Abstract:

Background – Idiom skills are essential for children to access age-appropriate media, curriculum resources and teaching. Children with Developmental Language Disorder (DLD) require support to develop the ability to understand and define idioms. However, research investigating 1:1 and classroom-based idiom skill intervention for children with DLD is limited.

Aim – To investigate the effectiveness of 1:1 Speech and Language Therapist (SLT) and classroom-based interventions to develop and maintain progress of the idiom skills of nine-16 year-olds with DLD.

Method – Forty-nine nine-16 year-olds from a specialist school for children with DLD received twenty intervention sessions to develop idiom skills during two school terms. Following a baseline period, twenty-four participants (aged 11-16) received ten 30-minute 1:1 SLT intervention sessions once per week for the first term and classroom-based intervention for the second term. Twenty-five participants (aged nine-16) received the same intervention in the reverse order. Classroom-based intervention was delivered collaboratively by English teachers and SLTs during English lessons. All participants were assessed on their ability to identify, interpret, explain and use idioms three months before, directly before and after each intervention and three months post-intervention, using a bespoke assessment including 48 idioms randomly assigned to three sets: 1:1 intervention, classroom-based intervention and control idioms.

Results – Participants made significantly more progress during the intervention blocks than during the baseline period (Block 1: *d*=1.91; Block 2: *d*=1.01) and post-intervention levels were maintained three months post-intervention. Idiom skills showed significant progress when targeted through both 1:1 *(d*=2.18) and classroom-based intervention (*d=0.*91) but 1:1 intervention was significantly more effective than classroom-based

intervention (*d=0.*63). Examination of the specific idiom skills targeted revealed that although idiom identification and interpretation skills did not progress significantly more during intervention blocks than the baseline period, idiom explanation (block 1: *d*=1.02; block 2: *d=0.*97); and use did (block 1: *d=0.*94; block 2: *d=0.*81). 1:1 intervention was more effective than classroom-based intervention for developing idiom explanation (*d*=1.32) and use (*d=0.*65). Progress on control items was not significantly different during intervention blocks than during the baseline period overall or for any of the individual idiom skills.

Conclusions – Both 1:1 SLT and classroom-based intervention are effective (although 1:1 is more effective) for teaching and maintaining idiom skills, particularly explanation and use. This means that SLTs and English teachers can help children to develop idiom skills which may enable better access to the curriculum and popular media.

What this study adds:

What is already known on this subject?
As children progress through primary and secondary school, they are exposed to an increasing number of idioms via curriculum resources and school staff. Children with DLD have difficulty interpreting and using idioms. There is little evidence regarding whether intervention can develop idiom skills in children with DLD.

What this study adds:
This study suggests that both 1:1 SLT and classroom-based interventions are effective for developing idiom explanation and use skills for 9 to 16 year-olds with severe DLD. However, 1:1 SLT was significantly more effective than classroom-based intervention. New skills were maintained for three months.

Clinical Implications:
Progress was achieved when target idioms were presented across multiple contexts using an interactive presentation, in which participants practised applying each idiom skill up to ten times, and an individualised worksheet to personalise this learning. Thus SLTs and English Teachers can support the development of children's idiom skills, which may in turn help them to access age appropriate curriculum resources and teaching as well as popular media. Although 1:1 SLT led to more progress, classroom intervention was also effective and can be used if 1:1 intervention is not feasible.

Introduction

An essential part of being an effective everyday communicator involves understanding and using non-literal language, including idioms. An idiom is a non-literal phrase such as "you're skating on thin ice," meaning "to be doing something that could lead to trouble." Idiom skills encompass four components: idiom identification, interpretation, explanation and use. Idiom identification involves identifying that a phrase is figurative and does not make sense in the given context (Nikolaenko, 2004). Idiom interpretation involves using contextual and pragmatic cues to interpret the meaning of the idiomatic phrase and therefore demonstrate comprehension of the idiom across multiple contexts (Norbury, 2004; Cain et al, 2009). Idiom explanation involves explaining the difference in the meaning of a given idiomatic phrase across multiple contexts (Whyte et al, 2013; Le Sourn Bissaoui et al, 2012; Caillies and Le Sourn-Bissaoui, 2013). For example "To turn over a new leaf" may mean 'do your homework on time' in one context but 'stop drinking caffeine' in another context. Idiom use involves using an idiom correctly with appropriate surrounding context (Nesi et al., 2006).

Development of idiom skills in typically developing children

Although the ability to understand and use short, literal sentences correctly is achieved by approximately five years of age in typically-developing (TD) children (Nippold, 1991), understanding and using non-literal language including idioms develops later (Nippold, 2007). Idiom skills typically develop gradually from age five and throughout adolescence and the age at which skills are acquired differs according to the component of idiom skill. These are acquired in the following order: identification, interpretation, explanation and then use of idioms (Caillies and Le Sourn-Bissaoui, 2013; Nippold and Taylor, 2002; Grunwell and Kerbel, 1998). Identification of idioms can begin in TD children around age five and this skill develops until age 12 (Nikolaenko, 2004; Spector, 1996). Idiom

interpretation continues to improve throughout adolescence (Nippold and Taylor, 2002). Idiom explanation skills also develop gradually with subtle developments between age six and 11 (Caillies and Le Sourn-Bissaoui, 2013; Grunwell and Kerbel, 1998; Levorato and Cacciari, 1995). For example, children have been noted to give plausible but not accurate non-literal explanations earlier in their idiom skill development (i.e. figurative with plausible reference to contextual cues but not in line with the accepted definition) before developing the skills to give the correct non-literal explanation as they grow older (Caillies and Le Sourn-Bissaoui, 2013; Cain et al, 2009). No research has investigated the ability of TD children to use idioms but it has been regularly noted (Levorato and Cacciari, 1999; Grunwell and Kerbel, 1998; Le Sourn Bissaoui et al, 2013) that this idiom skill is likely to develop last of the four idiom skills.

Development of idiom skills in children with Developmental Language Disorder (DLD)

Children with DLD achieve significantly lower scores on idiom skill testing than TD children of the same age (Whyte et al., 2011; Stothard et al., 1998; Vance and Wells, 1994) and difficulties in this area persist throughout adolescence (Rinaldi, 2000; Qualls et al., 2004). Although studies involving children with DLD are limited in number and by study sample size, the sequence of idiom interpretation and explanation skill development in DLD appears to be similar to that of TD children with interpretation skills developing before explanation skills (Grunwell and Kerbel, 1998; Norbury, 2004; Abrahamsen and Smith, 2000). However, the development of idiom skills tends to be much slower and children with DLD are more likely to interpret idioms literally than TD children (Rinaldi, 2000; Mashal and Kasirer, 2011).

Poor idiom skills are likely to impact on children's access to education. Children require idiom skills to access lessons and national curriculum resources, and this requirement

increases as they progress through education (Colston and Kuiper, 2002; Lazar et al., 1989; DfE, 2014). It is likely that children with weak idiom skills will find lessons increasingly challenging to access and therefore it is important to identify interventions which can ameliorate such difficulties in this population.

Idiom intervention Studies

Overall, five intervention studies have been published which focus on improving idiom skills, each involving different participant populations, assessment and intervention methods. Table 1 details key information related to these.

Table 1: Summary of Idiom Intervention Studies.

(Insert Table 1 here)

Different clinical populations

The study by Abrahamsen and Smith (2000) is most relevant to the current study as it is the only one which included participants with a diagnosis of DLD and compared the effectiveness of two idiom intervention methods: computer-based intervention delivered in a 1:1 situation and classroom-based group intervention. Results revealed that children with DLD learned idiom explanation skills through both types of intervention, but that 1:1 computer-based intervention appeared to be more effective than classroom-based intervention. However, conclusions that can be drawn from this study are hindered by limitations in study design. The study lacked application of an experimental control; although different sets of idioms were targeted during each of the two intervention blocks, both blocks were delivered concurrently. The two blocks also differed in terms of dosage (eight 15-minute computer-based 1:1 sessions versus eight 30-minute classroom-based sessions) and materials and procedures (the computer programme involved a structured procedure with explicit teaching with links to personal experiences of idioms whereas the

classroom-based sessions were more child-led with discussion, role play and worksheet activities). These design flaws mean that the unique influence of each intervention cannot be disentangled. The study findings are further weakened due to the study's limited sample size (nine children) and age range (nine-11 years) a lack of maintenance and generalisation measures, no measure of identification, interpretation, use skills and even though idiom explanation skills were measured this did not include story contexts. Thus, in summary, while this study provides some information around intervention to develop idiom explanation skills for children with DLD, more robust studies investigating the effectiveness of different intervention methods for developing all four idiom skills in children with DLD, across the age range during which idiom skills typically develop (five-16 years) are required.

