A	**Set B**
Stage	Canal
Secretary	Mankind
Wisdom	Enemy
Invention	Shore
Librarian	Ocean
Machinery	Article
Creature	Soldier
Shelter	Gift
Journey	Population

Ceremony	Anxiety
Consider	Combine
Suggest	Avoid
Deserve	Blame
Suspect	Hinder
Disappear	Observe
Offend	Discover
Discuss	Appear
Recognise	Defend
Forbid	Hesitate
Confess	Compose

Appendix B: Non-words used for lexical decision task

Transcription of non words used for lexical decision task (lower level)			
vɛp	'vɛɹɪp	'fɛpɑm	lɔɪg
'tɑgɪtʃƏn	tɹeɪg	'cɔɪgɑ	'ɪmgɜ'pɹɪndʒ
staɪg	θɑk	ʧæmk	'ɪfəʊk
sɜ'kɛp	sʌ'pætʃ	'ɑtæ'faɪk	'fæbu
'ætɜ	sɜθ	'mɛkɪθɑ	klɜn
'ʧɒpɜg	'sɛkɑ	'nʌsɛɹə	'ɑgæʃ
'ɛkaɪf	ʧi	ɒ'fɛnɑ	sɑp
gɑ	klɜst	'sæntip	si'kɑt
lɑb	ɛ'kɔs	ʃɒ'gæz	'ʃaɪku
'gʌʧəutɑ	'ɪfsɑ	tu'tɛdʒ	'tɑbə

Transcription of non words used for lexical decision task (higher level)			
tɪk'ɛʃ	'gæptɪsi	'ɜgɪsɑ	tɒp'sɑk
'tɛcklɛdʒ	'dʒæzɜg	ʧeɪ	tæ'gɪm
sli'tɑ	lɑbɛn'ɔɹaɪ	'æʧɛp	'sɒkɑ'ɹuʧɛp
'rɛpæʧɜ	'ɛpsɛm'ʧɛə	ɪs'ɔɪb	'ʃɪmtɪə
'pɒmdʒæk	'bækənɜɹaɪ	'mɪnsʌfɑ	'sɛpgəmə
'pɛdsɒmɜ'ɹu	'lɪpgæt	sæsk	æpɛ'dʒu
'æʃɛmp	'pɜdɪg	'sɛtə'laɪp	'bɛkɪmp
'sænɜɹiʌp	ʃum	'təulpʃɑ	kɹɑ
'ʧɛmki	tɜ'pu	'ɪku	'dɛkʃəuk
fɪlə'taɪp	'tɪfɪʃ	æd'tɜp	ɛp'sɑɹɛku

Appendix C: Example of definition and sentence production responses with scoring (pre intervention).

Definition production:

Lower level:

Target word	**Response**	**Points received**
desert	When you go in the desert.	0
	Hot.	0.5
	Somewhere very hot and dry.	1

Higher level:

Target word	**Response**	**Points received**
article	Front page.	0
	A bit what's in the newspaper.	0.5
	Piece of information from a newspaper.	1

Sentence production:

Lower level:

Target word	**Response**	**Points received**
Furniture	When you sit on it.	0
	people have furniture for sitting down and comfy.	0.5
	Everyone likes the new furniture.	1

Higher level:

Target word	**Response**	**Points received**
forbid	We forbid about dessert.	0
	The fortress is fobid.	0.5
	I forbid you to go into that cupboard.	1

Appendix D: Description of intervention delivery.

Intervention sessions 1-5:

The asterix marks in the table show the tasks that may have been omitted for some pupils depending on ability levels. For example, pupils who had significant difficulties with rhyme or with understanding the meaning of the terms noun and verb were not asked to generate rhyming words for each of their target words and were guided by the SLT as to whether the word was a noun or a verb without going into much detail in this area. A key element of facilitation is providing the student with specific praise and encouragement, which applies to each task listed below.

