# Combining implicit and explicit intervention approaches to target grammar in young children with Developmental Language Disorder.

Samuel D Calder[1,2], Mary Claessen[2], & Suze Leitão[2]

**Author Affiliations:** [1]Department of Education, Western Australia
[2]School of Psychology and Speech Pathology, Curtin University, Perth, WA, Australia

## Abstract

Children with developmental language disorder are likely to experience difficulties with morphosyntax, especially regular past tense marking. Few studies have evaluated the effectiveness of intervention to improve morphosyntax in young school-aged children with DLD. This study investigated the efficacy of combined explicit and implicit intervention techniques delivered by a speech pathologist to improve receptive and expressive grammar, including the use of past tense morphosyntax, using a multiple baseline single case experimental design. Participants were aged six to seven years and received two 1:1 45 minute sessions per week for five weeks (total 7.5 hours) using Shape Coding intervention techniques combined with implicit approaches. Two of the three participants made statistically significant gains on standardised tests of general receptive and expressive grammar. Two of the three children made statistically significant improvement on measures of expressive morphosyntax, with one participant continuing to improve five weeks post treatment. Findings suggest that this approach was efficacious. These findings warrant further investigation using larger group comparison research studies.

## Key words

Grammar, intervention, morphosyntax, developmental language disorder, Shape Coding

## I Introduction

Children with Developmental Language Disorder (DLD) often have difficulty with the production and comprehension of grammar at sentence level (Ebbels, 2014). This includes particular difficulties with a range of morphosyntactic skills: grammatical morphemes associated with tense (Leonard, 2014), complex syntactic structures such as passives (Norbury et al., 2001) and *wh*-questions (van der Lely and Battell, 2003), verb acquisition (Oetting et al., 1995), and verb-argument structure (Ebbels et al., 2007). There is evidence to suggest that children with DLD have difficulty with the implicit learning of expressive (Evans et al., 2009) and receptive (Conti-Ramsden et al., 2015) grammar, but may respond well to information that is offered explicitly (Lukács et al., 2017, Lum et al., 2014, Ullman and Pierpont, 2005).

Ebbels' (2014) describes the emerging evidence base for the effectiveness of implicit and explicit approaches to grammar intervention for school-aged children with DLD. Implicit approaches aim to increase the frequency of target forms in input and output, which, theoretically, increases the likelihood that a child will learn them. A range of studies has empirically tested implicit techniques, including imitation, modelling, focused stimulation, and conversational recasting. The findings are generally favourable for the treatment of morphosyntax, particularly for younger children (see Leonard, 2014, for discussion). However, gains in expressive morphosyntax have not been mirrored in receptive morphosyntax (Cirrin and Gillam, 2008).

Explicit approaches aim to improve children's learning of the rules of grammar through explicit metacognitive teaching and use of visual supports (Ebbels, 2014; Cirrin and Gillam, 2008) to allow children to actively reflect on language targets. In an early-stage efficacy study, Finestack and Fey (2009) used a 'deductive' approach compared to 'inductive' to teach novel morphemes to six to eight year old children with DLD. The deductive approach was more effective than the inductive- (or implicit) approach, with gains being maintained and generalised.

Ebbels (2007) conducted a series of studies which provided preliminary evidence supporting the use of Shape Coding, an approach which uses shapes and colours to make grammatical rules explicit, with older children with DLD. Zwitserlood et al. (2015) conducted a within subject concurrent single case experimental design investigating the effects of 'MetaTaal' for improving complex syntax for older Dutch speaking children with DLD. Participants improved in their ability to produce relative clauses, but no improvement was observed in the receptive task. Metalinguistic training aims to enhance meta-awareness to support learning rules of grammar explicitly in a compensatory way. Although evidence for improvement in grammar comprehension is mixed, through explicit interventions children may be able to consciously reflect upon the rules of grammar in the presence of receptive language difficulties to improve understanding, especially older children (Ebbels et al., 2014).

Explicit approaches have been demonstrated to be effective in developing expressive morphosyntax with school-aged children with DLD when delivered by a speech pathologist. There is some evidence to support the use of implicit grammar intervention approaches combined with explicit instruction with preschool-aged children. In a comparison study of 34 five year old children with DLD, Smith-Lock et al. (2013) assigned participants to either an experimental group which received a combination of explicit direct instruction and implicit approaches, or a control group receiving general language stimulation. Children in the experimental group made significant gains in their use of targeted expressive morphemes, including past tense –ed, possessive's, and nominative-case pronouns. Smith-Lock et al. (2015) outlined the use of a systematic cueing hierarchy combined with explicit teaching principles which was effective in improving preschool-aged children's use of expressive morphosyntax when compared to conversational recasting alone. Kulkarni et al. (2014) evaluated the use of Shape Coding combined with recasting and grammar facilitation to improve the use of past tense morphemes with two children aged 8;11 and 9;4 with language impairment. Both children made statistically significant gains in their use of the target structure in a sentence completion task.

Explicit intervention provides information in a manner congruent with the hypothesised profile of strengths and weaknesses in children with DLD (Ullman and Pierpoint, 2005). Further, combining explicit and implicit techniques such as Shape Coding with systematic cueing hierarchies is likely to increase the opportunities and salience of teaching, and should therefore assist with implicit learning of grammatical information (Lum et al., 2014).

Studying the effects of using a combined explicit and implicit approach (Ebbels, 2014) to teach true, as opposed to novel (cf. Finestack and Fey, 2009), English morphemes to children with DLD, especially those known to be problematic for this population (Leonard, 2014), will inform clinical practice. Thus far the evidence has highlighted the limited effectiveness for either approach in improving receptive morphsyntax in children with DLD. Further, while evidence exists for explicit intervention procedures such as Shape Coding to improve expressive and receptive grammar for older school-aged children with DLD (Ebbels et al. 2007, 2014), there is limited evidence to support its use for younger school-aged children aged between six and seven years.

The current study, therefore, investigates the efficacy of a combined implicit and explicit teaching approach in a sample of younger children with DLD targeting both receptive and expressive morphosyntax. The research questions are as follows:

1. Do general expressive grammar skills improve significantly in children aged six to seven years with DLD following combined explicit and implicit intervention using Shape Coding techniques?
2. Do general receptive grammar skills improve significantly in children aged six to seven years with DLD following combined explicit and implicit intervention using Shape Coding techniques?

3. Do specific morphosyntax skills (past tense marking) improve significantly in children aged six to seven years with DLD following combined explicit and implicit intervention using Shape Coding techniques, and do improvements in expressive morphosyntax generalise to non-taught grammatical targets?

## II Method

Ethical approval for the study was obtained from the Curtin University Human Research Ethics Committee and the Western Australian Department of Education.

### *1 Participants*

Participants included three children (two male; one female) aged 6;2-7;0, presenting with grammar difficulties who attended a Language Development Centre (LDC), a specialised school for children with DLD diagnosed by a speech pathologist. The participants had been referred following a formal assessment of language functioning, and had attended the school for at least two years (see Table 1). Participants were selected based on classroom teachers identifying grammar difficulties as their primary concern. The children's teachers expressed no specific concerns regarding vocabulary, although this was not assessed formally. In addition, all children had age appropriate phonological development. Further characteristics include the children speaking English as a primary language, the absence of a neurological diagnosis or cognitive impairment, hearing within normal limits, and no additional speech pathology services accessed.