Other intervention studies detailed in Table 1 have involved different clinical populations; Autism Spectrum Disorder (ASD) (Whyte et al, 2011), Moderate Learning Difficulties (MLD) (Ezell and Goldstein, 1992), typically developing (TD) children with weak reading skills (Lundblom and Woods, 2012) and both children with MLD and ASD (Mashal and Kasirer, 2011). Key findings from these other studies are given in Table 1 and these are discussed below. These findings help identify further factors that need to be considered when designing idiom interventions in future.

Idiom Assessment Outcome Measures

Previous studies have used tests of idiom interpretation (Ezell and Goldstein, 1992; Whyte et al, 2011; Lundblom and Woods, 2012; Kasirer and Mashal, 2011) and explanation (Whyte et al, 2011; Abrahamsen and Smith, 2000) to measure the effectiveness of idiom skill interventions and they have produced positive results (see Table 1). No previous studies have involved assessments of idiom identification or use.

Different outcome measures present different challenges, especially across participant populations. For example, although two previous studies involved measuring idiom interpretation skills of participants with ASD, one presented idioms verbally in stories (not in writing or alongside writing) then children matched idioms to definitions (Whyte et al, 2011) and the other presented idioms in a written booklet and children matched them to one from a choice of four definitions. It is likely that participants with weaker language or memory would perform worse on the story listening task and that participants with literacy difficulties would perform worse on the written task. It is important that the profile of participants is considered when planning assessments and that the same assessments are used across studies involving the same participant populations to improve the validity and comparability of results.

1:1 Versus Classroom Based intervention

Together, previous studies have shown that 1:1, group, classroom-based and a combination of these intervention delivery methods are effective for improving idiom skills. However, no study has investigated the effectiveness of intervention delivered through 1:1 sessions compared with classroom sessions exclusively. 1:1 intervention may be most effective for building foundation idiom skills because children are given more opportunities to express themselves and receive individual feedback. Alternatively, classroom-based intervention may be most effective as children might be more motivated to learn with their peers and consolidate skills through watching others during group activities such as role play. A previous study focusing on other areas of language found that group intervention was more cost effective, due to little difference between the effectiveness of 1:1 and group interventions (Boyle et al., 2009; Dickson et al., 2009). It is important to determine which delivery method results in most progress and which is

most cost-effective, as this will inform service managers of the most efficient therapy packages to provide.

Maintenance and Generalisation

Maintenance of improved idiom skills was reportedly achieved in all studies that investigated this (Ezell and Goldstein, 1992; Whyte et al, 2011; Mashal and Kasirer, 2011; Lundblom and Woods, 2011). However, this was measured using visual analysis of graphs only for two studies (Ezell and Goldstein, 1991; Lundblom and Woods, 2012) and one study administered maintenance assessments after a short break of between ten days and three weeks after completion of intervention (Whyte et al, 2011). This limits conclusions which can be drawn about longer-term maintenance of any improvements.

As all idioms are constructed differently and can be interpreted in different ways across multiple contexts, it cannot necessarily be expected that idiom skills can generalise to novel idioms or across multiple contexts. Three previous studies investigated the generalisation of idiom interpretation skills but findings were mixed across participant populations; generalisation of targeted idioms to novel story contexts was achieved for children with MLD (Mashal and Kasirer, 2011) but not for children with ASD (Whyte et al., 2011; Mashal and Kasirer, 2011) and generalisation to novel idioms as measured using a definition and idiom matching task was shown in children with MLD (Ezell and Goldstein, 1992). One study investigated generalisation of idiom explanation skills and found that generalisation to novel idiom items was not shown in participants with ASD (Whyte et al, 2011). However, results of some of these studies must be considered with caution because of limitations in experimental design. For example, although one study used sets of treated and control idiom items, experimental control was lost because participants made similar progress on both sets (Mashal and Kasirer, 2011). These findings suggest that children with MLD may have a greater ability to generalise idiom

skills than children with ASD but more investigation into this, and the ability of children with DLD to generalise idiom skills, is required.

Summary

In summary, the evidence around the effectiveness of various interventions to develop, maintain and generalise idiom skills is limited, especially for children with DLD. Therefore the gaps which need addressing are: whether idiom skill intervention is effective for progressing and maintaining idiom skills overall and if a 1:1, classroom or combined intervention delivery method is most effective. Also, whether progress can be made across each of the four individual idiom skills and the extent to which such progress generalised. Response to intervention will be tested directly following intervention and maintenance will be tested at least three months following completion of intervention to limit the possibilities of short-term impact or practice effects and the level of any progress will be investigated using statistical analysis. Three months may be considered an appropriate time frame before maintenance reassessment as it is the length of an intervention term, gives time to embed skills while other targets are addressed.

Aims

This study aims to address some of the gaps identified above by answering the following primary research questions:

1: Do participants make more progress in idiom skills during intervention than during a baseline period and are post-intervention levels maintained?

2: Does progress with intervention differ with 1:1 SLT versus Classroom-based intervention?

In addition, the study will aim to address these secondary research questions:

3: Does intervention lead to more progress on each of the idiom skills of identification, interpretation, explanation or use than during a baseline period, and which intervention method of delivery is most effective for each?

4: Does 1:1 intervention lead to more progress on control idioms than during a baseline period and thus is generalisation of idiom skills achieved overall and across the four skill components?

Methodology

Study Design

This study used a within-participants design whereby participants were assessed across five time points, in between which were four periods of interest: baseline period, intervention block 1, intervention block 2, maintenance period. A summary of the times when assessments and interventions were administered is shown in Figure 1. At time point 1 a battery of language, pragmatic and cognitive assessments was administered to ensure participants met inclusion criteria. Standardised idiom skill assessments were administered at time point 1 and time point 5 to measure changes to standardised test scores pre and post-intervention (using only the standardised assessments suitable for their age; see Table 2). A Bespoke Idiom Skills Test (described in detail below) was created for the purpose of this study to measure changes in idiom skills at each time point 1 to 5.

Figure 1: Timeline Including Idiom Skills Intervention and Repeated Assessments.

