**The importance of natural change in planning school based intervention for children with Developmental Language Impairment (DLI)**

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**The importance of natural change in planning school based intervention for children with Developmental Language Impairment (DLI)**

***Abstract***

Some reports suggest that there is an increase in the number of children identified as having developmental language impairment (Bercow,2008). Yet resource issues have meant that many Speech and Language Therapy (SLT) services have compromised provision in some way. Thus efficient ways of identifying need and prioritising intervention are needed. Despite this, children’s natural change is rarely formally considered when intervention planning. The role of age, gender and non-verbal IQ in predicting change has also not always been considered. A longitudinal baseline period is important because it may guide teachers and language therapists towards different therapeutic aims/methods for different groups of children. This study reports on 22 children aged 4-7 identified by teachers as having language difficulties. All children took part in a classroom-based semantic language intervention in two phases, the first led by speech and language therapists (SLTs), followed by a phase led by trained learning support assistants (LSAs). Two Natural Change subgroups were compared: One group showed natural change in language over a 6 week period before the intervention ran (n=11; Baseline Improvers) whilst the other group did not show language change in this non-intervention period (n=12; Baseline Non-Improvers). The groups were well-matched on skills at study entry and differed only on score-change without intervention. Language skills were assessed at 3 subsequent time points: pre-therapy, post-SLT-therapy and post-LSA-therapy. In the group as a whole, significant changes were seen across all language measures except expressive vocabulary. Non-verbal cognitive ability showed no change over time, and did not predict language change. There were important differences in the patterns shown by each subgroup depending on natural change without intervention. Notably, Baseline Non-Improvers changed during intervention more than Baseline Improvers. The results suggest that use of a longitudinal baseline may be useful when planning interventions and deciding where to focus limited resources.

***Introduction***

Children with developmental language impairments (DLI) present with difficulties in language that are the primary source of concern, but which are not sufficiently explained by other causes such as general delay or deafness (Leonard, 1998). DLI is reported to affect between 7 and 25% of the population depending on which criteria are applied (Tomblin et al, 1997). Despite this relatively large population, language impairment is under-researched when compared to similar disorders such as autism and dyslexia (Bishop, 2010), and therefore it is often difficult to identify evidence on which to base clinical practice.

In recent years, the clinical and educational focus on language learning difficulties has shifted somewhat from a narrow definition of Specific Language Impairment (SLI) to a more inclusive category of children with language impairment regardless of cognitive ability or social background (see Bishop, 2014 and Reilly et al, 2014 for a comprehensive discussion on terminology). Thus whereas SLI referred purely to children with low language and no cognitive or social deficits, DLI is a wider term which encompasses children for whom language is a primary difficulty but who may also experience additional cognitive difficulties. This change is partly due to research suggesting that children with poor language skills have similar profiles regardless of whether the language impairments occur in isolation or in the context of more general delay (Tomblin & Zhang, 1999; Leonard, Miller & Finneran, 2009; Pearce, James & McCormack, 2010) and that such children respond to treatment in comparable ways despite different background elements (Fey, Cleave, Long & Hughes, 1994; Bishop, Adams & Rosen, 2006). Children with DLI may also show varied natural trajectories, for example, those with more persistent DLI and those with more transient forms of impairment, but this developmental aspect has not been fully explored in relation to intervention need. There is evidence that those whose language resolves in the early years have better associated outcomes generally (Snowling, Adams, Bishop & Stothard, 2001; Snowling et al, 2006). Some documentation has also suggested that there is a growing body of children with DLI. For example Bercow (2008) reported that in some neighbourhoods in the UK , more than half of children entering school may have language difficulties. Thus early intervention for those whose language is not improving is an important aim for therapy within the context of cost-effective and efficient service delivery. Nevertheless, this is not as easy as it might appear: differing measures and test score thresholds are recommended and assessments are rarely taken over time when deciding on who would benefit from therapy. Yet it may be that some children identified as having low language in school, do not need, and would not benefit from intervention.

Recent work looking at Dynamic Assessment (DA) in children with DLI has begun looking at potential to learn in different contexts (Hasson & Botting, 2010; Hasson, Dodd and Botting, 2012; Camilleri and Botting, 2013). In these paradigms children usually undergo extensive test and re-test procedures to determine their potential for learning with and without support. However DA procedures are often time consuming and may need additional training. One alternative is to take a so-called longitudinal baseline using regular assessments in order to assess natural change before planning intervention. Although this is not identical to a DA approach, the children are receiving some input and prompting to learn in the regular classroom environment. Thus their potential to learn without specialist input is still being measured.