**Table 1.** Demographic and diagnostic information

| | Gender | Age of assessment and CELF-P2 Core Language Score at entry to the LDC | | Age at initial baseline assessment |
|---|---|---|---|---|
| Participant 1 | Male | 4;11 | 77 | 7;0 |
| Participant 2 | Female | 4;7 | 59 | 6;6 |
| Participant 3 | Male | 4;3 | 68 | 6;2 |

CELF-P2: Clinical Evaluation of Language Fundamentals Preschool (Wiig et al., 2004); LDC: Language Development Centre

*2 Assessments*

The Test of Reception of Grammar 2 (TROG-2) (Bishop, 2003) and Test of Early Grammatical Impairment (TEGI) (Rice and Wexler, 2001) were administered pre- and post-intervention as *receptive* and *expressive* grammar measures, respectively.

Pre- and post-intervention measures also included the production of modified grammar probes based on each child's specific targets adapted from the Grammar Elicitation Test ((GET); Smith-Lock et al., 2013). The test was designed to elicit multiple instances of specific grammatical targets, consisting of 30 probes per target with an equal distribution of allomorphs for each structure. Production of grammatical morphemes possessive 's ('S), regular past tense –ed (-ED), and regular third person singular –s (3S) was assessed using the GET, totalling 90 probes.

The paper version of the test was scanned and digitally converted into a PowerPoint® presentation so it could be administered via computer to enhance engagement. Measures were taken in the baselines and treatment phases to observe trends specific to each participant. Post-treatment assessments were carried out by blinded assessors.

Correct production of relevant grammar structures in 90 untrained probes was recorded in a dichotomous scale. Any response besides the desired structure was recorded as incorrect. Notably, no lexical items from the GET were explicitly treated during intervention. Therefore, the GET functioned as a generalisation probe in the context of this study (see Smith-Lock, 2015, for discussion).

The untrained probes included 30 probes assessing the treated grammatical structure (-ED), 30 probes assessing an extension of the treated structure (3S), and 30 probes assessing a structure serving as a control measure ('S). Within each category of probes, all possible allomorphs were included (i.e. [d], [t] and [əd] for -ED; [s], [z], [əz] for 3S and ‘S) and targets were distributed equally within each category of probe. See Appendix A in Smith-Lock et al. (2013) for a list of the GET probes.

Repeated measurements were collected during all phases of the study across 14 data points: all 90 items were probed at A1 and A2 during the pre-treatment, and at A4 and A5 during the post-treatment baseline phase. The battery of probes was reduced to 27 from 90 at A3 and for the nine data points of the intervention phase. The items were randomly presented at each data point, yet equally distributed.

***3 Experimental Design***

This study used a multiple baseline single case experimental design (SCED) (Tate et al., 2014). It is best described as a Phase I study using Robey’s five-phase model clinical outcome research (Robey, 2004), in that the purpose of this study was to select “a therapeutic effect, identify it if it is present, and estimate its magnitude” (p. 403).

**Table 2.** Timetable of assessment and intervention.

| Pre-treatment baseline<br>5 weeks | | | Intervention<br>5 weeks | Post-treatment baseline<br>5 weeks | |
|---|---|---|---|---|---|
| A1<br>TROG-2<br>TEGI<br>GET<br>(90 items) | A2<br>GET<br>(90 items) | A3<br>GET<br>(27 items) | B1-B9<br>GET (27 items) | A4<br>TROG-2<br>TEGI<br>GET<br>(90 items) | A5<br>GET<br>(90 items) |

Pre-treatment and post-treatment baselines were collected at five testing points (A1-A5): A1-A3 were collected during a 5-week pre-treatment phase, with A3 being collected immediately prior to intervention commencing, while A4 and A5 were collected during the post-treatment baseline phase (five weeks) following the five weeks of intervention (see Table 2).

***4 Procedures***

**Pre-treatment baseline phase**

At A1, the TROG-2 and TEGI were administered and scored. Results were analysed to confirm the presence of a grammatical impairment, in particular, omission of past tense morphology as a treatment target, and select the participants' grammatical targets. The 3S marker was considered an extension to -ED since regular past tense only marks tense within syntax, regardless of subject-verb agreement (e.g. the boy/s walked), whereas 3S marks both tense and subject-verb agreement (e.g. he walks vs. they walk), indicating that 3S is a more complex morphosyntactic structure for children to master (Thornton et al., 2016). At A2, the GET (90 probes) was re-administered. At A3 (immediately pre-treatment) the GET was reduced to a random selection of 27 items (9 –ED; 9 3S; 9 'S) to avoid fatiguing the participants, yet maintain relativity for comparison to pre- and post-GET measures.

**Treatment phase**

Here, treatment will be explained within the model suggested by Warren, Fey, and Yoder (2007) for describing treatment intensity. The mean dose was 49 (range: 16-84, SD: 17.84) trials within 45 minute sessions; dose form was metalinguistic training using Shape Coding combined with a systematic cueing hierarchy; dose frequency was twice a week; total intervention duration was five weeks, and; cumulative intervention intensity was (45min x 2 times per week x 5 weeks), resulting in a total of 10 individual therapy sessions and 7.5 hours of therapy. All sessions were carried out by the first author[1] in a familiar setting within the LDC. Prior to beginning treatment for each session, repeated measures from the GET were taken.

Treatment was based on explicit grammar intervention approaches using metacognitive training techniques from Shape Coding by Susan Ebbels® (Ebbels, 2007). Sessions followed an *a priori* established format, beginning with an explicit teaching component where the clinician reminded the child of what was learned in previous sessions, and explicitly stated the goals of the session: for example to produce -ED in simple subject + verb + object (SVO) sentences. Shape Coding was then used to teach the child to use the target form following a series of planned steps. First, the child and clinician revised the required vocabulary by carrying out a task that was representable with an SVO sentence (e.g. *I rolled the*

[1] Who had completed Shape Coding training

*playdough*). Second, the concepts required to create a simple sentence were revised with reference to the shapes. This included identifying the shape that matched the sentence subject (*Who?/What?;* oval), the verb (*What doing?;* hexagon), and the object (*Who?/What?*; rectangle). Past tense was indicated visually with the use of a blue arrow, pointing left and down. Each allomorph was represented orthographically (i.e. [əd] = ‘ed’; [d] = ‘d’; [t] = ‘t’). Production of SVO sentences was then targeted with the following steps: (a) the clinician explicitly stated the goal and modelled a sentence using the corresponding shapes; (b) the clinician commentated the action in real time (i.e. used 3S form), and then stopped and asked what had happened. At the same time, the past tense arrow was placed inside the hexagon to cue the child to use the –ED morpheme when responding to the prompt. Present tense forms (i.e. 3S) were used as a point of contrast to help the child understand the difference between tense markers. Finally; (c) the clinician and child continued to take turns completing actions and the child would respond to the cue to elicit the past tense structure.