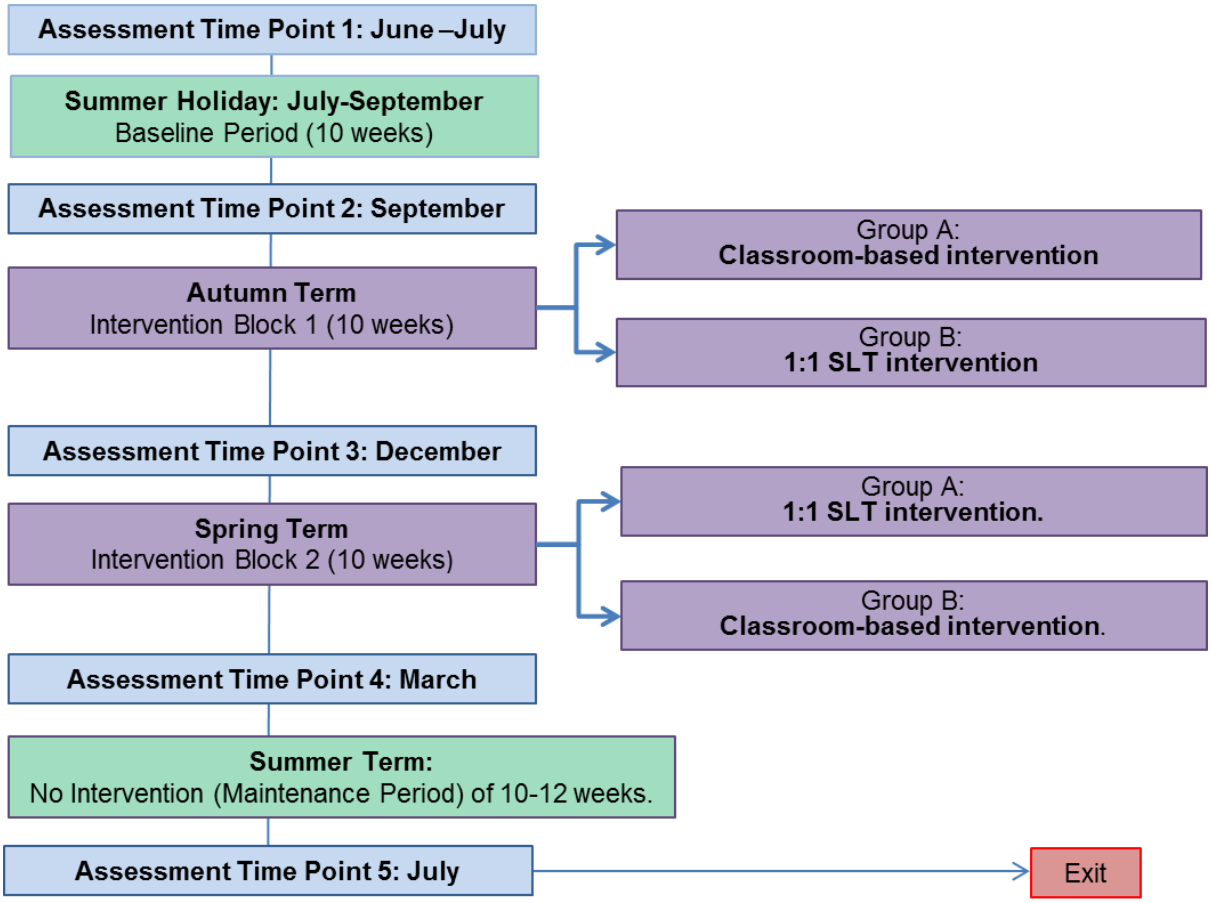


Table 2: List of Standardised Idiom Assessments.

Assessment and Source	Participants
1. Clinical Evaluation of Language Fundamentals-5 (CELF-5) Figurative Language Skills subtest[a]	a. All
2. TOWK Figurative Usage Subtest[b]	b. All
3. Assessment of Comprehension and Expression (ACE) Non-literal Comprehension Test subtest[c]	c. Age 9-11
4. Fullerton Language Test for Adolescents (FLTA) Idiom subtest	d. Age 11+

[a](Wiig et al., 2013), [b](Wiig and Secord, 1991), [c](Adams et al., 2001), [d](Thorum, 1986)

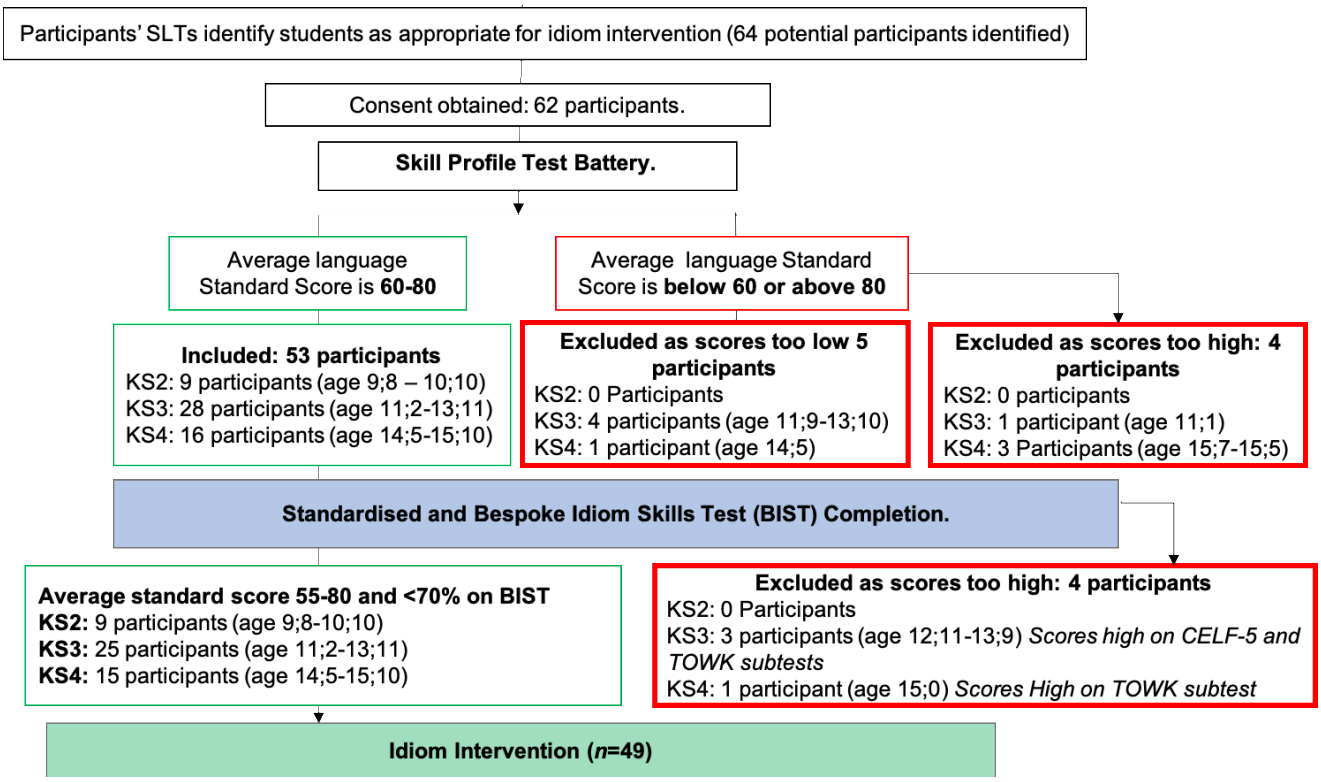
All assessments were administered by nine SLT students recruited for different stages of the study who were unfamiliar with the participating children and blind to the participant groupings and assessment time points.

Ethical approval was granted for this study by University College London ethics committee.

Participants

Forty-nine participants were recruited from a specialist school in South East England for children with DLD. In the English education system children are divided into Key Stage (KS) groups by age and participants were recruited from three key stages; nine participants from KS2 (age seven-11), 25 participants from KS3 (age 11-14) and 15 participants from KS4 (age 14-16). Although the literature suggests that idiom skill development begins at age five in TD children, the youngest participants recruited were aged 9. This was because idiom skill intervention was not seen as a priority for any children aged younger than 9 attending the participating school at the time of recruitment for this project. All participants were receiving regular direct speech and language therapy. Participants whose average standard score on Clinical Evaluations of Language Fundamentals version 4 (CELF-4) (Wiig et al., 2003) core language index was between 60 (2.5 standard deviations below mean) and 80 (1.5 standard deviations below mean) were included as this indicated that while they had language difficulties (<80), foundation language skills were not a higher priority for therapy, which would probably be the case for those with scores below 60. Children whose average standard score on the standardised idiom skill subtests listed in Table 2 was between 55 (3 standard deviations below average) and 80 were included as this indicated a weakness in idiom skills. Finally, children completed the Bespoke Idiom Skills Test (described below). Children who achieved between 5 and 70% on this test were included in the intervention study. 70% was chosen as the cut-off in order to avoid ceiling effects. These inclusion criteria are summarised in Figure 2.

Figure 2: Flow Chart Demonstrating Participant Recruitment, Inclusion and Exclusion Criteria.



Seven English teachers and nine SLTs participated in the study. The teachers had an average experience of 22.7 years teaching each (range three-30 years) and an average of 10.6 years' experience teaching children with DLD (range two-22). All agreed to incorporate the collaborative idiom intervention into 10 of their English lessons for 30 minutes during one lesson each week over one school term. The SLTs agreed to provide 1:1 idiom intervention in the other term to participants on their caseload. All participants were set in English classes of up to 10 pupils. Although not all children in each English class were participants in the project, they all received the classroom intervention. The English classes were assigned to two larger participant groups of 25 and 24 participants, balanced as well as possible according to number, age and gender. Each large group of participants was allocated to an intervention order: Classroom then 1:1 SLT intervention or the reverse. The numbers, genders and average ages of groups of participants in each participant group are shown in Table 3.

Table 3: Distribution of Participants Across Two Intervention Groups.