Task description	Facilitation strategies
SLT to introduce the new target word (pupils received 7 intervention sessions in total; 1 thirty -minute session per week, with a 5 minute revision session between each one. The content of the sessions is described below): 1. Present the word in written and spoken form	• Repetition • Allow processing time
2. Student to repeat the word aloud and discuss whether they think the word is a *noun or a verb.	• Symbols for noun and verb • Makaton signing
3. Student to practise spelling the target word by writing it on the 'new word' sheet	• SLT to support with sounding out the word
4. Reinforce phonological features of the word: • Pupil and therapist repeat the word together	• Repetition • Cued articulation

• Identify each phoneme in the word • Clap out the word and count the syllables • The pupil then completes the 'what does it sound like?' section of the poster (i.e. number of syllables, first sound, last sound and *rhyming words)	
5. The SLT used the target word in a sentence and the pupil used this to check that they identified the correct word type (noun/ verb) and then adjust/ expand on their predicted definition accordingly.	• Repetition • Allow processing time • Symbols for noun and verb if required
6. The pupil is then shown the definition of the word (from the Oxford Dictionary, 2007) and they recorded this in the bottom section of the 'new word' sheet.	• Support with reading • Repetition
7. Creating cue cards: Students created 2 cue cards for each word- one showing the written word and the other a picture created by the pupil to help them remember the meaning of the word.	• Visual and verbal prompts
Repeat tasks 1-7 for word 2.	• As above
8. Game activity: • The cue cards showing the written words were displayed and labelled as 'word one' and 'word two.' • Instruction cards were placed face down on table.	• Visual and verbal prompts • Modelling • Corrective feedback

These consisted of the following: - Sentence starters: the beginning of a sentence containing one of the target words. Students were asked to read and complete the sentence. - Definitions: two definitions (worded differently) were included for each word to promote a more in depth understanding and to avoid rigidity or rote learning of word meanings. - Instruction: to create a sentence containing word 1 /2 - Instruction: to produce a definition for word 1 / 2. - Instruction: to spell word 1 / 2 • A board game or reward system (e.g. stickers) were utilised during this activity if the therapist decided it would be appropriate and motivating for the student.	

BAUMAN, J. & CULLIGAN, B. 1995. About the General Service List. http://jbauman.com/gsl.html
BECK, I. L., MCKEOWN, M. G. & KUCAN, L. 2013. *Bringing words to life: Robust vocabulary instruction*, Guilford Press.
BISHOP, D. V. M., SNOWLING, M. J., THOMPSON, P. A., GREENHALGH, T. & CATALISE-CONSORTIUM 2017. Phase 2 of CATALISE: a multinational and multidisciplinary Delphi consensus study of problems with language development: Terminology. *Journal of Child Psychology and Psychiatry*, n/a-n/a.
BISHOP, D. V. M., SNOWLING, M. J., THOMPSON, P. A., GREENHALGH, T. & CONSORTIUM, C. 2016. CATALISE: A Multinational and Multidisciplinary Delphi Consensus Study. Identifying Language Impairments in Children. *PLoS ONE,* 11**,** e0158753.
BLOOM, P. 2000. *How Children Learn the Meanings of Words,* Cambridge, MA, MIT Press.
BOLDERSON, S., DOSANJH, C., MILLIGAN, C., PRING, T. & CHIAT, S. 2011. Colourful semantics: A clinical investigation. *Child Language Teaching & Therapy,* 27**,** 344-353.
BRYAN, A. 1997. Colourful Semantics. *In:* CHIAT, S., LAW, J. & MARSHALL, J. (eds.) *Language disorders in children and adults: psycholinguistic approaches to therapy.* London: Whurr.
CAIN, K., LEMMON, K. & OAKHILL, J. 2004. Individual Differences in the Inference of Word Meanings from Context: The Influence of Reading Comprehension, Vocabulary Knowledge and Memory Capacity. *Journal of Educational Psychology,* 96**,** 671-681.
CHIAT, S. 2000. *Understanding children with language problems*, Cambridge University Press.
CLARKE, P. J., SNOWLING, M. J., TRUELOVE, E. & HULME, C. 2010. Ameliorating Children's Reading-Comprehension Difficulties: A Randomized Controlled Trial. *Psychological Science,* 21**,** 1106-1116.
DIGNEN, S. 2007. *Oxford Junior Illustrated Dictionary*, Oxford University Press.
DOCKRELL, J. & LINDSAY, G. 1998. The ways in which speech and language difficulties impact on children's access to the curriculum. *Child Language Teaching & Therapy,* 14**,** 117-133.
EBBELS, S. H. 2007. Teaching grammar to school-aged children with Specific Language Impairment using Shape Coding. *Child Language Teaching and Therapy,* 23**,** 67-93.
EBBELS, S. H., NICOLL, H., CLARK, B., EACHUS, B., GALLAGHER, A. L., HORNIMAN, K., JENNINGS, M., MCEVOY, K., NIMMO, L. & TURNER, G. 2012. Effectiveness of semantic therapy for word-finding difficulties in pupils with persistent language impairments: a randomized control trial. *International Journal of Language & Communication Disorders,* 47**,** 35-51.
EBBELS, S. H., VAN DER LELY, H. K. J. & DOCKRELL, J. E. 2007. Intervention for verb argument structure in children with persistent SLI: a randomized control trial. *Journal of Speech Language and Hearing Research,* 50**,** 1330-1349.
EBBELS, S. H., WRIGHT, L., BROCKBANK, S., GODFREY, C., HARRIS, C., LENISTON, H., NEARY, K., NICOLL, H., NICOLL, L., SCOTT, J. & MARIĆ, N. 2017. Effectiveness of 1:1 speech and language therapy for older children with (developmental) language disorder. *International Journal of Language & Communication Disorders,* 52**,** 528-539.
ELLIS WEISMER, S. & HESKETH, L. J. 1996. Lexical learning by children with Specific Language Impairment: Effects of linguistic input presented at varying speaking rates. *Journal of Speech and Hearing Research,* 39**,** 177-190.
FRICKE, S., BOWYER-CRANE, C. A., HALEY, A. J., HULME, C. & SNOWLING, M. 2013. Efficacy of language intervention in the early years. *Journal of Child Psychology and Psychiatry,* 54**,** 280-290.
GOOD, J. E., LANCE, D. M. & RAINEY, J. 2015. The Effects of Morphological Awareness Training on Reading, Spelling, and Vocabulary Skills. *Communication Disorders Quarterly,* 36**,** 142-151.
GRAY, S. 2005. Word learning by preschoolers with specific language impairment: Effect of phonological or semantic cues. *Journal of Speech Language and Hearing Research,* 48**,** 1452-1467.