As a consolidation exercise, the clinician would say a phrase targeted within the session, and the child would repeat the phrase while pointing to the corresponding shapes. The clinician would then elicit production of the phrase as described above. The shapes would then be taken away, and the child would say the target sentence without visual support.

Further, the Shape Coding cueing system was explicitly mapped on to the systematic cueing hierarchy designed by Smith-Lock et al. (2015, p. 313). These cues were delivered verbally to the children in response to any production of the target form in error. Therefore, Shape Coding was used to explicitly teach morphosyntactic concepts, and the cueing hierarchy was used to implicitly, yet systematically, scaffold the children to produce the target correctly with reference to the shapes and arrows as visual cues. All facilitation of the grammar patterns was embedded within age appropriate, naturalistic games and activities based on those used in Smith-Lock et al. (2013, 2015). Each activity ran for 15 minutes, with two activities taking place per session with a reward game selected by the child between activities. Elicitation and cueing as described above were implemented during reward games. See Appendix A for an example session plan. Every effort was made to keep the verbs targeted in sessions not to overlap with those in the GET, as indicated in Smith-Lock et al. (2013, 2015).

In this respect, the lexical items were seen as a vehicle for teaching the morphological rule of tense marking. Therefore, there was no controlling for existing verb vocabulary knowledge (i.e., distribution of high vs. low frequency verbs). As summarised in Smith-Lock (2015), there is evidence that children with DLD are able to learn and generalise (see below) past tense marking to verbs regardless of frequency effects or phonological patterns. A total of 114 verbs were targeted throughout the intervention phase (See Appendix B for a list of verbs listed according to allomorphic structure).

**Post-treatment baseline phase**

Immediately after the five weeks of intervention, the TROG-2 and TEGI were re-administered. The GET was also re-administered once immediately following intervention (A4) and again after five weeks (A5) using the full 90 items, but presented in random order. Post-treatment assessments were audio recorded and scored by final year speech pathology students blinded to the research.

***5 Statistical analysis***

For the pre-post analysis, we calculated the reliable change index (RCI) for the TROG-2 and TEGI. The RCI statistic was used to calculate whether the participants' change in score (i.e. pre-post difference in standard scores) was statistically significant by using the reliability values of both the TROG-2 and TEGI assuming normal distribution and known parameters of the sample population (Unicomb et al., 2015). In addition, 'clinically' significant change in standard score is reported. Standard deviations from the normative sample as indicated in the TROG-2 test manual were used to determine if the participants had crossed clinical boundaries - improvement in standard score of one standard deviation was considered crossing one clinical boundary. Due to the dichotomous nature of the TEGI qualitative descriptors (i.e. at or below criterion), and the grossness of each measure (i.e. improvement of ~10%

expected between each age range), clinical significance is reported using the RCI statistic only for the TEGI.

In order to determine if change in scores on the GET was due to the intervention rather than other factors, the McNemar's Test of Change was conducted. This analysis determines if the participants made significant gains in use of the treatment target (–ED or 3S) over the treatment period, and confirms if there were no gains on the control measure ('S). Analysis included change from A1-A2 (stability of baseline), A2-A4 (treatment effect), and A4-A5 (maintenance).

To analyse the repeated measures statistically, *Tau-U*[2] was computed for each tested grammatical structure. This statistic is derived after Kendall's Tau and the Mann-Whitney *U* and is used for SCEDs by combining the nonoverlap and trend of the data (Parker et al., 2011). *Tau-U* uses the combination of contrasts to calculate an aggregated effect size (ES). Pre- and post baseline contrasts were unable to be calculated using *Tau-U,* as at least three data points are required to compute a meaningful Mann-Whitney *U* statistic. McNemar's Test of Change was therefore used to analyse pre-post treatment effects using nominal data as a criterion for success on measures of morphosyntax across all phases, whereas *Tau-U* analyses were used to analyse treatment effects with reduced chance of variance through repeated measures of morphosyntax using percentage correct of targets across pre-baseline and intervention phases only.

## III Results

### *1 Participant 1*

Participant 1 (P1) attended 10/10 sessions with a mean dose of 41.8 trials (range: 16-72, SD: 15.1). Pre-post data are reported in Table 3. P1's TROG-2 standard score increased from 65 to 97, which exceeded the RCI statistic (4.21), suggesting improvement is both positive and statistically significant. A

---

[2] (http://www.singlecaseresearch.org/calculators/tau-u).

change of 15 in standard score on the TROG-2 was required to meet the RCI. P1 crossed two clinical boundaries (i.e. improved by 2 standard deviations), and at A4 was considered within-normal limits.

**Table 3.** P1 pre-post assessment scores.

| Assessment | A1 | A4 | RCI | Reference sample SD |
|---|---|---|---|---|
| TROG-2 | | | | |
| Total blocks passed | 6 | 13 | | |
| Standard Score | 65 | 97 | 4.21 | 15.32 |
| Percentile | 1 | 42 | | |
| TEGI | | | | |
| 3S probe | 22 | 50 | | |
| Past tense probe | 52.6 | 83.3 | | |
| Be probe | 73 | 100 | | |
| Do probe | 50 | 77.8 | | |
| Elicited grammar score | 49.4 | 77.8 | 14.96 | 6 |

P1's TEGI Grammar Composite Score improved from 49.4% to 77.8% and exceeded the RCI (14.96)[3]. It should also be noted that while P1 made good progress on the Past Tense Probe (the intervention goal), progress was observed across all measures on the TEGI.

P1's GET raw scores are reported in Table 4. McNemar's Test of Change was used to determine if change was statistically significant across treatment and control measures on the GET. A change in both measures would reduce confidence in attributing change to intervention. P1's use of –ED was stable during baseline (A1-A2), and improved significantly over the intervention period ($p$ <0.001), however decreased significantly over five weeks of maintenance ($p$=0.031), reducing his percentage correctness to 60% from 80% post-treatment. An unstable baseline was evident for the production of -3S ($p$=0.013),

[3] The large RCI value can be explained by the low standard deviation of the normed sample which is used in calculation of RCI.

with a significant decrease in performance in production of ‘S from A4-A5 (*p*=0.022). All other tests were non-significant.