Intervention group	Key Stage	No. participants (male:female)	Mean Age	No. Classes	No. Teachers
Classroom intervention first	KS2	9 (7:2)	10;3	1	2
	KS3	9 (3:6)	12;4	2	2
	KS4	6 (5:1)	15;0	2	2
	Total	24 (14:9)	12;4	5	6
1:1 SLT intervention first	KS2	0	NA	0	0
	KS3	16 (11:5)	12;11	3	2
	KS4	9 (4:5)	14;11	2	2
	Total	25(15:0)	13;7	5	4

A power analysis was administered based on reported effect sizes of other intervention studies. For example, Abrahamsen and Smith (2000) found an effect size of *d*=1.21 and Lundblom and Woods (2012), an effect size of *d*=1.53. With two groups of 24 and 25 and similar effect sizes to these studies, power would be 98.5% or 99.99%. Thus, the participant group sizes for this intervention study are adequate. The smallest effect size with 80% power that could be achieved for a study with 49 participants is 0.378. This is acceptable as many education language interventions have effect sizes of between 0.3 and 0.4 (Hattie, 2009).

Bespoke Idiom Skills Test (BIST)

Participants' changing idiom skills over time were measured through repeated administration of a Bespoke Idiom Skills Test (BIST) over all five time points and standardised idiom skills tests at the first and final time points. The BIST was developed by the first author and is comprised of four subtests to assess each of the four idiom skills: identification, interpretation, explanation and use. The test contained 48 idiom items in total: 16 idioms targeted in 1:1 SLT intervention, 16 targeted in classroom intervention and 16 control idioms. Idioms were balanced across these sets in all four subtests according to decompositionality and familiarity. Decompositionality refers to the

extent to which an idiom contains words linked to its literal meaning. For example “it’s raining cats and dogs” is decomposable as it contains a word linked to its literal meaning (“raining”) but the idiom “you’re in hot water” is non-decomposable as it does not contain a word linked to its literal meaning. Idioms were evaluated for decompositionality by four SLTs and a specialist English teacher and for familiarity by 50 UK-dwelling university graduates who were currently working in education with seven-16 year olds, using electronic surveys and rated idioms using a four-point rating scale. Average ratings were calculated for each idiom: idioms averaging 1-2 were categorised as low-familiarity and those averaging 3-4 as high-familiarity.

For each subtest, 12 idioms were presented orally alongside written presentation; six of which were presented with context and six in isolation (see Appendix A). The idioms from each set were balanced across each subtest and presence of context according to their original source (English curriculum texts, teacher-talk or media) and ratings for compositionality and familiarity. The BIST idioms were differentiated across each Key Stage group to include idioms that matched the compositionality of idioms that each age group would be exposed to through curriculum resources, teacher-talk and the media.

The BIST was piloted on three TD children from each Key Stage and the test administration and scoring forms and procedure instructions were amended in line with comments made by pilot participants and testers. For the idiom identification subtest, participants scored 1 for a correct response and 0 for an incorrect response and for the idiom interpretation, explanation and use subtests they scored 0 for an incorrect response, 1 for a plausible, but incorrect response and 2 for a correct response. The highest score for the identification subtest was 12 and for the other subtests was 24 but scores were converted to percentages so that scores across subtests could be directly

compared. Examples of BIST test items and scoring procedures are provided in Appendices B and C. The full idiom lists for each KS are provided in Appendix D.

Categorisation of responses to the BIST and overall scores at each time point were subject to inter-rater reliability checking by the assessors. An agreement of a minimum of 98.4% was achieved between the three raters for each Key Stage test group and time point. Following piloting, four volunteer SLT University students completed assessment training then administered the BIST to three randomly selected participants from each Key Stage age group twice, one month apart, and test-retest reliability checking was carried out. All test-retest overall score sets across each key stage were highly correlated and not significantly different; KS2 (r=.99, p=0.9), KS3 (r=.83, p=0.7) and KS4 (r=.80, p=0.22). Therefore, reliability checks suggest that the BIST is a reliable measure of idiom skills.

Intervention Procedures and Materials

The intervention followed a prescriptive, structured approach. English teachers and SLTs were provided with a set of 16 idioms per term of intervention and an interactive PowerPoint presentation, poster and worksheet linked to each idiom. The presentation was used to guide teachers and SLTs through a session in which children were asked to identify, interpret, explain and use 16 targeted idioms. Each idiom was introduced using presentation slides in the same format which included pictorial demonstrations of idioms used across multiple contexts with scaffolding which was gradually reduced as participants progressed through the presentation (See Supplementary Materials 1). The presentation was designed to be visual and interactive to encourage participant motivation and to reduce dependence on the SLT to explain when answers were correct or incorrect and instead to focus on providing individualised feedback. The worksheet had space for participants to note the meaning of the targeted idiom in their own words

and in a picture as well as record when they might use the idiom in future and their responses to discussion points such as ‘when did you stick your head in the sand?’ or ‘have you ever been in a pickle?’ (See Supplementary Materials 2). The posters provided a picture of the idiom, its definition and examples of its use across three scenarios (See Supplementary Materials 3). Within each key stage, all participants targeted the same 32 idiom items (16 in classroom and 16 in 1:1 SLT sessions), regardless of their performance on the BIST. One new idiom was taught per session (ten in total) and the six additional idioms were taught during these sessions through example, consolidation and worksheet activities.

1:1 SLT Intervention

One-to-one direct SLT intervention was delivered by each participant’s usual SLT through ten 30-minute sessions during the allocated 10-week SLT intervention term. It was recommended that SLT session activities were differentiated to suit the children’s individual interests. To monitor fidelity, the first author communicated with SLTs on a weekly basis, watched a video of a randomly-selected session and evaluated their use of resources, questioning, modelling and feedback. During the term when participants were not receiving 1:1 SLT idiom intervention, they received 1:1 SLT intervention targeting speech and language skills unrelated to figurative language, for example, speech sounds, vocabulary or grammar.

Classroom-based Intervention

Classroom intervention was jointly delivered by the participants’ usual English teacher and SLT through collaborative support in English lessons. The class teacher and SLT met on a weekly basis for 30 minutes to collaboratively plan incorporation of idiom skills intervention resources into English lessons.

Before delivering the intervention, SLTs and English teachers attended a one-hour demonstration and discussion session to observe and discuss how to differentiate and individualise idiom skill intervention resources for each participant in their class and how to respond when a participant was incorrect. When participants were incorrect, intervention providers explained this and then explored incorrect idiom interpretation, explanation or use by asking questions to highlight contextual cues and using answers to model correct responses. For example, for the sentence “Max the dog was barking then Jack asked him to keep it down,” intervention providers may have asked “how does Jack feel?”, “who was Jack talking to?” or “what does Jack want the dog to do?” Providers used information gathered from questions to model inferencing and generation of a correct response and participants were praised for changing or correcting their responses.

To monitor fidelity, the first author communicated with intervention SLT and English teacher pairs on a weekly basis, read collaborative logs throughout the intervention period and also watched a video of a randomly-selected lesson, checking that resources were delivered in the correct order (powerpoint, worksheet then poster) and monitoring that providers were giving feedback to participants as per the intervention training. Although classroom-based and 1:1 SLT intervention providers agreed to follow the prescriptive intervention as per the provided protocol, the authors communicated openly with them during the intervention period. Of all of the idioms to be targeted, 92% were taught to participants in classroom sessions and 98% in 1:1 SLT sessions.

Attendance

Participant attendance was recorded by English teachers and/or SLTs during each intervention term. Overall there was an attendance rate of 97% for classroom sessions and 94% for 1:1 SLT sessions.