Intervention models

Reviews of intervention for children with speech and language difficulties have revealed a number of key issues (Law et al, 1998). Firstly, there is a dearth of available evidence that is of high quality in terms of scientific design (Law, Garrett & Nye, 2004; Cirrin & Gillam, 2008). In Cirrin & Gillam's (2008) systematic review of the literature on intervention in school aged children with DLI, only 21 studies met tight scientific criteria. Second, of the studies that do exist, expressive language appears to be more successfully treated than receptive language (Boyle, McCartney, O’Hare & Forbes, 2009) and this intervention may be best done one-to-one or in small groups by specialist staff (although see McCartney, Boyle, Ellis, Bannatyne & Turnbull, 2011, below). As highlighted above, most of the available evidence has not considered individual differences (i.e. what works for whom) or whether less-specialist staff can be as effective as SLTs. Third, models of ‘universal provision’ in which SLT staff train non-specialists to deliver classroom wide interventions to all children regardless of language skill, have been criticised (Law et al, 2002). Ebbels et al. (2014) have even highlighted that this approach actually risks *widening* the gap between those with good and poor language. Ebbels et al. have also emphasised the need to explore child progress as part of the assessment process. In a context where resources are limited and intervention must be targeted carefully to ensure efficiency, this is an important factor to consider.

At the same time, the use of less specialised staff in the delivery of intervention is an option for many services. Currently, the research evidence on this topic is both scarce and complex. McCartney and colleagues have recently investigated the benefits of direct vs. indirect forms of intervention within mainstream classrooms using randomised controlled trial (RCT) methodology (Boyle et al., 2009). They found that, in line with Law et al. (1998) expressive language difficulties but not receptive language abilities changed after intervention compared with a group receiving no additional therapy. Contrary to previous evidence, there was no difference in language change across direct vs indirect intervention type. Thus indirect methods (when trained and supported LSAs were employed) were as effective as face-to-face input by SLTs. Despite this success using an RCT approach, a second study showed that using the manualised intervention in more of a consultancy-style approach was much less effective, largely because the intervention was not carried out regularly or consistently. The McCartney group thus concluded that group therapy led by speech and language therapy assistants or trained LSAs was the most efficient and cost effective method, but that checks on intervention delivery needed to be in place. A similar finding was also reported by Mecrow, Beckwith and Klee (2010) who found that an ‘enhanced consultancy’ model using specialist teaching assistants led to significant change in expressive and receptive language scores on a standardised test, and to a lesser extent phonological skills and wider communication ability. These studies add to the suggestion that non-direct SLT input may be a viable alternative or complement to universal service delivery or more targeted consultation approaches (Dickson et al, 2009).

Intervention research has the potential to inform policy makers and clinicians about the type and duration of therapy that is most effective or efficient (depending on design). The McCartney study cited above suggests that whilst RCT designs are highly useful at establishing potential efficacy they often fail to address the effectiveness in real-world settings. Furthermore, there is often discontent in the SLT profession that interventions reported in a highly positive way following RCTs cannot be replicated in practice due either to high resource demands or due to highly selective participant groups which do not reflect actual SLT caseloads. A notable addition to evidence from practice is a recent study by Broomfield and Dodd (2011) which conducted a large scale *within-service* RCT whereby more than 700 referred children were randomly assigned to speech-language therapy or to a no treatment group. The specific programme of therapy ran its regular clinical course in each case and so varied from child to child, but the results show convincing overall evidence for SLT effectiveness across the group as a whole, and for 3 separate subgroups with speech, expressive and comprehension difficulties respectively. It did not however, explore which children responded best to therapy. There is an important question about the contribution that non-verbal IQ and age make to change over time, and especially during intervention, which appears missing from much of the current literature.

Because of the marked syntactic and morphological difficulties in DLI (Leonard, 1998), these have often been the main focus of therapy, often in quite narrow training formats. Intervention for semantic difficulties in children has been relatively under-researched, despite studies showing substantial difficulties in this area for children with DLI (e.g., Botting & Adams, 2001; McGregor, Newman & Reilly, 2002, Munro, Lee and Baker, 2008). Recently, the Better Communication Research Programme, also reported that there was relatively little evidence that packages designed specifically to help language were being used in educational settings (see overview by Dockrell, Lindsay, Roulstone and Law, 2014). Since semantic skills are essential for accessing the school curriculum (Parsons, Law & Gascoigne, 2005) especially where reading comprehension is concerned (see Nation, Snowling & Clarke, 2007) there is a strong rationale for improving this aspect of language even in children with non-specific DLI. The Education Endowment Fund web resource is an important addition to the available information for professionals regarding the existing evidence in this area (https://educationendowmentfoundation.org.uk/)

Present study

This study reports on children taking part in a semantically-based intervention package designed and delivered by ‘The Education Project Team’ in a Northeast London Borough in the UK. The programme employs part/full time SLTs to deliver a new intervention model across all of its primary schools. This intervention included training education staff to deliver language stimulation groups, as well as training for parents. Although the intervention is based in the UK, its content and administration would be applicable to most speech-language services and educational systems.

Very little attention has been given in previous studies to compating change before and during intervention. The present study attempts to address this by grouping children into Natural Change groups according to a baseline monitoring period (non-intervention change) prior to therapy – those who improved without intervention (Baseline Improvers; BI) and those who did not (Baseline Non-Improvers; BNI). The study has a real-world focus: we have evaluated change during an existing clinical intervention with two phases, one SLT-led and the other LSA-led; we have also used widely available measures of language outcome so that replications are facilitated and so that we are not merely assessing training on a specific task, but instead identifying more generalised language change. This type of progress is most beneficial to children with DLI, rather than an improvement on one small aspect of linguistic skill.