**Table 4.** P1 GET raw scores

| Target | Pre-baseline phase | | | Intervention phase | | | | | | | | | Post-baseline phase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | A4 | A5 |
| -ED | 12/30 | 8/30 | 3/9 | 7/9 | 4/9 | 5/9 | 5/9 | 6/9 | 7/9 | 6/9 | 5/9 | 5/9 | 24/30 | 18/30 |
| 3S | 11/30 | 22/30 | 7/9 | 6/9 | 7/9 | 7/9 | 5/9 | 7/9 | 4/9 | 6/9 | 8/9 | 6/9 | 24/30 | 23/30 |
| ‘S | 15/30 | 14/30 | 6/9 | 4/9 | 7/9 | 5/9 | 6/9 | 3/9 | 7/9 | 4/9 | 5/9 | 6/9 | 17/30 | 8/30 |

**Repeated measures**

P1’s repeated measures are presented in Figure 1. For the target structure, *Tau-U* (see Table 5) indicated a stable baseline, *s*= -1, *z*= -0.52, *p*=0.60, *Tau*= -0.33, 90%CI[-1, 0.72]. The treatment was shown to have a significant effect on the frequency of –ED produced correctly, *s*=27, *z*=2.50, *p*=0.01, *Tau*=1, 90%CI[0.34,1] when pre-baseline scores (A1-A3) were compared to the intervention phase (B1-B9). These phase contrasts were combined and yielded an aggregate ES of 0.49. *Tau-U* analyses for all other phase contrast for remaining grammatical structures were non-significant.

*[insert Figure 1 about here]*

**Figure 1.** P1 repeated measures across 14 timepoints

**Table 5.** P1 Tau-U repeated measures.

| | *s* score | *z* score | *p* value | *Tau* | 90% CI |
|---|---|---|---|---|---|
| -ED | | | | | |
| A1-A3 vs A1-A3 | -1 | -0.52 | 0.60 | -0.33 | -1, 0.72 |
| A1-A3 vs B | 27 | 2.50 | 0.01 | 1 | 0.34, 1 |
| Aggregated ES | - | 1.29 | 0.20 | 0.49 | -0.13, 1 |
| 3S | | | | | |
| A1-A3 vs A1-A3 | 3 | 1.57 | 0.12 | 1 | -0,05,1 |
| A1-A3 vs B | 1 | 0.09 | 0.92 | 0.04 | -0.62, 0.70 |
| ‘S | | | | | |
| A1-A3 vs A1-A3 | 1 | 0.52 | 0.60 | 0.33 | -0.72, 1 |
| A1-A3 vs B | 1 | 0.09 | 0.92 | 0.04 | -0.62, 0.70 |

ES= effect size

***2 Participant 2***

Participant 2 (P2) attended 8/10 sessions with a mean dose of 49.5 trials (range: 31-67, SD: 13.0). Scores reported in Table 6, indicate that she did not improve by the required 19 points in standard score to exceed the RCI for the TROG-2. P2 exceeded the RCI for the TEGI (5.27).

P2's GET raw scores are reported in Table 7. Analysis indicated a stable baseline (A1-A2) for production of –ED, and a significant improvement over the intervention period ($p$=0.03), which continued over the maintenance period ($p$=0.03). However, the maximum percentage correct achieved by P2 was 53% at timepoint A5. All other analyses were non-significant.

**Table 6.** P2 pre-post assessment scores.

| Assessment | A1 | A4 | RCI | Reference sample SD |
|---|---|---|---|---|
| TROG-2 | | | | |
| Total blocks passed | 5 | 7 | | |
| Standard Score | 67 | 76 | 0.94 | 19.32 |
| Percentile | 1 | 5 | | |
| TEGI | | | | |
| 3S probe | 10 | 0 | | |
| Past tense probe | 5.6 | 47 | | |
| Be probe | 10.5 | 17.6 | | |
| Do probe | 0 | 0 | | |
| Elicited grammar score | 6.5 | 16.15 | 5.27 | 6 |

TROG-2: Test of Reception of Grammar-2; TEGI: Test of Early Grammatical Impairment

**Table 7.** P2 GET raw scores

| Target | Pre-baseline phase | | | | Intervention phase | | | | | | Post-baseline phase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | A4 | A5 |
| -ED | 3/30 | 0/30 | 0/9 | 1/9 | 1/9 | 1/9 | 0/9 | 2/9 | 0/9 | 0/9 | 6/30 | 16/30 |
| 3S | 1/30 | 0/30 | 0/9 | 0/9 | 1/9 | 0/9 | 0/9 | 1/9 | 0/9 | 0/9 | 2/30 | 2/30 |
| 'S | 2/30 | 4/30 | 1/9 | 3/9 | 4/9 | 4/9 | 2/9 | 0/9 | 2/9 | 0/9 | 4/30 | 3/30 |

**Repeated measures**

P2's repeated measures are reported in Figure 2. The target structure was produced with a stable baseline, *s*=-2, *z*= -1.05, *p*=0.29, *Tau*=-0.67, 90%CI[-1,0.38], and did not improve significantly when baseline and intervention phases were compared *s*=9, *z*=1.03, *p*=0.31, *Tau*=0.42, 90%CI[-0.26,1]. Post-treatment, P2's frequency of correct production of the target structure increased from 20% at A4 to 53% at A5. *Tau-U* analyses for all other comparisons were non-significant (see Table 8).

*[insert Figure 2 about here]*

**Figure 2.** P2 repeated measures across 14 timepoints.

**Table 8.** P2 Tau-U repeated measures.

| | s score | z score | p value | Tau | 90% CI |
|---|---|---|---|---|---|
| -ED | | | | | |
| A1-A3 vs A1-A3 | -2 | -1.05 | 0.29 | -0.67 | -1, 0.38 |
| A1-A3 vs B | 9 | 1.03 | 0.31 | 0.42 | -0.26, 1 |
| 3S | | | | | |
| A1-A3 vs A1-A3 | -2 | -1.04 | 0.29 | -0.67 | -1, 0.38 |
| A1-A3 vs B | 1 | 0.11 | 0.91 | 0.05 | -0.64,0.74 |
| Possessive ('S) | | | | | |
| A1-A3 vs A1-A3 | 1 | 1.02 | 0.60 | 0.33 | -0.72, 1 |
| A1-A3 vs B | 9 | 1.03 | 0.31 | 0.43 | -0.26, 1 |

***3 Participant 3***

Participant 3 (P3) attended 10/10 sessions with a mean dose of 55.9 trials (range: 30-84), and his scores are presented in Table 9. P3's standard score on the TROG-2 increased from 79 to 97, crossing a clinical boundary, close to the RCI (1.97), and improving to fall within the normal range.

P3's TEGI Grammar Composite Score improved from 25.6% to 34.4%, exceeding the RCI statistic (4.64). The largest increase was on the Past Tense Probe Score (5.6% to 33.3%).

**Table 9.** P3 pre-post assessment scores.

| Assessment | A1 | A4 | RCI | Reference sample SD |
|---|---|---|---|---|
| TROG-2 | | | | |
| Total blocks passed | 6 | 10 | | |
| Standard Score | 79 | 97 | 1.97 | 18.44 |
| Percentile | 8 | 42 | | |
| TEGI | | | | |
| 3S probe | 30 | 30 | | |
| Past tense probe | 5.6 | 33.3 | | |
| Be probe | 50 | 47 | | |
| Do probe | 16.7 | 27.3 | | |
| Elicited grammar score | 25.6 | 34.4 | 4.64 | 6 |

P3's GET raw scores are reported in Table 10. McNemar's Test of Change demonstrated a stable baseline for all three tested structures, and significant improvement was only observed between timepoints A4 and A5 (baseline to immediately post-treatment) for the control measure, 'S, with an increase from 0% to 16.7% correct (*p*=0.031). Although a 10% improvement was made in the production of -ED during maintenance, it was not statistically significant (*p*= 0.45).