Results

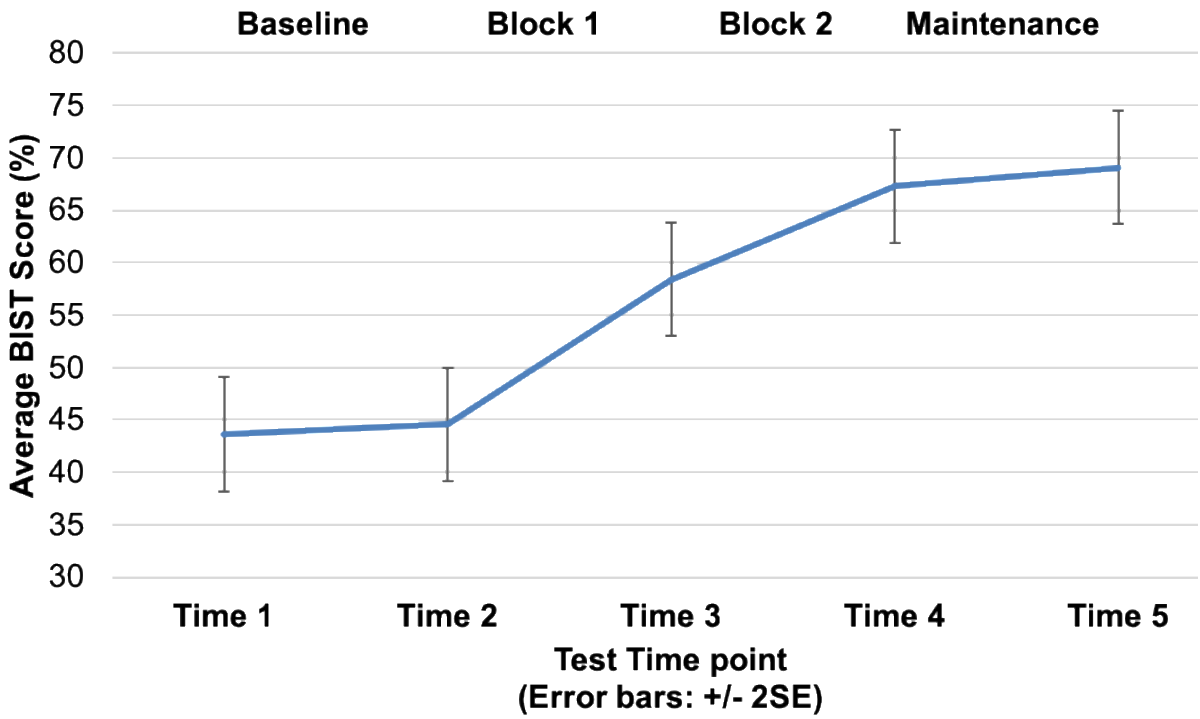
Given the complex design of the study and the increased chance of finding spurious significant results, further analyses were restricted to those needed to answer the specific research questions posed. Furthermore, in order to reduce the effects of multiple comparisons, a False Discovery Rate (FDR) (Benajmini and Hochberg, 1995) calculation was used. All *p*-values reported have been corrected by the FDR calculation (q=0.032).

Results of an initial mixed 5x3x4x2 analysis of variance (ANOVA) with three within participant variables: time (pre-baseline, post-baseline, post-intervention block 1, post-intervention block 2, post-maintenance period), idiom set (targeted in 1:1 SLT sessions, targeted in classroom sessions and control), subtest (identification, interpretation, explanation and use) and two between participant variables: Key Stage (2, 3 and 4) and intervention group (classroom intervention first, 1:1 SLT intervention first) showed no effect of Key Stage (p=.704) and no significant interactions between Key Stage and participant group (p=.838) or idiom set (p=.076). As Key Stage was not a main effect and did not interact with any other variables it was not considered in any further analyses.

Research Question 1 *Do participants make more progress in idiom skills during intervention than during a baseline period and are post-intervention levels maintained?*

The average total BIST scores achieved by participants at each time point are shown in Figure 3. This shows scores remained steady during the baseline and maintenance periods but increased during intervention blocks 1 and 2.

Figure 3: Average BIST Total Score at Each Time Point.



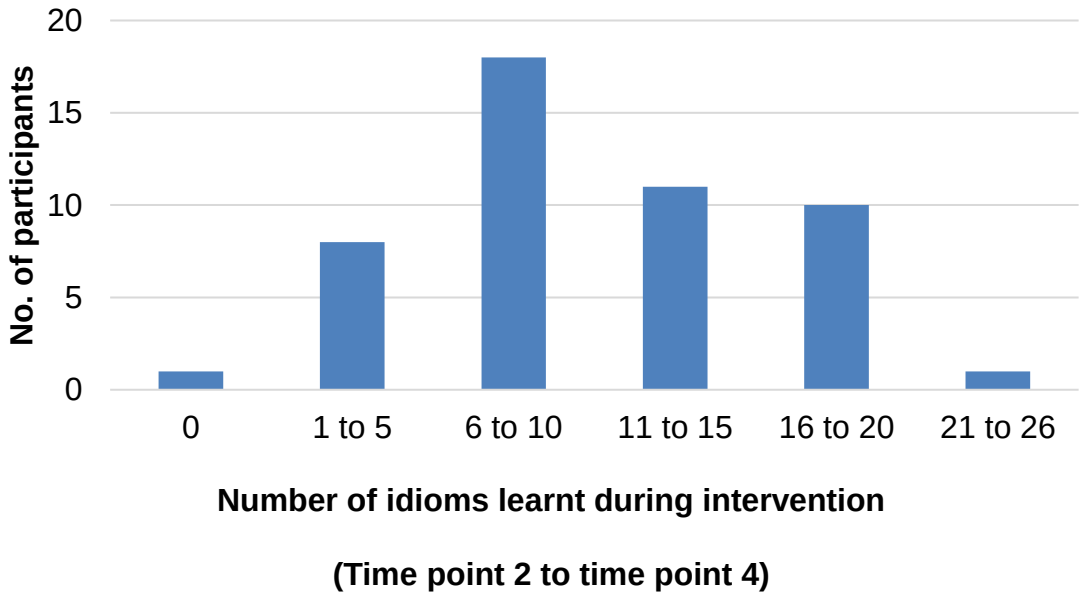
To answer the first half of the question, a repeated measures analysis of variance (ANOVA) was conducted using the change in total BIST score (combined across both participant groups) during baseline and intervention periods with one within-participant variable: time (baseline period (change in scores between Time 1 and 2), intervention block 1 (change in scores between Time 2 and 3), intervention block 2 (change in scores between Time 3 and 4)). The results showed a main effect of time ($F(2, 2068.09)=15.221$, $p<.001$, $\eta_p^2=.241$) and planned comparisons showed the progress made during both intervention blocks was greater than the progress made during the baseline period (Intervention Block 1: $p<.001$, $d=1.23$; Intervention Block 2: $p<.001$, $d=0.87$).

In order to check if progress made during each intervention block was significantly greater than zero, one-sample *t*-tests were conducted. These showed that the progress made during the baseline period did not differ significantly from zero ($p=.496$, $d=0.06$) but the progress made during both intervention blocks did (Intervention Block 1: $p<.001$,

d=1.11; Intervention Block 2: *p*<.001, *d*=0.88). Therefore, both blocks of intervention were effective.

There was some variation in the participants' response to intervention. The distribution of the number of idioms learned by participants during the intervention (between time points 2 and 4) is shown in Figure 4. An idiom was counted as "learned" when a participant achieved a correct score across all four subtests (score of 1 on the identification subtest or 2 for other subtests) at time 4 (post-intervention), but not at time 2 (pre-intervention) .

Figure 4: Range in Number of Idioms Learnt by Participants.



To establish whether post-intervention levels were maintained, a one sample *t*-test compared change of scores during the maintenance period (Times 4 to 5) to zero. There was no significant change (*p*=.392, *d*=0.14), showing post-intervention levels were maintained for three months, but scores did not improve further.

Research Question 2 *Does progress with intervention differ with 1:1 SLT versus Classroom-based intervention?*

The analysis for research question 1 combined classroom and 1:1 intervention. For question 2 we will split these and compare progress during the two interventions.

Table 4 shows the mean change in scores during the blocks of 1:1 SLT intervention versus classroom-based intervention, regardless of the order in which these were delivered (which is investigated in the next research question). One sample t-tests showed the change in scores differed significantly from zero for both intervention methods; 1:1 SLT intervention (p<.001, d=1.01) and classroom-based intervention (p<.001, d=0.96).