In addition, this study contributes information about the factors of age, gender and non-verbal IQ as well as whether these children were previously on a speech-language therapy caseload. As noted above these potentially important influences on change over time are often unreported in the literature.

The children were selected for these language stimulation groups by the school on the basis of language need. This is important because it means that children who are not currently on SLT caseloads are included as well as those with identified language disorders.

Specifically our aims in this study were to:

1. Evaluate whether significant language gain occurs during the intervention period for the group as a whole
2. Explore whether Natural Change Group (Baseline Improvers vs Baseline Non-Improvers) has an effect on pattern of change during intervention.
3. Investigate whether any additional factors such as age, gender, non-verbal IQ or caseload status are associated with change over time

***Method***

Intervention background

The Education Project Team (EPT) is a group of speech and language therapists established to tackle poor semantic skills in children with DLI in mainstream primary schools. The team was brought together partly as a result of the findings of the Bercow report (2008which was an independent review of UK services for children and young people with speech, language and communication needs that identified a need for increased emphasis to be placed on services which promote and facilitate the communication of children.

The language intervention followed a standard procedure in a manual format focused primarily on developing vocabulary and semantic skills developed by the EPT. The intervention package was aimed at children aged between 4 and 7 years of age (UK key stage 1, years R, 1 and 2) but with different variations for each school year group. Table 1 gives a detailed description of the weekly activities in the intervention groups for each age group. More details can be obtained from the clinical authors at their correspondence addresses. The groups were set up and led by a Speech and Language Therapist (SLT) over a six week period. The language groups were carried out in mainstream primary schools across the whole borough. An SLT carried out three intervention groups for each school in the borough; one group in reception (age 4-5), one group in year 1 (age 5-6) and one group in year 2 (age 6-7). A maximum of six children attended each group. Each weekly session lasted approximately 45 minutes. Following the first six week intervention stage, a trained and supported learning support assistant continued to administer the group in school on a weekly basis, but the SLT led intervention finished. The specific intervention goals were i) to improve receptive and expressive vocabulary knowledge; ii) to improve the understanding and production of sentence level language via intervention targeting semantic knowledge.

Children were selected by teachers to attend the groups using a checklist which asked teachers to identify children with:

1. Difficulty understanding and using basic topic vocabulary e.g. clothes, food, transport, animals
2. Difficulty understanding semantic aspects of language e.g. following instructions, concepts, categories, basic reasoning
3. Difficulty using semantic aspects of language e.g. forming meaningful sentences, sequencing events, giving an explanation
4. Attention and listening difficulties e.g. sitting still, staying focused
5. Difficulty with group skills e.g. sharing, taking turns, eye contact

The checklist was intended as a quick and simple method of targeting children who might benefit based on the teacher’s existing knowledge of the children. Before identifying children, and as an introduction to the intervention, staff had received some general training from the EPT staff about language difficulties in children of this age. No formal screening measures were used to select children.

[Table 1 about here]

Evaluation Study

*Participants*

As noted above, the intervention was being carried out in every school in the borough. However this evaluation involves the children from 2 sample schools participating in the wider intervention. These schools were spread across the borough both geographically and in terms of SES and were selected only on the basis of being the next 2 schools to receive intervention. As a proxy indicator for SES, free school meal eligibility in each school was noted. One school had 15% children eligible for free school meals, the other had 29%. The UK average for free school meal eligibility is 15.9% with a range from 4.2% to 47.5%. One was in the north of the borough, the other in the south. Despite these differences, the children from different schools did not significantly differ on any measure of language (all ps>0.2) at baseline and so have been treated as one group.

Thirty-six children (18 from each of the 2 participating schools) had previously been selected by teachers to attend language intervention groups. Teachers indicated that these children were experiencing primary language difficulties; however, the children participating in the study did not all have ‘diagnosed’ speech and/or language difficulties and only some were currently on the local NHS speech and language therapy caseload (n=8, see below).

Following identification for intervention (but before the intervention actually began), all families of participants were sent a separate consent form explaining the evaluation study. In total, 34 of the 36 families who had children identified for intervention also agreed to participate in the evaluation study, however, 4 children were found not to score low on any test of language and a further 8 children did not have data available at all testing points. These 8 children did not differ on any measure at study entry compared to those included in this paper. Of the remaining 22 children, 13 were boys and 9 were girls. The children were aged between 4;2 years and 7;1 years (mean=5;7 years, SD=9mths). Eight of the participating children were recruited from UK 'reception' class (4-5 year olds) while 7 were recruited from each of UK 'year 1' (5-6 year olds) and UK 'year 2' classes (6-7 year olds). All of this group scored at least -1SD on one test of language. Two of the children also scored below this threshold on a test of non-verbal ability. Table 2 indicates the mean standard scores for each test for the group as a whole.

[Table 2 about here]

In terms of receiving speech and language services, only 8/22 children were concurrently on the SLT caseload when the evaluation began. Caseload children were not significantly different from non-caseload peers on any measure at study entry, although sentence repetition which showed a borderline disadvantage for the caseload group (t(20)=2.0; p=0.06) perhaps in keeping with reports that recalling sentences maybe a marker for persistent language disorder (Conti-Ramsden, Botting & Faragher, 2001: all other p values >0.1).