**Table 10.** P3 GET raw scores

| Target | Pre-baseline phase | | | Intervention phase | | | | | | | | | Post-baseline phase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | A4 | A5 |
| -ED | 4/30 | 2/30 | 0/9 | 0/9 | 2/9 | 0/9 | 1/9 | 2/9 | 0/9 | 1/9 | 3/9 | 0/9 | 2/30 | 5/30 |
| 3S | 4/30 | 0/30 | 0/9 | 0/9 | 3/9 | 0/9 | 0/9 | 2/9 | 0/9 | 0/9 | 0/9 | 0/9 | 0/30 | 2/30 |
| 'S | 2/30 | 0/30 | 0/9 | 0/9 | 1/9 | 0/9 | 2/9 | 0/9 | 3/9 | 4/9 | 1/9 | 3/9 | 5/30 | 4/30 |

*[insert Figure 3 about here]*

**Figure 3.** P3 repeated measures across 14 timepoints.

**Table 11.** P3 Tau-U repeated measures.

| | s score | z score | p value | Tau | 90% CI |
|---|---|---|---|---|---|
| -ED | | | | | |
| A1-A3 vs A1-A3 | -3 | -1.57 | 0.12 | -1 | -1, 0.05 |
| A1-A3 vs B | 6 | 0.56 | 0.58 | 0.22 | -0.44,0.88 |
| 3S | | | | | |
| A1-A3 vs A1-A3 | -2 | -1.05 | 0.30 | -0.67 | -1, 0.38 |
| A1-A3 vs B | -1 | -0.09 | 0.93 | -0.04 | -0.70, 0.62 |
| 'S | | | | | |
| A1-A3 vs A1-A3 | -2 | -1.05 | 0.30 | -0.67 | -1, 0.38 |
| A1-A3 vs B | 15 | 1.39 | 0.17 | 0.56 | -0.10, 1 |

**Repeated measures**

P3's repeated measures are reported in Figure 3. *Tau-U* analyses showed structures were produced with stable baselines (see Table 10). Further analyses were non-significant across all phase contrasts between grammatical constructs.

**IV Discussion**

This study evaluated the efficacy of combining explicit and implicit intervention approaches to improve use of morphosyntax in six to seven-year-old children with DLD. It was hypothesised that participants would (1) improve in standard scores on expressive and (2) receptive grammar assessments, and; (3) improve in their use of targeted –ED and generalise to untrained lexical items. During the transition to school-aged learning contexts, children are faced with increased demands intersecting language learning and use, and cognition more generally. The current study adds further evidence for an intervention approach which combines implicit (Smith-Lock et al., 2013) and explicit intervention techniques, which may draw upon relatively spared areas of functioning for children with DLD (Lukács et al., 2017; Ullman and Pullman, 2015). Results for individual participants will be discussed below.

*1 Participant 1*

P1 demonstrated statistically significant improvement in receptive and expressive grammar, and to be within-normal limits in receptive language functioning with an increase of two standard deviations in standard scores supporting the first and second hypotheses. This is of particular interest, as the TROG-2 is not a specific measure of tense marking, which was the focus of intervention. It could be argued that the metalinguistic aspect of intervention may have had an impact on how P1 comprehended grammar, as argued by Zwitserlood et al. (2015). That is, in general the intervention may have resulted in more active and conscious awareness and understanding of grammar. Alternatively, the TROG-2 blocks P1 passed in post-testing involve some element of understanding morphological structures at sentence level. It could be argued that the explicit focus on syntactic components targeted hierarchically within Shape Coding (i.e. past tense informs present tense) had improved stored knowledge of SVO structures across past and present tense morphological contexts. That is, targeting morphology at sentence level may facilitate greater knowledge of morphosyntax, generally.

P1 demonstrated significant improvement with a moderate effect size (0.49) on only the treated target (-ED), indicating that progress in the use of regular past tense can be attributed to five weeks of intervention, rather than external factors, supporting hypothesis 3 and similar to the findings reported in Smith-Lock et al. (2015). However, P1 demonstrated a statistically significant decrease ($p$=0.031) on the same measure at maintenance (A5), suggesting that some children with DLD may require longer time periods or increased exposures to retain information (Lum et al., 2014). Despite the visual supports and scaffolding inherent to Shape Coding being systematically withdrawn during therapy, the reliance on such explicit techniques may require a more gradual release of responsibility. This is reflected in the large range of trials across sessions (16-72) for P1. The decline in performance may indicate he would have retained gains if dosage were held constant. Further, one option may be to greater utilise the role reversal aspect of the therapy approach which would give the clinician insight to the child's internal state of understanding of the treatment targets.

***2 Participant 2***

P2's results are similar to P1, however response to therapy took longer. Pre-post scores on standardised measures indicate that although progress was 'clinically' significant for both receptive and expressive grammar measures, change was not statistically significant for receptive grammar. In fact, P2 remained at the severe end of functioning for receptive grammar, putting her at risk for social and academic difficulties (Ebbels, 2014). Hypothesis 2 was not supported.

P2 made statistically significant gains on the use of the treated target but not on control or extension measures, suggesting improvement in the use of past tense is attributable to intervention. Similar to P1, these findings support hypothesis 3. However, in contrast to P1, P2 continued to make significant improvement in her use of the target during the five-week follow-up period, but with no improvement in control or extension structures, suggesting that for some children, this approach may have lasting effects. This finding is interesting, since limited improvement in receptive grammar was made. The significant increase in the maintenance period suggests that children with P2's profile may need extra time to process and consolidate their learning. Results from repeated measure analyses support these claims. Additionally, P2 experienced the lowest range and SD in dose, which may suggest that holding dose at a more constant rate contributes to lasting effects of intervention when compared to higher variance in dose trials as experienced by P1 and P3.

***3 Participant 3***

A different profile was observed when analysing P3's results. P3 made statistically significant progress on standardised measures, supporting hypotheses 1 and 2, but not on the treated target outcomes pre-post, nor through analyses of repeated measures. The latter findings do not support hypothesis 3. Notably, P3 responded very well within sessions, however, within session gains did not transfer to between session performances. While it appears that P3 simply was unable to retain the information learned within sessions, there is evidence to suggest that although immediate retention (i.e. a matter of minutes) is impaired in children with DLD, longer-term retention (i.e. overnight) is similar to age-matched, typically developing peers (Lukács et al., 2017). Perhaps P3's lack of progress is explained by the child's limited self-awareness that he was expected to consistently use -ED in varying contexts, not just in response to clinician cueing. This is of particular interest, as P3 received the highest mean number of trials (55.9) and often a higher number of trials (up to 84) within sessions compared to P1 and P2. Similar to P1, an increase in the total intervention duration may be required to demonstrate improvement. However, no discernible pattern of improvement was observed through the repeated measure analyses, and so the issue for P3 may be responding to the dose form. Future intervention for P3 may focus more on using role-reversal to encourage meta-linguistic reflection on accuracywhere the client must respond to the clinician's erroneous forms. This may serve to increase salience of incorrectness associated with omitting the –ED morpheme in obligatory contexts, and eventual transferral of using the morpheme beyond cueing interactions with the clinician.