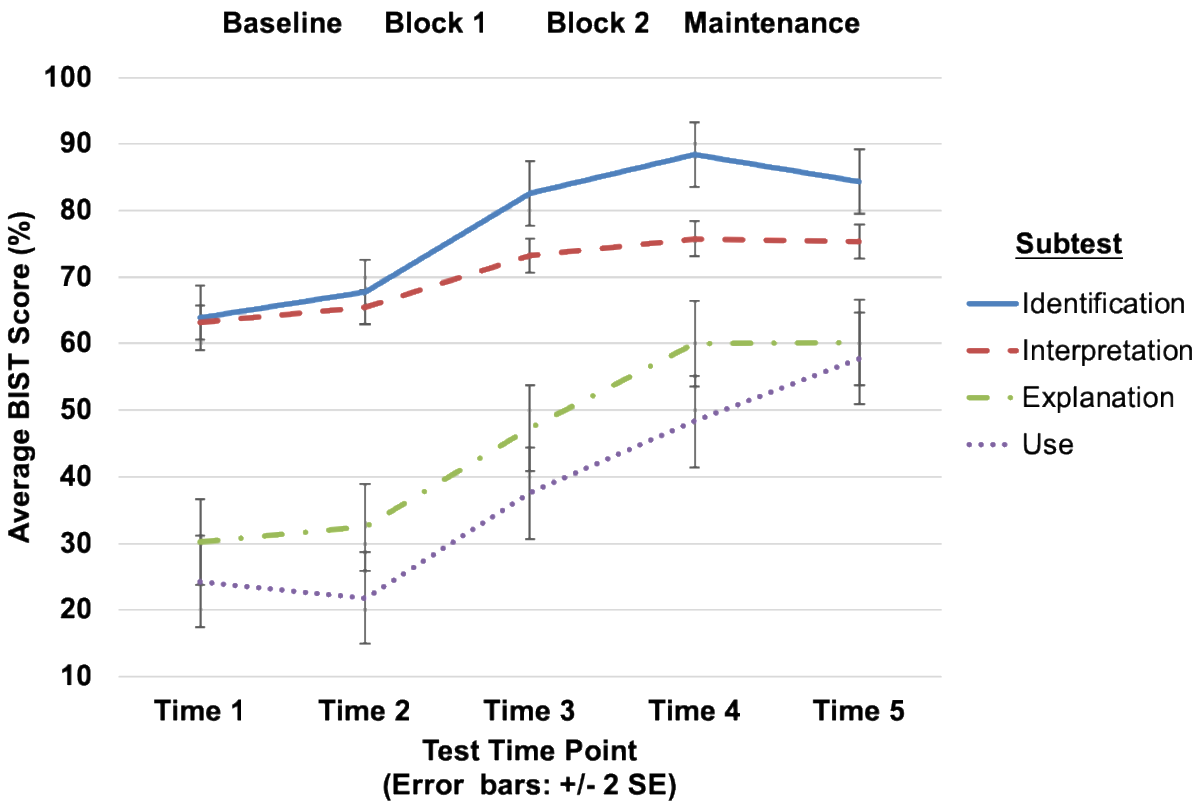
Table 4: Change and Range Scores for Each Intervention Delivery Method (%).

Intervention method	Mean Change	SD Change	Range Pre-intervention	Range post-intervention
1:1 SLT Intervention	14.8	9.7	4.6-80.9	25.0-89.3
Classroom-based Intervention	7.9	12.4	10.7-89.3	23.8-94.1

A paired samples *t*-test compared progress during the two different intervention delivery methods and showed a significant difference (p=.002, d=0.63) with greater progress during the 1:1 SLT intervention than during the classroom-based intervention.

Research Question 3 *Does intervention lead to more progress on each of the idiom skills of identification, interpretation, explanation or use than during a baseline period, and which intervention method of delivery is most effective for each?*

Figure 5: Average Score at Each Time Point Across Each of the Four BIST Subtests.



The previous analyses combined the four idiom skills, but here we consider the individual skills. The mean scores across BIST subtests and time are shown in Figure 5. Visual analysis indicates greater progress during intervention than during the baseline period.

Four repeated measures analyses of variance (ANOVAs) were conducted using the change score for each BIST subtest (including all idioms), one for each subtest (identification, interpretation, explanation and use) with one within-participant variable: time (baseline period, intervention block 1, intervention block 2). Results showed no significant effect of time for the identification, $F(1.79, 38.30)=3.17$, $p=.069$, $\eta_p^2=0.62$ or interpretation, $F(1.75, 43.20)=1.73$, $p=.226$, $\eta_p^2=.035$ subtests. There was however a significant effect of time for the explanation, $F(1.70, 216.38)=11.93$, $p<.001$, $\eta_p^2=.199$ and use subtests, $F(1.63, 436.55)=9.02$, $p=.001$, $\eta_p^2=1.58$. Planned comparisons for these showed greater progress during both intervention blocks than during the baseline period (Explanation: Intervention Block 1: $p<.001$, $d=1.01$; Intervention Block 2: $p<.001$,

*d=0.*96; Use: Intervention Block 1: *p*=.001, *d=0.*68; Intervention Block 2: *p*=.001, *d=0.*50). However, each block contained both 1:1 and classroom intervention, so we now consider each of these separately.

Table 5: Standard Deviation, Change and Range Scores (%) for Idiom Explanation and Use Subtests Across Each Intervention Delivery Method.

	Mean Change	SD Change	Range Pre-intervention	Range Post-intervention
Explanation 1:1 block	17.3	15.2	0-70.8	12.5-87.5
Explanation Class block	10.4	11.6	8.3-79.2	0-91.7
Use 1:1 block	19.1	21.8	0-58.3	0-75.0
Use Class block	7.4	22.5	0-83.3	0-95.9

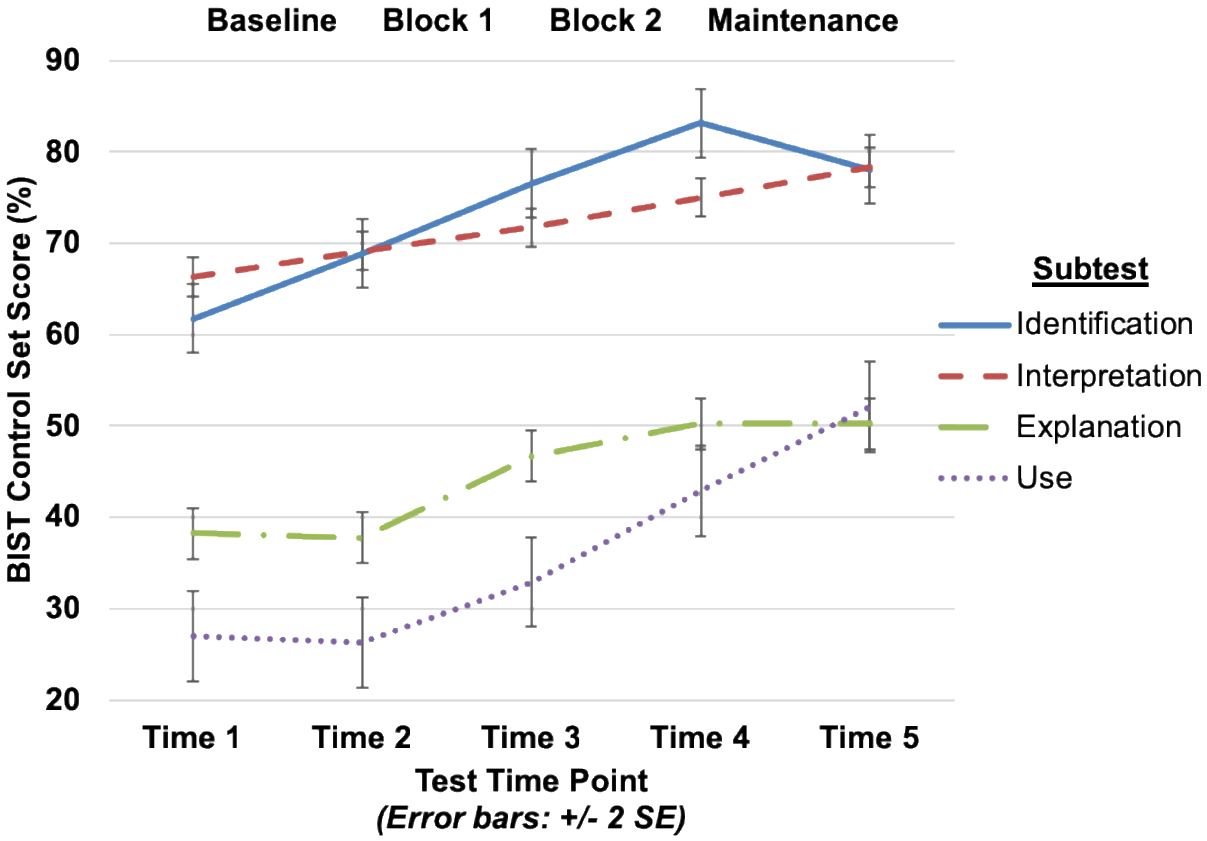
Table 5 shows the change in scores for the idiom explanation and use subtests with each intervention method (regardless of timing). One sample t-tests showed this differed significantly from zero for idiom explanation for both 1:1 SLT intervention (*p*<.001, *d*=1.14) and classroom intervention (*p*<.001, *d=0.*89) and for idiom use for both the 1:1 SLT (*p*<.001, *d*=0.87) and marginally for classroom-based intervention: (*p*=.041, *d=0.*33). The change in scores during both intervention blocks was more variable (as shown by the larger standard deviations) for the idiom use subtest than the idiom explanation subtest.