*Natural Change subgroups*

Following initial data collection at study entry (time 1) and immediately pre-therapy (time 2) it became apparent that the 22 children fell into two subgroups: Half of the children showed improvement in raw language scores of at least 5 raw points during the 6 weeks before intervention began. This group will be termed the Baseline Improvers (BI) group and consisted of 11 children (2 girls, 9 boys); the second half of the children showed no language improvement, or a decline in raw scores during the non-intervention phase. This group will be termed the Baseline Non-Improvers (BNI; 7 girls, 4 boys). Children were initially coded as improvers(+1), stable (0) or declining(-1) for each test. These codes were then summed and to classify as a Baseline Improver children needed to score more than 1 (indicating overall gain). The language tests used to determine groups are detailed below. The difference in gender distribution fell just short of significance (Fisher’s exact p=0.08). The 2 children with IQ scores of lower than 1SD from the mean were also in this group but the groups did not differ on non-verbal score or any language score taken at study entry (all p values >0.4). Four children from each group were on the local Speech Language Therapy caseload. Thus these two groups were very well matched at study entry despite subsequently showing different developmental pathways in the non-intervention period.

*Measures*

The assessments were all standardised and objective which limited potential bias. Raw scores were recorded in order to sensitively measure change and this was possible because the children were carefully matched on age and gender. Change in children with low language is difficult to measure using standard scores because the tests were not designed to measure change and are not sensitive enough for this purpose. Outcome assessments were chosen for appropriateness to intervention goals (vocabulary and receptive semantic content) as well as measurement of sentence level language skills known to indicate language difficulties (sentence repetition skills; see Conti-Ramsden, Botting & Faragher, 2001) and for real-world usefulness and availability in terms of clinical practice (i.e. they were well known by, used by and available to clinicians). The assessment tasks were administered to the children in the following order in each assessment session:

* **Expressive One Word Picture Vocabulary Test** (EOWPVT) (Brownwell, 2000):

This assessment measured the children’s expressive vocabulary. The researcher presented the child with a series of illustrations which depicted objects, actions and concepts. The child was asked to name the illustrations. This assessment was continued until a basal and ceiling level was established.

* **CELF Recalling Sentences** (CRS) (CELF4; Wiig & Semel, 2006): This task assessed the children’s expressive language through the child’s ability to repeat sentences of varying lengths and complexity without changing the word meanings and structure. The researcher spoke each sentence out loud one at a time and asked the child to repeat exactly what she said and scored the child’s attempts according to the scoring method outlined in the assessment.
* **British Picture Vocabulary Scale II** (BPVS II) (Dunn, Dunn, Whetton & Burley, 1997): This assessment is a measure of receptive vocabulary. The child was presented with four pictures per page. The four pictures included the target word plus three distracters. The researcher read a word out loud and asked the child to point to the target picture. This assessment was continued until a basal and ceiling level had been established.
* **CELF Concepts & Following Directions** (CFD) (CELF4; Wiig & Semel, 2006): In order to assess the children’s receptive language, this task measured children’s ability to interpret, recall and execute oral commands of increasing length and complexity. The researcher presented the child with a series of pictures and read out instructions. The task was continued until the ceiling level was established.
* **Raven’s Coloured Progressive Matrices** (RCPM)(Raven et al, 2003): An assessment of non-verbal ability. The task consists of a series of multiple choice trials of abstract reasoning. The researcher shows a series of patterns with a missing piece and asks the child to choose the best missing piece to fit into the space.

*Assessment Timeline and procedure*

There was a period of six weeks between Time 1 (study entry) and Time 2 (pre-therapy) assessments; a period of six weeks between pre-therapy and post SLT-therapy assessments; and a period of six weeks between the post SLT-therapy and post LSA-therapy assessments. Fig 1. illustrates this timeline.

[Fig.1 about here]

Each assessment session took place in a quiet room within the child’s school. The researcher sat alongside the participating child. The researcher was the second author, a qualified speech and language therapist with experience of testing children with communication difficulties. She carried out all assessments at each of the timeline intervals and was not blind to intervention status. However she was completely independent from the Education Project Team and had no involvement with the design, implementation or future success of the intervention. Ethical approval was granted by the School of Community & Health Sciences Ethics Sub-Committee of City University London. Informed written consent was obtained from the children’s parents prior to the commencement of the study.

***Results***

Main effects of time were seen for all measures for the group as a whole. However when the subgroups were analysed, different patterns of change over the course of the study were seen. Mixed (group x time) ANOVAs were run for each test using scores at time points 2, 3 and 4 (pre-therapy, post-SLT and post-LSA assessments) to determine whether Natural Change group was significantly related to subsequent pattern of change during and after an intervention period.

Figures 2-5 show the change patterns for the BI and BNI groups on each measure and this information is also summarised in Table 3. The change from study entry to pre-therapy (Longitudinal Baseline) was not included in subsequent ANOVAs or the accompanying Figures because these scores were used to determine subgroup membership and circularity is therefore avoided. However it can be seen in Table 3 that for each test, the progress without intervention looks very different for the BI group (children who showed natural, non-intervention change) compared to the BNI group (children who showed no improvement without targeted intervention).