## *4 General discussion*

Overall findings are consistent with previously published studies (Kulkarni et al., 2013; Smith-Lock et al., 2015), suggesting combined implicit and explicit teaching of grammar may be effective for children with DLD at the intersect of preschool and school-age. However, it should be noted that although two of the three children improved receptive grammar functioning to within-normal limits and production of targeted morphosyntax improved, expressive grammar functioning remained clinically impaired. This may indicate that the total intervention duration was not sufficient to facilitate long-term gains. The magnitude of effect for expressive morphosyntax was only positive for P1, indicating that although clinically significant improvement was observed, further research is needed to determine the ideal frequency of intervention for children with DLD. Additionally, the range in dose experienced by the three participants suggests further research is required to determine the optimal dose within intervention sessions.

It may have been useful to quantify the learning processes of the participants using dynamic assessment procedures (cf. Finestack and Fey, 2009). Capturing morphosyntactic learning with phases of dynamic assessment would allow the evaluation of learning pattern through deductive methods of grammar intervention, and possibly serve as a criterion for success, clinically.

There are limitations to this study. Firstly, additional baseline assessment measures, such as measures of word learning, may have provided useful information for individual profiling. Future studies should use such measures to develop a more detailed understanding of reasons for variation in response to intervention which requires consideration of individual profiles beyond what is offered by the CELF P2. Secondly, results from SCEDs must be interpreted with caution. Although some external factors such as maturation were controlled for statistically, other extraneous variables such as internal variability between participants were unable to be controlled without a group comparison. Further, the dose (range 16-84 trials per session) was not held constant across all sessions across all participants. These factors impact the ability to make valid causal inferences using SCED. Thirdly, Mann-Whitney *U* ideally requires at least four baseline measures to be calculated confidently. The current study used three pre-treatment baseline measures, which may have impacted the results from *Tau-U* analyses. In addition, at least four post treatment baseline measures would have allowed for statistical analysis of repeated measures post-treatment. Finally, the key outcome measure in the present study assessed only *expressive* morphosyntax. Although gains on receptive grammar as measured by the TROG-2 were observed for two out of three participants, a more specific measure of receptive morphosyntax may yield a more accurate profile of the receptive grammar gains made as a result of the investigated intervention.

***5 Conclusion***

Findings from the current Phase I efficacy study suggest explicit intervention techniques outlined in Shape Coding (Ebbels, 2007) combined with implicit language facilitation techniques are efficacious in improving receptive and expressive grammar for children aged six to seven years with DLD if delivered by a speech pathologist, in 1:1 45 minute sessions, twice a week for five weeks. These findings warrant further investigation and Phase II-III research studies. In addition, further research into the mechanisms of learning that are addressed by current, evidence-based intervention techniques (Ebbels et al., 2007; Smith-Lock et al., 2015; Zwitserlood et al., 2015) may serve to help clinicians better understand how spared and impaired functioning informs intervention planning.

**Acknowledgements**

The authors would like to acknowledge the contribution made by the LDC speech pathology, teaching and administration teams, and the Curtin University student speech pathologists who assisted with assessments.

**Funding**

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Declaration of conflicting interest**

The Authors declare that there is no conflict of interest.

**Biographies**

Samuel is a PhD student and speech pathologist working with children with DLD.

Suze and Mary are clinicians, academics and researchers in the area of treatment effectiveness and DLD.

**Notes**

1. Who had completed Shape Coding training.
2. http://www.singlecaseresearch.org/calculators/tau-u.
3. The large RCI value can be explained by the low standard deviation of the normed sample which is used in calculation of RCI.

**References**


BISHOP, D. 2003. Test for Reception of Grammar-2 (London: The Psychological Corporation). *CIT0003.*

CIRRIN, F. M. & GILLAM, R. B. 2008. Language intervention practices for school-age children with spoken language disorders: A systematic review. *Language, Speech, and Hearing Services in Schools,* 39**,** S110-S137.

CONTI-RAMSDEN, G., ULLMAN, M. T. & LUM, J. A. G. 2015. The relation between receptive grammar and procedural, declarative, and working memory in specific language impairment. *Frontiers in Psychology,* 6.

EBBELS, S. 2007. Teaching grammar to school-aged children with specific language impairment using Shape Coding. *Child Language Teaching and Therapy,* 23**,** 67-93.

EBBELS, S. 2014. Effectiveness of intervention for grammar in school-aged children with primary language impairments: A review of the evidence. *Child Language Teaching and Therapy,* 30**,** 7-40.

EBBELS, S. H., MARIC, N., MURPHY, A. & TURNER, G. 2014. Improving comprehension in adolescents with severe receptive language impairments: a randomized control trial of intervention for coordinating conjunctions. *International Journal of Language & Communication Disorders,* 49**,** 30-48.

EBBELS, S. H., VAN DER LELY, H. K. & DOCKRELL, J. E. 2007. Intervention for verb argument structure in children with persistent SLI: a randomized control trial. *Journal of Speech Language & Hearing Research,* 50**,** 1330-49.

EVANS, J. L., SAFFRAN, J. R. & ROBE-TORRES, K. 2009. Statistical learning in children with specific language impairment. *Journal of Speech, Language, and Hearing Research,* 52**,** 321-335.