HYDE-WRIGHT, S. H., GORRIE, B., HAYNES, C. & SHIPMAN, A. 1993. What's in a name? Comparative therapy for word-finding difficulties using semantic and phonological approaches. *Child Language Teaching and Therapy,* 9**,** 214-229.

KAN, P. F. & WINDSOR, J. 2010. Word Learning in Children With Primary Language Impairment: A Meta-Analysis. *Journal of Speech Language and Hearing Research,* 53**,** 739-756.

LAW, J., RUSH, R., SCHOON, I. & PARSONS, S. 2009. Modeling Developmental Language Difficulties From School Entry Into Adulthood: Literacy, Mental Health, and Employment Outcomes. *Journal of Speech Language and Hearing Research,* 52**,** 1401-1416.

LESAUX, N. K., KIEFFER, M. J., FALLER, S. E. & KELLEY, J. G. 2010. The effectiveness and ease of implementation of an academic vocabulary intervention for linguistically diverse students in urban middle schools. *Reading Research Quarterly,* 45**,** 196-228.

LUBLINER, S. & SMETANA, L. 2005. The effects of comprehensive vocabulary instruction on title I students' metacognitive word-learning skills and reading comprehension. *Journal of Literacy Research,* 37**,** 163-200.

MA, W., GOLINKOFF, R., HIRSH-PASEK, K., MCDONOUGH, C. & TARDIF, T. 2009. Imageability predicts the age of acquisition of verbs in Chinese children. *Journal of Child Language,* 36**,** 405-423.

MCKEOWN, M. G., BECK, I. L., OMANSON, R. C. & POPLE, M. T. 1985. Some Effects of the Nature and Frequency of Vocabulary Instruction on the Knowledge and Use of Words. *Reading Research Quarterly,* 20**,** 522-535.