[Table 3 about here]

*Expressive Vocabulary - EOWPVT*

Expressive vocabulary showed a significant linear interaction of group and time from pre-therapy to follow up (F(2,40)=4.08, p=0.024) and this interaction masked any main effects of group (F(1,20)=2.24, p=0.15) or time (F(2,40)=1.29,p=0.29) neither of which were significant. Fig.2 shows that the BI group did not benefit from the direct SLT intervention or the LSA follow up, and they showed no significant change between any time point. The BNI group on the other hand, showed no improvement during initial SLT intervention, but had made significant gains at follow-up after continued trained LSA input.

*Expressive Language – CELF recalling sentences*

Expressive language showed a statistically significant quadratic interaction effect (F(1,20)=4.43; p=0.048) in which the BNI children showed gain during direct SLT intervention, but did not maintain this in the LSA follow up period, and the BI group showed gains throughout the programme of intervention. See Fig 3 and Table 3 for details. This measure also showed a linear main effect of time (F(2,40)=5.86; p=0.006) but no significant main effect of group (F(1,20)=0.59; p=0.45).

*Receptive Vocabulary- BPVS II*

No significant interaction was seen for receptive vocabulary (F(2,40)=2.44; p=0.10). However there was a significant main effect of time (F(2,40)=4.11; p=0.02) and Fig 4 shows that this change over time was driven entirely by gains in the BNI group who benefitted from both stages of therapy whilst the BI group did not maintain gains during the LSA-led stage. There was no overall main effect of group (F(1,20)=1.26; p=0.28).

*Receptive Language – CELF Concepts and Following Directions*

For receptive language there was also no significant interaction between time x group (F(2,40)=1.19; p=0.32). A significant main effect of time was seen (F (2,20)=3.64;p=0.035) and again this was led by gains in the BNI group. There was no main effect of group (F(1,20)=2.08; p=0.16).

Summary of changes during intervention

Thus while significant main effects of time are seen for all measures, this picture is more complex when the natural change of children is taken into account. In three out of four of the skills measured (all except Expressive Language), the pattern indicated that children who benefitted most from the intervention as a whole (SLT + LSA sessions) were the BNI group, that is, those who had *no*t made natural progress in the baseline period. Expressive Language showed a slightly different pattern with both groups benefitting during the SLT-led sessions but only the BI group continuing to gain in the follow up LSA sessions.

Nonverbal ability and relationship between language tasks

The non-verbal measure, Raven’s CPM did not show an interaction between group x time (F(2,40)=0.38; p=0.69) or main effects of time (F(2,40)=1.15; p=0.33) or group (F(1,20)=0.87, p=0.36). Therefore non-verbal ability did not show any significant change over the duration of the study.

Furthermore there was no correlation between study entry non-verbal ability and change on any language variable (all rs<0.3; all ps>0.2).

*Gender and age*

The results revealed that change during SLT treatment was only different across genders for Expressive Language (CELF Recalling Sentences). For this measure boys showed significantly less change (mean=1.1, SD=3.6) than girls (mean=6.9, SD=5.6; t(20)=2.96; p=0.008).

Age was not associated with treatment changes on expressive measures (both rs<0.10; both ps>0.8). However age did appear related to change on receptive measures with older children showing less change than younger ones for receptive language (r=-0.46, p=0.032) but more change in receptive vocabulary than younger children (r=0.47, p=0.031).

*Caseload status*

Children identified as receiving SLT support (i.e. considered to be on the regular SLT caseload; n=8) did not change any differently during intervention compared to non-caseload participants (all ps>0.2) except for on recalling sentences where they showed less change (mean=0.0, SD=3.0) than those not on the SLT caseload (mean=5.4, SD=5.3; t(20)=2.6, p=0.017).

***Discussion***

The findings of this study suggest that systematically observing natural baseline development before providing language intervention might be an efficient way to assess need and to streamline services without abandoning direct intervention. The participants who had improved without intervention (BI group) showed fewer additional gains when specialist direct resources were available. Therefore the added value, and cost effectiveness of the groups is lessened for these children. The BNI group on the other hand appeared to gain significantly when specialist resources were available. It is important to note that these gain effects are not caused by simple regression to the mean, since children were grouped based on *longitudinal* data rather than a single point low performance. For this reason, the changes seen in intervention are also unlikely to be simple practice effects, at least in the BNI group.

SLT vs LSA input and therapy effects

Although the Education Project Team input is wide ranging, involving whole school training and parent advice sessions as well as direct input, it has the advantage of being relatively efficient in terms of resources (initially 6 hours of SLT-led sessions). Because the programme is in the form of a standardised manual, school learning support assistants (LSAs) are trained in the running of groups and are able to continue input with some success for BNI children, seen in the continued gain at follow up for this group. Because a no-intervention longitudinal baseline was taken, the gains seen in the BNI group appear to be particularly evident in this group and only occur during the therapy period. Non-verbal abilities were also measured as a control variable, and remained unchanged throughout the course of this investigation, again suggesting that the language change seen was not a general marker of progress. However, as we acknowledge below, this study is preliminary in this respect and a large scale RCT is now needed to provide more conclusive evidence in this respect. The findings seem to confirm those of Boyle et al (2009) that a combination of SLT and LSA led intervention can have effects, but goes further in highlighting which children might show the most change.