FINESTACK, L. H. & FEY, M. E. 2009. Evaluation of a deductive procedure to teach grammatical inflections to children with language impairment. *American Journal of Speech-Language Pathology,* 18**,** 289-302.
KULKARNI, A., PRING, T. & EBBELS, S. 2014. Evaluating the effectiveness of therapy based around Shape Coding to develop the use of regular past tense morphemes in two children with language impairments. *Child Language Teaching and Therapy,* 30**,** 245-254.
LEONARD, L. B. 2014. *Children with specific language impairment*, Cambridge, MA, MIT Press.
LUKÁCS, Á., KEMÉNY, F., LUM, J. A. & ULLMAN, M. T. 2017. Learning and Overnight Retention in Declarative Memory in Specific Language Impairment. *PloS one,* 12**,** e0169474.
LUM, J. A. G., CONTI-RAMSDEN, G., MORGAN, A. T. & ULLMAN, M. T. 2014. Procedural learning deficits in specific language impairment (SLI): A meta-analysis of serial reaction time task performance. *Cortex,* 51.
NORBURY, C. F., BISHOP, D. V. & BRISCOE, J. 2001. Production of English finite verb morphology: a comparison of SLI and mild-moderate hearing impairment. *J Speech Lang Hear Res,* 44**,** 165-78.
OETTING, J. B., RICE, M. L. & SWANK, L. K. 1995. Quick Incidental Learning (QUIL) of words by school-age children with and without SLI. *J Speech Hear Res,* 38**,** 434-45.
PARKER, R. I., VANNEST, K. J., DAVIS, J. L. & SAUBER, S. B. 2011. Combining nonoverlap and trend for single-case research: Tau-U. *Behav Ther,* 42**,** 284-99.
RICE, M. & WEXLER, K. 2001. Test of early grammatical impairment. *San Antonio, TX: The Psychological Corporation*.
ROBEY, R. R. 2004. A five-phase model for clinical-outcome research. *J Commun Disord,* 37**,** 401-11.
SMITH-LOCK, K. M. 2015. Rule-based learning of regular past tense in children with specific language impairment. *Cogn Neuropsychol,* 32**,** 221-42.
SMITH-LOCK, K. M., LEITAO, S., LAMBERT, L. & NICKELS, L. 2013. Effective intervention for expressive grammar in children with specific language impairment. *International Journal of Language & Communication Disorders,* 48**,** 265-282.
SMITH-LOCK, K. M., LEITAO, S., PRIOR, P. & NICKELS, L. 2015. The Effectiveness of Two Grammar Treatment Procedures for Children With SLI: A Randomized Clinical Trial. *Language, Speech & Hearing Services in the Schools,* 46**,** 312-24.
TATE, R. L., PERDICES, M., MCDONALD, S., TOGHER, L. & ROSENKOETTER, U. 2014. The design, conduct and report of single-case research: resources to improve the quality of the neurorehabilitation literature. *Neuropsychol Rehabil,* 24**,** 315-31.
THORNTON, R., ROMBOUGH, K., MARTIN, J. & ORTON, L. 2016. Negative sentences in children with specific language impairment. *First Language,* 36**,** 228-264.
ULLMAN, M. T. & PIERPONT, E. I. 2005. Specific language impairment is not specific to language: the procedural deficit hypothesis. *Cortex,* 41**,** 399-433.
UNICOMB, R., COLYVAS, K., HARRISON, E. & HEWAT, S. 2015. Assessment of Reliable Change Using 95% Credible Intervals for the Differences in Proportions: A Statistical Analysis for Case-Study Methodology. *J Speech Lang Hear Res,* 58**,** 728-39.

VAN DER LELY, H. K. & BATTELL, J. 2003. Wh-movement in children with grammatical SLI: A test of the RDDR hypothesis. *Language,* 79**,** 153-181.
WARREN, S. F., FEY, M. E. & YODER, P. J. 2007. Differential treatment intensity research: a missing link to creating optimally effective communication interventions. *Ment Retard Dev Disabil Res Rev,* 13**,** 70-7.
WIIG, E. H., SECORD, W. & SEMEL, E. M. 2004. *CELF preschool 2: clinical evaluation of language fundamentals preschool*, Pearson/PsychCorp.
ZWITSERLOOD, R., VAN WEERDENBURG, M., WIJNEN, F. & VERHOEVEN, L. 2015. 'MetaTaal': Enhancing complex syntax in children with SLI: A metalinguistic and multimodal approach. *International journal of language & communication disorders / Royal College of Speech & Language Therapists,* 50**,** 273-297.