MURPHY, A., FRANKLIN, S., BREEN, A., HANLON, M., MCNAMARA, A., BOGUE, A. & JAMES, E. in press. A whole class teaching approach to improve the vocabulary skills of adolescents attending mainstream secondary school, in areas of socioeconomic disadvantage. *Child Language Teaching and Therapy***,** 0265659016656906.

NASH, H. & SNOWLING, M. 2006. Teaching new words to children with poor existing vocabulary knowledge: a controlled evaluation of the definition and context methods. *International Journal of Language & Communication Disorders,* 41**,** 335-354.

NASH, M. & DONALDSON, M. L. 2005. Word learning in children with vocabulary deficits. *Journal of Speech Language and Hearing Research,* 48**,** 439-458.

NIPPOLD, M. A. 2010. It's Not Too Late to Help Adolescents Succeed in School. *Language, Speech and Hearing Services in Schools,* 41**,** 137-138.

OETTING, J. B., RICE, M. L. & SWANK, L. K. 1995. Quick incidental learning (QUIL) of words by school-age children with and without SLI. *Journal of Speech and Hearing Research,* 38**,** 434-445.

PARSONS, S., LAW, J. & GASCOIGNE, M. 2005. Teaching receptive vocabulary to children with specific language impairment: a curriculum-based approach. *Child Language Teaching and Therapy,* 21**,** 39-59.

RICE, M. L., BUHR, J. & OETTING, J. B. 1992. Specific-Language-Impaired Childrens Quick Incidental-Learning of Words - the Effect of A Pause. *Journal of Speech and Hearing Research,* 35**,** 1040-1048.

RICE, M. L., OETTING, J. B., MARQUIS, J., BODE, J. & PAE, S. Y. 1994. Frequency of Input Effects on Word Comprehension of Children with Specific Language Impairment. *Journal of Speech and Hearing Research,* 37**,** 106-122.

RICHES, N., TOMASELLO, M. & CONTI-RAMSDEN, G. 2005. Verb learning in children with SLI: frequency and spacing effects. *Journal of Speech Language and Hearing Research,* 48**,** 1397-1411.

SNOW, C. E., LAWRENCE, J. F. & WHITE, C. 2009. Generating Knowledge of Academic Language Among Urban Middle School Students. *Journal of Research on Educational Effectiveness,* 2**,** 325-344.

SPENCER, S., CLEGG, J., LOWE, H. & STACKHOUSE, J. in press. Increasing adolescents' depth of understanding of cross-curriculum words: an intervention study. *International Journal of Language & Communication Disorders***,** n/a-n/a.

SPENCER, S., CLEGG, J., STACKHOUSE, J. & RUSH, R. 2017. Contribution of spoken language and socio-economic background to adolescents' educational achievement at age 16 years. *International Journal of Language & Communication Disorders,* 52**,** 184-196.

ST. JOHN, P. & VANCE, M. 2014. Evaluation of a principled approach to vocabulary learning in mainstream classes. *Child Language Teaching and Therapy,* 30**,** 255-271.

STEELE, S. & MILLS, M. 2011. Vocabulary intervention for school-age children with language impairment: A review of evidence and good practice. *Journal of Child Language Teaching and Therapy,* 27**,** 354-370.

THRONEBURG, R. N., CALVERT, L. K., STURM, J. J., PARAMBOUKAS, A. A. & PAUL, P. J. 2000. A comparison of service delivery models: effects on curricular vocabulary skills in the school setting. *American Journal of Speech-Language Pathology,* 9**,** 10-20.

VAN DER LELY, H. K. J. 1994. Canonical Linking Rules - Forward Versus Reverse Linking in Normally Developing and Specifically Language-Impaired Children. *Cognition,* 51**,** 29-72.

WILSON, J., ALDERSLEY, A., DOBSON, C., EDGAR, S., HARDING, C., LUCKINS, J., WISEMAN, F. & PRING, T. 2015. The effectiveness of semantic therapy for the word finding difficulties of children with severe and complex speech, language and communication needs. *Child Language Teaching & Therapy,* 31**,** 7-17.

ZENS, N. K., GILLON, G. T. & MORAN, C. 2009. Effects of phonological awareness and semantic intervention on word-learning in children with SLI. *International Journal of Speech-Language Pathology,* 11**,** 509-524.