Heterogeneity of children with language impairment

Evaluating language based interventions for children is a complex process. The heterogeneity of the children involved has been often acknowledged (e.g, Conti-Ramsden & Botting, 1999), but is seldom addressed when exploring intervention. The present study supports previous research reporting that non-verbal cognitive skills are not good predictors of response to treatment (e.g., Fey, Cleave, Long & Hughes, 1994; Bishop, Adams & Rosen, 2006). However no previous research to our knowledge has explored the importance of individual differences in natural language change when determining the efficacy of intervention.

This study took a very practical approach to sampling, beginning with children selected by teachers for an existing intervention. This means that the findings are more readily generalizable, because children did not have to meet some arbitrary criteria for inclusion. It is an interesting finding in itself that 85% of the children selected by teachers to attend the Education Project Team groups scored low on objective language tests, suggesting that teachers can with some guidance accurately identify children with communication need (see also Botting, Conti-Ramsden & Crutchley, 1997). However, not all of these children were on existing SLT caseloads. This may be a feature of limited resources and referral systems, or more likely, it may reflect additional difficulties experienced by the children receiving services that were simply not measured here. Even so, caseload children were evenly distributed between groups based on their non-intervention change, and caseload children did not change differently to the groups on the majority of measures. The only exception to this is their poorer progress on recalling sentences, perhaps confirming this test’s status as a marker for more persistent language difficulties.

Limitations of the study

It must be noted that the final sample of children who had full data sets in this study was small and additional information about the children’s backgrounds and histories (such as comorbid difficulties, additional home languages and social status) would also have been useful in determining who benefits from the group-based intervention. Nevertheless, our groups were very well matched on their age, nonverbal ability, caseload status and language skills at study entry, suggesting again that observing natural *change* may be more important in assessment than taking diagnostic measures at a single referral point. This is important when considering how the baseline information is used. We could have applied a single-case approach in which the study-entry assessment is used as a within-subject control. However because the groups are matched at this point, and it is the *change* in baseline which is important, we would need to statistically control for *change in scores*. Indeed if analyses are run with ‘study-entry to pre-therapy change’ as a continuous covariate, significant improvement is seen during the intervention period over and above this baseline. However we have chosen not to use this methodology because the small numbers stretch the feasibility of this ANCOVA approach. Grouping the sample according to baseline has a similar effect of using within-subject baseline information in relation to later change and our results start to suggest that the change seen during intervention is due to the intervention itself. It is important to note, though, that this design is based on clinical practice, and is not ideally situated to explore efficacy of intervention per se. In future research, a randomised control group design would help to answer this question. What our data indicates is that even in an experimental design, it is important to consider not just whether change happens during intervention, but for which children this is most evident. This useful clinical information is sometimes buried in control/intervention group comparisons. Moreover, although we cannot conclusively state that the intervention was effective in causing change, we can show a relationship between change within the intervention period and previous natural change, rather than a random pattern of change. Similarly, if change is due to practice effects, they would be expected across all children in both groups, rather than showing very different patterns over time. Well-used standardised language assessments were employed as outcome measures here in order that the findings are applicable widely. However more sensitive measures of change would also be useful. Although we have used raw scores to give some sensitivity, this is only possible because the groups are so well matched for age at study-entry, and it should be noted that changes seen may not be detected by standardised scores. However we believe that for low-scoring children who appear to be making no natural change in the general classroom, even small improvements in language skill on the same measures are valuable.

Implications for practice

These findings have important policy and practice implications. In the current climate, services are necessarily economising and many direct or specialist services are being compromised. In this process, it may be the children with the most severe needs who are served least well (see Ebbels et al. 2014 for a discussion of the risks in providing only Universal provision). A systematic observation period before or at the start of referral is likely to facilitate efficient service delivery, and targets children who show the most difficulty in making progress if left untreated. Note that, this is not a model which simply selects the most severely affected, rather, it considers the *potential to change* in a similar way to dynamic assessment (see Hasson, Dodd & Botting, 2012; Hasson & Joffe, 2007), although the ‘training’ given in the baseline period was simply regular classroom education. Importantly, this study is the first to show that children who are not making progress independently, are also the individuals who then appear to change most during direct intervention.

Another interesting aspect of this study is that change was observed in skills that are well documented as being difficult to ameliorate. For example, significant change was seen for the BNI group (who showed no natural language progress) for both receptive vocabulary and receptive language skills, even using standardised tests (which are often insensitive to change in low scoring participants- see Hasson & Botting, 2010). Receptive vocabulary and language are reportedly difficult to treat and a recently review by Ebbels (2014) has also highlighted how little research evidence exists for children who have receptive difficulties.

Many researchers have reported the benefits of early language intervention (Bishop & Leonard 2001). However, the results of this study revealed that younger age was only a factor in response to intervention for *receptive* language. This, coupled with the fact that children with a range of cognitive levels benefitted from therapy is a positive finding. It appears that the intervention administered was effective at increasing the language skills of children across a wide range of age and ability.