Paired samples *t*-tests showed there was only a marginally significant difference between progress made during the 1:1 SLT and classroom-based intervention blocks for the explanation subtest (*p*=.042, *d*=0.51). There was however a significant difference for the use subtest (*p*=.012, *d=0.*53) with 1:1 intervention resulting in greater change.

Research Question 4 *Does intervention lead to more progress on control idioms than during a baseline period and thus is generalisation of idiom skills achieved overall and across the four skill components?*

Previous analyses used overall scores, combined across all idiom sets (targeted 1:1 or in the classroom and control idioms). In this analysis, we looked only at the control idioms (which were never targeted). The BIST scores across each subtest and time on just the control idioms are shown in Figure 6. Visual inspection indicates more progress during intervention blocks than during the baseline period on explanation and use subtests.

Figure 6: Average BIST Control Set Score at Each Time Point Across all Four Subtests.



Five repeated ANOVAs were conducted on the change in scores only for the control set of the BIST, one on the overall scores and four across the four subtests with one within-participant variable: time (across baseline and intervention periods). These showed no main effect of time overall (Baseline: Mean=1.53 (SD=7.98); Intervention1: 6.19 (12.26); Intervention 2: 5.83 (12.91); $F(1.66, 198.18)=2.22$, $p=.135$, $\eta_p^2=.044$) or for any of the subtests: identification (Baseline: 7.14 (25.52); Intervention1: 4.65 (26.12); Intervention2: 6.63 (27.37); $F(2, 47)=.013$, $p=.987$, $\eta_p^2=.001$), interpretation (Baseline: 2.30 (16.47);

Intervention1: 2.55 (25.64); Intervention2: 3.32 (27.45); $F(1.74, 15.88)=.02$, $p=.987$, $\eta_p^2=.000$), explanation (Baseline: 0.51 (0.87); Intervention1: 8.93 (18.75); Intervention2: 3.57 (19.09); $F(1.71, 1285.82)=3.39$, $p=.054$, $\eta_p^2=.066$) and use (Baseline: 0.77 (11.24); Intervention1: 63.63 (31.36); Intervention2: 9.95 (23.80); $F(1.48, 1988.93)=2.23$, $p=.165$, $\eta_p^2=.044$).

Another method to investigate generalisation of idiom skills is to explore the scores on standardised tests of idiom skills administered at time points 1 and 5 (although we acknowledge there is no experimental control for these measures). None of the idioms used in the BIST are present in these tests. Sets of paired samples *t*-tests investigated the difference between pre and post-intervention scores on the CELF-5 figurative language, TOWK figurative usage and FLTA subtests and showed significant progress in idiom interpretation ($p<.001$, $d=0.77$) and explanation ($p<.001$, $d=0.53$) skills as measured using the CELF-5 and idiom interpretation ($p<.001$, $d=0.53$) as measured using the TOWK. They showed no significant progress in idiom explanation as measured using the FLTA ($p=.705$, $d=0.38$). It was not possible to investigate the change in scores on standardised tests of idiom identification and use skills as no such tests for these skills exist.

Discussion

This study aimed to evaluate the effectiveness of an intervention designed explicitly to improve idiom skills in 49 nine-16 year olds with DLD. A secondary aim was to consider the context in which this would be most effective by comparing 1:1 SLT therapy with intervention delivered in a classroom setting jointly by an SLT and an English teacher. Our results showed that intervention was effective for improving overall idiom skills when delivered through both 1:1 SLT and classroom-based sessions, with 1:1 intervention

being more effective. When considering each of the four individual idiom skills, intervention improved idiom explanation and use but not idiom identification and interpretation. Although the difference in effectiveness of 1:1 SLT and classroom delivery methods was only marginally significantly successful for idiom explanation, 1:1 SLT was significantly more effective for idiom use. Improvements in idiom skills did not appear to generalise to untaught idioms as measured using the BIST control items.

Research Question 1: Effectiveness of Intervention Overall

This is only the second study known to the authors to investigate the effectiveness of idiom intervention for children with DLD. The previous study with children with DLD (Abrahamsen and Smith, 2000) should be interpreted with caution due to a lack of control in its study design. In our study, overall, idiom skills improved significantly during each intervention block and this progress was significantly greater than during the baseline period. Absence of change during the baseline and maintenance periods suggests that a practice effect does not account for the progress seen with intervention.

Research Question 2: 1:1 SLT versus Classroom-based Intervention

Both 1:1 SLT and classroom-based intervention delivery methods were effective for developing idiom skills overall, but 1:1 was more effective. The study by Abrahamsen and Smith (2000) is key for comparison to the current study as it involved participants with DLD and both 1:1 and classroom-based intervention. In contrast to our study, they concluded that classroom intervention was more effective than 1:1 intervention. However, the conclusion that intervention was effective was based on pre versus post-intervention tests with no control for non-specific effects such as maturation or practice effects. Both 1:1 computer and classroom intervention delivery methods were provided during the same time frame, so they may have impacted on each other. The difference between the progress made with the two interventions was not tested directly but inferred

from a significant interaction between time and intervention method for idioms tested in isolation (but not with a story context), which may be considered as an inappropriate use of parametric analyses as all participants scored zero pre-intervention. In addition, the two interventions differed in ways other than just the method of delivery: classroom intervention involved a higher dosage (30 minutes per week) than 1:1 intervention (15 minutes per week) and the intervention methods and providers were different; the classroom-based intervention sessions involved discussion and role play and the shorter 1:1 intervention sessions involved idiom and meaning matching games. Abrahamsen and Smith (2000) hypothesised that classroom sessions were more effective because they were longer and provided opportunities to contrast and investigate literal and figurative meanings suggested by different pupils in the class. In contrast, they suggested 1:1 sessions were not as fun and interactive and therefore not as motivating for pupils.

Our study eliminated many of the above issues by comparing 1:1 and classroom interventions which differed minimally from each other except for the method of delivery. We also directly tested the difference in progress with two methods, our data were normally distributed allowing parametric analyses and we included a baseline period to provide control for maturation and practice effects. Thus our study provides a stronger test of the relative effectiveness of the two delivery methods and the effect sizes were larger and significantly different for 1:1 than for classroom intervention indicating that 1:1 intervention is more effective.

For the current study, fidelity assessment showed that 98% of the 1:1 SLT targeted idioms were taught in 1:1 SLT sessions and 92% of the classroom targeted idioms were taught in classroom sessions. This could be driving the difference noted in effectiveness

of 1:1 versus classroom based intervention. However, there may be several other reasons for this finding. For example, 1:1 sessions gave participants increased opportunities to practise using idioms across multiple contexts and contexts of their own choice then receive personalised feedback. This may have helped to make sessions more personal, fun and interesting and therefore motivating. The gap between the effectiveness of 1:1 and classroom intervention for developing idiom use skills may have been narrowed if classroom sessions provided increased opportunities for individuals to practise and develop their ability to use idioms across multiple contexts. These findings also suggest that idiom explanation skills are likely to develop more than idiom use skills with intervention, especially 1:1 SLT intervention, as more targeted and individualised feedback is required to improve idiom use skills. Regardless of these suggestions, both delivery methods were effective and therefore if 1:1 intervention is not possible in a particular setting, classroom intervention could be substituted.