**Figures**

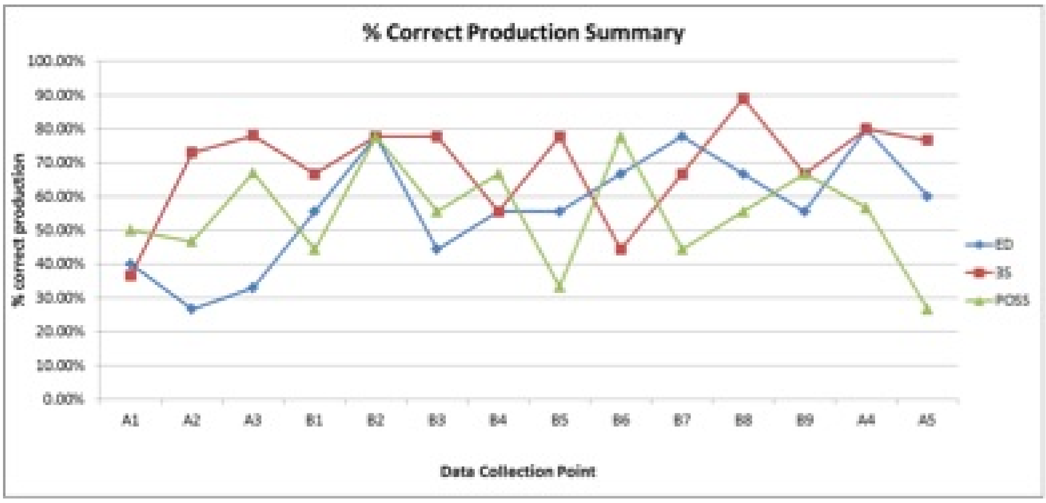


**Figure 1. P1 repeated measures across 14 timepoints.**

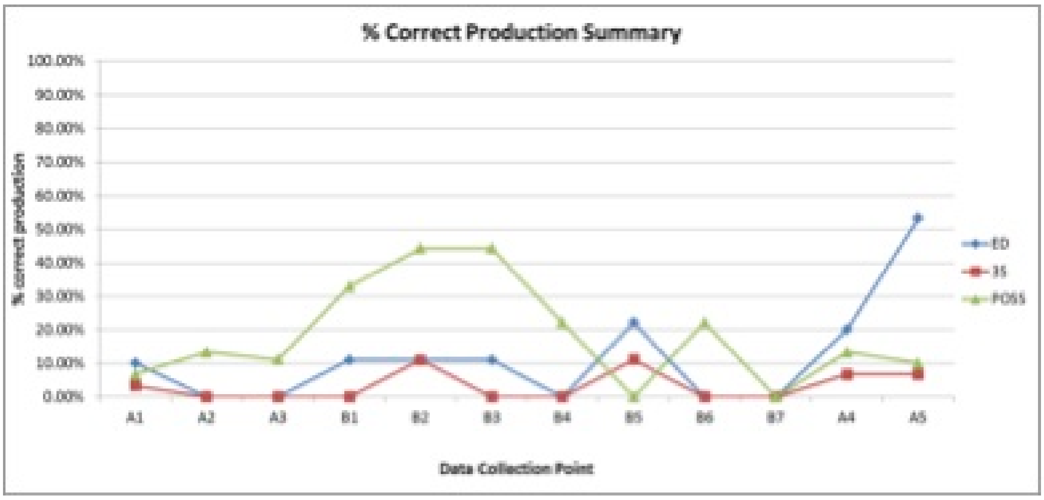


**Figure 2. P2 repeated measures across 14 timepoints.**

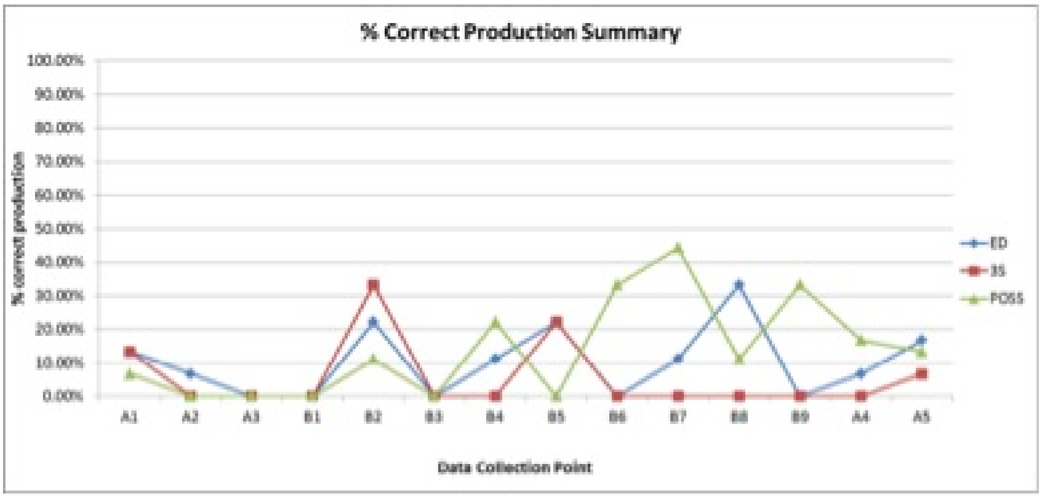


**Figure 3. P3 repeated measures across 14 timepoints.**

**Appendices**

**Appendix A**. Example Session Plan

**Goal:** To elicit –ed by stating actions that happened in the past

**Procedure:** Make reference to use of first person subject (I) and second person subject (you) as WHO in explicit teaching component prior to activity (note: other sessions included nouns beyond pronominals, such as animals). Sit on the floor and work through following steps:

1. Check-up/teach vocabulary through acting out tasks
   - SUBJECTS: I, you
   - VERBS: knocked, rolled, lifted, etc
   - OBJECTS: ball, pin, stars
2. SHAPE: Introduce the sentence coding. Highlight the link between SUBJECT and OBJECT as indicated through verb. *Remember, the oval WHO/WHAT is doing the action, and the rectangle WHO/WHAT goes inside the WHAT DOING.*
3. Target: Target SV/O/A sentences one at a time using steps 4-7. Introduce each alongside its corresponding shape.
4. Action: Child and speech pathologist take turns to say a sentence and match it to the template. **Task explanation**:

   *We are going to each take turns at bowling today. When it's your turn, you have to roll the ball and try to knock down the bowling pins. Then you get to collect all the stars under the bowling pins that you have knocked down*

   *It's my turn first. I will roll the ball [roll the ball] – what did I do? I roll**ed** the ball!*

   *Did you hear the ending sound /**d**/? When an action has happened we say a /**t**/ or /**d**/ sound on the end of the word. Listen carefully. I roll**ed** the ball. You have a turn!*

   Then prompt: e.g. "*That looked fun! What did you do? You roll**ed** the ball.*"

5. Do steps 4-7 for sentences with a variety of verbs (from **Targets**). Repeat changing between First person subject (I) and second person subject (you). For each verb/sentence you carry out and prompt for, do steps 6 & 7. Repeat steps 4 & 5 using target WHAT DOINGs and different subjects if necessary.

   *Now you will say some sentences about us and WHAT DOING that have already happened.*

6. Coding: Lay large shapes on the floor and student to use as cues to produce SV/O sentences- they can act out the sentences if necessary, then explain what is happening. Show blue left down ed arrow and place it in the WHAT DOING. **Explain**: *We use the arrow that points to the left to tell us it has already happened. Any arrow that points this way tells us the WHAT DOING has already happened.*

7. Questions: Participant to answer *'What did you/I do?'* on phrases containing target VERB. Work through VERBs that elicit allomorphs (/d/, /t/, /ed/).

   *EG*

   *I/you roll the ball (with action). What did I/you do?*

   *I/you knock the pins down (with action). What did I/you do?*

   Repeat for all verbs in **Targets.**

Cueing hierarchy:

1. *Try that sentence again* (point to the left down ed arrow in the WHAT DOING).
2. *I didn't hear the past /t/, /d/, /ed/ sound on the WHAT DOING. Try again.*
3. *Here is the sentence without the past -ED sound* (WHO/WHAT + VERB/s + WHO/WHAT; manipulate shapes)- *try again*.
4. *I'll say the sentence, then you try* (Model and point to shapes, emphasising inflection and pointing to left down ed arrow).

8. Consolidation:

   - At the end of the session, review the VERBs covered in the session

- Comprehension task
  - Speech pathologist say phrase (SUBJECT VERBed/OBJECT)
  - Child to select SUBJECTs and OBJECTs and place them on shapes or point to the shapes following comp questions (e.g *What's the WHO/WHAT?*)
- Production
  - Student say phrase
- Repeat without shapes, but bring them back to check responses as necessary
- Monitoring task: when student is secure, speech pathologist starts to make errors and student corrects them (e.g. I roll the ball) first with templates, then without.

**Targets:** /t/: knocked, replaced; /d/: rolled; /əd/: lifted, collected

**Materials:** 10 Bowling pins, ball, 10 stars (to be placed under bowling pins)

Shape Coding visual prompts:

**-** SUBJECT- *WHO/WHAT?* (oval, red)

**-** VERB- *WHAT DOING?* (hexagon, blue)

**-** OBJECT- *WHO/WHAT?* (rectangle, red)

**-**Left down 't', 'd' and 'ed' arrow

(/t/, /d/, /əd/ left down arrows are available if teaching phonological difference between inflections as a specific goal or strategy to achieve the goal)

**Time:** 15 minutes

**Appendix B.** Trained verbs

| [t] allomorph | [d] allomorph | [əd] allomorph |
|---|---|---|
| asked | lined up | added |
| attacked | answered | arrested |
| baked | bandaged | bleated |
| balanced | carried | collected |
| barked | chewed | counted |
| bounced | climbed | created |
| boxed | cried | demanded |
| bumped | dived | ended |
| chased | echoed | glided |
| chirped | exclaimed | injected |
| chopped | explained | landed |
| clapped | explored | lifted |
| clucked | flattened | rested |
| cooked | fluttered | separated |
| danced | fried | started |
| escaped | gobbled | strutted |
| flipped | he-hawed | tasted |
| grouped | hummed | trotted |
| handcuffed | hurried | twisted |
| jumped | listened | visited |
| kicked | measured | waited |
| knocked | miowed | |
| looked | mooed | |
| marched | moved | |
| mixed | neighed | |
| oinked | offered | |
| pinched | piled | |
| placed | played | |
| poked | poured | |
| pricked | pulled | |
| pushed | purred | |
| quacked | relieved | |
| raced | replied | |
| replaced | rolled | |
| scooped | rubbed | |

| | |
|---|---|
| searched | shuffled |
| sipped | slithered |
| squashed | spied |
| squawked | twirled |
| squeaked | viewed |
| stacked | waved |
| stepped | wobbled |
| stopped | wriggled |
| stretched | yelled |
| sucked | |
| swapped | |
| talked | |
| tapped | |
| watched | |