***Conclusions***

In the context of changing economic and organisational structure within SLT provision and the public sector more widely (see Gallagher & Chiat, 2009; Law et al, 2004, and Boyle et al, 2009; McCartney et al, 2011), efficiency and cost of provision become salient considerations (Dickson et al, 2009). Overall, this study adds evidence to support the importance of noting natural change when establishing intervention needs. In contrast, our findings suggest that age, gender, non-verbal ability and caseload status have only minimal impact on change during intervention. Larger scale controlled intervention studies assessing baseline change are now needed to further explore for whom therapy works best.

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Table 1a: Example session plan ages 4-5

|  |  |  |
| --- | --- | --- |
| Activity | Example | Comments (bold=stepping down; *italic*=stepping up) |
| **Hello Song**  **(5 minutes)** | Sing the hello song to each child. Encourage everybody to take part in the singing. | Use gestures/signs alongside singing e.g. sign who and where etc. |
| **Group Rules**  **(3 minutes)** | Children take turns to recall one of the group rules e.g. good looking, good listening, good sitting, good waiting. | **If a child has forgotten a group rule you can prompt them by pointing to the visual aid corresponding to the rule.** |
| **Gelling/Turn Taking Activity**  **(5 minutes)** | Fishing for names: Attach name stickers to fish. The children take it in turns to fish and then read aloud the name. They can then pass it to their peer or their peer can request the label when they hear their name. Ask the child to choose whose turn is next. | Support children to identify the name on the label e.g. “This name begins with a ‘t’, whose name begins with a ‘t’?” (use sounds not letters) or “Is this sticker for Tom or Amy?” |
| **Speaking Activity**  *What’s in the bag/box*  **(15 minutes)** | Fill the bag/box with toy animals. Encourage the children to take it in turns to reach into the bag and pull out an object. The child should name the object. Reinforce the vocabulary for the rest of the group by repeating what the child has said e.g. “Yes, it’s a horse”. | If the child does not say anything lead them into it with an open ended sentence, e.g. “Oh look, you’ve got the/a \_\_\_\_” pausing to allow the child to offer the answer.  **If the child still does not name the object, provide them with the first sound e.g. “It starts with a h” and allow them time to name it. If the child still does not name the object, offer them a forced alternative e.g. “Is it horse or a rabbit?” and allow them time to choose the answer.**  *If the child can easily name the object, ask them questions about it e.g. What colour is it? Where would you find this animal? What can you do with this animal? etc.* |
| **Understanding Activity**  *Give me…*  **(15 minutes)** | Place 4 toy animals on the table. Ask the child to find/show a named animal e.g. “Give me the elephant” (from choice of elephant, monkey, lion and zebra). When the child selects the correct object, reinforce the vocabulary by saying “Well done, you’ve found the elephant”. | **If child has difficulty giving/showing 1 item, the adult can reduce the number of objects to 2 (i.e. elephant and monkey) and make the request again e.g. “Give me the elephant”.**  *If child can consistently give you/show you 1 object, extend the activity by asking them to give you/show you 2 objects e.g. “Give me the elephant and the lion”.*  *Increase the number of objects requested to 3 and then 4 etc. You will need to increase the number of objects that the child has to choose from.* |
| **Goodbye Song**  **(2 minutes)** | Sing the goodbye song and encourage children to say goodbye to each other. This signals that the session is finished and it is time to return to class. | Use gestures/signs alongside singing e.g. sign who and where etc. |

|  |  |  |  |
| --- | --- | --- | --- |
| Activity | Example | | Comments (**bold=**stepping down; *italic*=stepping up) |
| **Age 5-6** | | | |
| **Group Rules**  **(5 minutes)** | Children take turns to recall one of the group rules e.g. good looking, good listening, good sitting, good waiting. | **If a child has forgotten a group rule you can prompt them by pointing to the visual aid corresponding to the rule.** | |
| **Gelling/Turn Taking Activity**  **(5 minutes)** | Children take it in turns to say what their favourite food is and why. | Support the children by modelling your favourite food and why. | |
| **Understanding Activity**  *In/on/under preposition lotto*  **(15-20 minutes)** | Give each child a lotto board. Hold the matching pictures in your hand and tell the children to listen to you describing the picture. Encourage the children to look carefully at their lotto boards and put their hand up if they think they have the picture. Reinforce the vocabulary when you pass the child the picture e.g. “Well done James, you have the dog sitting on the bed.” | **If a child puts their hand up and points to an incorrect picture, repeat the description of your picture and then clarify with the child. E.g. “Does your picture show the doll on the table or under the table?” Accompany the description with hand gesture to provide a visual prompt for the preposition to support the child in recognising that they are incorrect.**  **Show the child the picture that you are describing so that they can see that it doesn’t match a picture on their lotto board.** | |
| **Speaking Activity**  *Fishing with preposition pictures*  **(15-20 minutes)** | Fishing. Attach pictures showing the prepositions in/on/under to fish. Use a selection of the same pictures as used in the lotto as the children will be familiar with these. Each child takes it in turns to fish and then describe the picture. | Encourage the children to use a short phrase to describe the picture e.g. “shoe under bed”.  **If a child is unable to use a phrase to describe the picture, ask the child “Is the shoe on or under the bed” using gesture to support their understanding of the preposition vocabulary.**  *If a child is able to use a short phrase to describe the picture ask them to use a full sentence e.g. The shoe is under the bed. You could extend by asking them “why?” For example, “Why do you think the shoe has been put under the bed?”* | |
| **Age 6-7** | | | |
| **Group Rules**  **(5 minutes)** | Children take turns to recall one of the group rules e.g. good looking, good listening, good sitting, good waiting. | **If a child has forgotten a group rule you can prompt them by pointing to the visual aid corresponding to the rule**. | |
| **Gelling/Turn Taking Activity**  **(5 minutes)** | Children take it in turns to say their favourite place and why. | Support the children by modelling your favourite place and why. | |
| **Understanding Activity**  **Find the group**  **(15-20 minutes)** | Place a selection of pictures face up on the table. One at a time, ask the children to find pictures belonging to a certain category. For example, “find me 2 fruits”. | **If a child is having difficulty finding the pictures, give them one picture and ask if they can find another one to go with it. E.g. Here is a picture of an apple which is a fruit. Can you find another fruit to go with the apple?** *If a child is easily able to identify an item belonging to a category, ask them to find 2 items that they think go together, name the items and then say which category they both belong to.* | |
| **Speaking Activity Sequencing**  **(15-20 minutes)** | Give each of the children 3 step sequencing pictures. Ask the children to look carefully at the pictures and put them in the correct order, thinking about which one is first, next and last. When the children have put their pictures in order, ask them to describe the sequence. | **Ask the child to describe what is in each picture. Then discuss which picture will be first and then which one will follow.**  **Use a visual cue to show the direction in which the pictures should be sequenced (e.g. draw 3 boxes going from left to right) in order to support the child’s ability to sequence the pictures correctly.**  *Extend the number of pictures to 4 when the child is able to consistently sequence 3 picture cards.* | |