Research Question 3: Progress Across Specific Idiom Skills

This is the first idiom intervention study with any population to measure the effectiveness of intervention for all four idiom skills: identification, interpretation, explanation and use. No previous studies have considered idiom identification or use skills; only explanation (Whyte et al, 2000; Abrahamsen and Smith, 2000) and/or interpretation (Ezell and Goldstein, 1989; Mashal and Kasirer, 2011; Lundblom and Woods, 2012, Whyte et al., 2011). These all found positive effects. Our study showed that idiom intervention was effective for improving idiom explanation and use (expressive) skills but not idiom identification and interpretation (comprehension) skills. Thus our findings contrast with previous studies with respect to interpretation skills. This may be due to key differences between our study and previous studies in terms of experimental design, nature of the participants, outcome measures and intervention methods.

The design of the BIST could have also led to the different pattern of the results on the different skills as the identification and interpretation subtests are multiple choice and the explanation and use subtests are open ended. This could have resulted in higher identification and interpretation scores pre-intervention with less potential for progress. However, while there did appear to be a ceiling effect for the identification subtest (participants scoring at ceiling increased from 8% pre-intervention to 26% post-intervention), this did not appear to be the case for the interpretation subtest (only 2% scored at ceiling pre-intervention and 6% post-intervention).

Some previous studies used outcome measures that may be considered easier for showing progress as they involved matching an idiom to one of three picture scenes (Ezell and Goldstein, 1992) or definitions in one context only, as taught during intervention sessions (Lundblom and Woods, 2012; Mashal and Kasirer, 2011). The current study used an idiom interpretation assessment that assessed skills using stimuli presented across multiple contexts and matching to a choice of three options that included literal, plausible and figurative interpretations. This design may be considered more challenging than assessments used in previous studies as it requires flexible thinking across multiple contexts and for participants to process the language given rather than use pictures to aid interpretation. There were some differences between intervention methods used for this study compared to previous studies. Our intervention involved participants discussing the meaning of idioms across multiple contexts and receiving feedback on their own explanations, allowing participants to reflect on their answers and practise using idioms flexibly across multiple contexts.

Previous studies have successfully used a range of very structured intervention activities and strategies which were not used in the current study including highlighting non-literal language in written narrative (Qualls, 2004), idiom drill worksheets (Abrahamsen and Smith, 2000; Whyte et al, 2011), group role play with discussion (Ezell and Goldstein, 1992; Abrahamsen and Smith, 2000), strategies to practise using contextual cues to interpret idioms and increasing the participant's exposure to the idiom in a range of contexts through discussion and simulation (Lundbloom and Woods, 2012). The current study found that the combination of using a presentation with an interactive component to introduce target idioms and practise idiom skills across multiple contexts, a worksheet to personalise learning and poster activities to consolidate skills was valuable. This combination allowed for explicit teaching and interactive practice of skills (Powerpoint presentation), personalisation of learning and discussion (worksheet) and consolidation across multiple contexts (poster).

It would be interesting to investigate the effectiveness of the different approaches used in previous research further, both in isolation and combination to find which intervention methods have the greatest influence on the development of idiom interpretation skills. Such findings would be beneficial for training SLTs and teachers in how to teach idiom skills. All previous studies in this area taught targeted idioms verbatim and in one presentation context (either in isolation or within one particular story context) rather than encouraging participants to use cues to interpret idioms across multiple story contexts. For example, the idiom "to turn over a new leaf" may be interpreted and explained differently when presented across the following two story contexts; "Jamie stole a laptop from the shop so he needs to turn over a new leaf" versus "Jamie ate three doughnuts and had a cheese burger so he needs to turn over a new leaf." In one context it may

mean “Jamie needs to stop stealing and pay for the items he wants” and in the other context it means “Jamie should stop eating unhealthy food and eat some healthy food instead.” It is possible that in order for nine-16 year-olds with DLD to develop the interpretation skills required to process idioms in spoken and written language correctly across multiple contexts without visual support, a dosage of intervention larger than 10 sessions may be required.

Research Question 4: Generalisation of Idiom Skills

Previous studies have failed to find evidence of generalisation of idiom skills, apart from in one participant group with a MLD diagnosis (Mahal and Kasirer, 2011), so we expected that participants in the current study would not show generalisation of idiom skills. Although visual inspection of Figure 6 indicated possible generalisation to explanation and use of untargeted idioms, the difference between time periods was only marginally significant or not significant and effect sizes were small. However, scores on standardised idiom tests differed significantly pre and post-intervention indicating generalisation of idiom interpretation and explanation skills. Nevertheless, the lack of experimental control on these measures means we must be cautious in this interpretation, and future studies should include experimental controls, for example including both baseline and maintenance periods as well as sets of both treated and untreated items. It would also be interesting to test generalisation using various assessment tasks. For example presenting targeted and novel idioms across multiple novel contexts, including contexts related to curriculum topics and popular media items, would provide more information on children’s ability to identify, interpret, explain and use idioms they read and hear about when they are learning at school and accessing age-appropriate media. thus, the focus of assessing generalisation of skills may be on the

functional impact of the intervention rather than on underlying impairment related weaknesses.

As repeated testing could lead to practice effects, experimental control is needed in the form of comparing progress on control versus target idiom items, or progress during baseline and intervention periods or progress in an intervention versus a control participant group. We included a baseline period, control idioms and test-retest reliability checks that showed BIST scores did not change significantly following re-testing. Therefore a practice effect is unlikely to account for our findings and reports of progress on core and control items are considered reliable.

Limitations and Future Directions

The main limitation of this study is that the idiom sets targeted in 1:1 SLT intervention and in classroom-based intervention remained constant across participants and therefore it is possible that differences in the difference in results across classroom and 1:1 SLT are due to differences between the idioms in the sets rather than delivery method. If the idioms had been counterbalanced across the intervention delivery methods this potential confound would have been avoided. However, it must be noted that idioms were balanced according to complexity (familiarity and compositionality) across idiom intervention sets (1:1 SLT, Classroom-based and control) with the aim of minimising the effects of stimuli set on results. Nevertheless, counterbalancing should be used in future studies to eliminate this confound.

Another limitation is that our participants were based in only one school which limits the generalisability of the findings to other settings, especially those where the implementation of this model of delivery would be more difficult. For example, not all schools, including specialist settings for DLD, are able to educate children in English

classes of only ten pupils. Therefore, further studies with a wider range of participants from across more than one educational setting are required to establish whether our findings can be replicated in other settings.

Although this study shows that it is possible to teach idiom skills, it did not provide convincing evidence of generalisation to non-targeted idioms. Given that this study targeted the teaching of thirty-two idioms but there are over six thousand idioms in the Oxford Dictionary for Current Idiomatic English (Ayto, 2010), some consideration is required around how intervention may need to be adapted in order to produce improvements in generalisable idiom skills and the extent to which this can be transferred to functional language skills. In order to improve generalisation, we recommend incorporating more activities using multiple contexts to practise reading comprehension and inference as part of future idiom intervention programmes. With this in mind, further research into the comparison of the number of responses logged as 'incorrect' versus 'don't know', and an error analysis of those logged as 'incorrect', may provide insight into whether children are able to learn the difference between not knowing how to interpret an idiom and incorrect or plausible responses.

Clinical Implications

This study provides evidence that both 1:1 and classroom-based intervention are effective for improving and maintaining idiom skills (particularly explanation and use) in nine-16 year-olds with DLD, although 1:1 is more effective. Thus, we recommend that idiom intervention be provided through 1:1 SLT sessions with opportunities for participants to identify, interpret and explain idioms across multiple contexts using contextual cues and generate multiple scenarios within which to use idioms. However, if 1:1 intervention is not feasible in a particular setting, classroom intervention could be used. In the current context of increasing pressures on resources, this is an important

finding for service providers seeking greater flexibility and cost-effectiveness in intervention delivery.

Conclusions

The current study has provided novel information to fill gaps in the current evidence base: idiom intervention involving discussion and practise of idiom skills across multiple contexts as delivered through 1:1 and classroom methods is effective for developing and maintaining the ability of nine-16 year olds with DLD to explain and use idioms (with 1:1 more effective than class for idiom use). This information can be used to direct future research to continue to expand and strengthen the evidence base in this field. We hope the findings of the study will also help SLTs and teachers evaluate and support the development of idiom skills in children and young people with DLD, thus improving their access to age appropriate curriculum resources and teaching as well as popular media.

Acknowledgements

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