Table 1b: Example session plans ages 5-6 and 6-7

Table 2: Participant characteristics (n=22) at study entry (standard scores 100/15)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | EOWPVT | CELF CRS | BPVS II | CELF CFD | Ravens |
| Mean | 78.8 | 70.5 | 87.7 | 73.2 | 97.5 |
| SD | 17.3 | 13.0 | 7.9 | 13.1 | 13.4 |
| N(%) <1SD | 15(68%) | 19(86%) | 7(32%) | 16 (73%) | 2(9%) |

Table 3: Raw scores on measures over time across groups (BNI n=11; BI n=11)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Baseline group | Study Entry | Pre-Therapy | Post SLT-Therapy | Post LSA- Therapy |
| EOWPVT | BNI | 37.1 (17.3) | 36.3 (15.1) | 36.1 (14.7) | 43.7 (19.7) |
| BI | 42.5 (16.1) | 48.2 (19.0) | 52.1 (19.2) | 47.6 (17.3) |
| CELF RS | BNI | 16.6 (13.6) | 16.6 (12.6) | 21.4 (14.9) | 19.0 (13.5) |
| BI | 17.0 (9.1) | 20.5 (9.9) | 22.6 (11.2) | 25.5 (10.4) |
| BPVS | BNI | 40.8 (8.0) | 40.6 (9.1) | 46.9 (11.1) | 48.2 (13.4) |
| BI | 43.8 (11.2) | 50.0 (11.3) | 51.8 (13.1) | 50.7 (14.1) |
| CELF CFD | BNI | 11.9 (7.8) | 10.5 (6.5) | 13.2 (6.8) | 15.5 (8.6) |
| BI | 10.6 (7.8) | 17.6 (12.1) | 19.1 (8.9) | 19.0 (12.7) |
| Raven’s CPM | BNI | 14.4 (3.2) | 14.3 (3.9) | 15.5 (4.2) | 15.4 (4.0) |
| BI | 15.8 (4.8) | 16.8 (6.2) | 17.6 (6.5) | 16.8 (6.6) |

Figure 1: Schedule of evaluation assessment

Figures 2-5: Differential intervention effects dependent on baseline change group

Non-intervention

baseline

Study Entry

Pre-Therapy

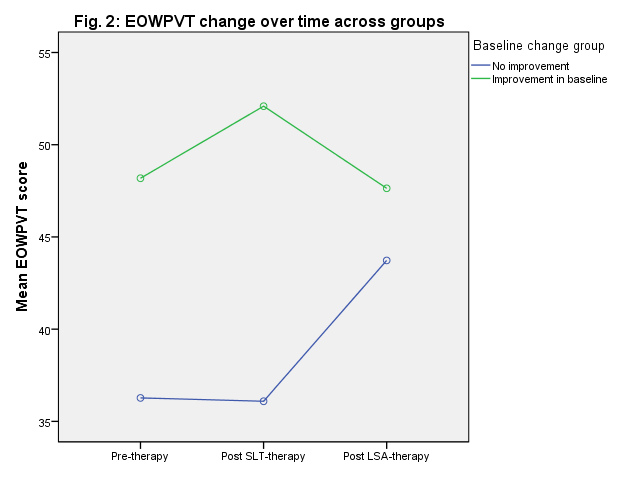
Post SLT-Therapy

Intervention period

Follow up

period

Post LSA-Therapy

******

