Oral Language Comprehension Difficulties in School-Aged Children: A Pilot Single Case Study to Investigate the Efficacy of a Combined Intervention Approach

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Table of Contents

List of Tables..............................................................................................................................v

List of Figures...........................................................................................................................vi

Acknowledgements....................................................................................................................vii

Abstract........................................................................................................................................viii

I Introduction..............................................................................................................................1

Basis of Language Comprehension..........................................................................................1
The Nature of Language Impairment..........................................................................................2
Critical analysis of the literature on interventions for language comprehension difficulties..........................................................................................................................3

(i) Grammatical Interventions – Metalinguistic vs. Processing Deficit Approach..........................3

(ii) Cognitive and Metacognitive Strategies..............................................................................5

(iii) General Language Interventions......................................................................................6

Conclusion...................................................................................................................................6

II Aims and Objectives...............................................................................................................7

III Methods.....................................................................................................................................8

Study Design.............................................................................................................................8

Ethical Approval..........................................................................................................................9

Recruitment...............................................................................................................................9

Participant................................................................................................................................10

Project Setting...........................................................................................................................12

Baseline Assessment and Rationale..........................................................................................12

Development of Criterion Referenced Probes..............................................................................14

Interpretation of Baseline Assessment.......................................................................................15

Intervention Approaches..........................................................................................................16

(i) Cognitive Approach - Comprehension Monitoring...............................................................16

(ii) Metacognitive Approach - Rehearsal Strategy....................................................................16
(iii) Metalinguistic Approach – Shape Coding ........................................ 17

Homework Activities ................................................................................. 18
Structure of Intervention Sessions .............................................................. 19
Treatment Fidelity ..................................................................................... 20
Data Collection ......................................................................................... 20
Clinical Observations ............................................................................... 20
Statistical Analysis ................................................................................... 21

III Results ................................................................................................... 22

I Pre vs. Post Therapy Data ....................................................................... 22
   (i) Standardised Assessments ............................................................... 22
   (ii) Criterion Referenced Probes .......................................................... 24

II In-Session Data – Quantitative ............................................................... 26
   (i) Metalinguistic Approach – Shape Coding ....................................... 26
   (ii) Metacognitive Approach – Rehearsal Strategy ............................... 28

III In-Session Data – Qualitative ............................................................... 29
   (i) Cognitive Approach – Comprehension Monitoring ....................... 29
   (ii) Spatial Concepts ............................................................................. 29
   (iii) Behavioural Data – Attention ....................................................... 30

IV Discussion ............................................................................................. 32

Implication of Central Executive Functioning on Language Impairment .... 32

What does this study tell us about poor comprehenders? ....................... 33

Do younger children with oral language comprehension difficulties benefit from a metalinguistic approach? ......................................................... 33

Are cognitive and metacognitive strategies effective compensatory mechanisms for the working memory deficits and processing limitations of young children? .... 34
   (i) Cognitive Strategy – Comprehension Monitoring ....................... 34
   (ii) Metacognitive Strategy – Rehearsal ............................................ 35
Limitations..........................................................................................................................35

(i) Study Design..................................................................................................................35
(ii) Limitations in Assessment............................................................................................36
(iii) Dosage............................................................................................................................36
(iv) Possible Undiagnosed Comorbid Attention Deficit Disorder..............................36

Conclusion..........................................................................................................................37

Reference List......................................................................................................................38

Appendices..........................................................................................................................45

Appendix I – Parent Information Letter...............................................................................45
Appendix II – Sample Probe – “Neither/Nor”.......................................................................49
Appendix III – Comprehension Monitoring Protocol.........................................................50
Appendix IV – Rehearsal Strategy Protocol.........................................................................52
Appendix V – Shape Coding Protocol - Introduction..........................................................54
Appendix VI – Shape Coding Protocol – Untreated & Treated...........................................55
Appendix VII – Data Collection Form – Shape Coding......................................................65
Appendix VIII – Data Collection Form – Rehearsal Strategy.............................................66
List of Tables

Table 1: Actual Timeline of Intervention Project

Table 2: JC’s Profile Pre-Assessment

Table 3: Baseline Assessment

Table 4: TROG 2 Grammar Comprehension Results

Table 5: ERRNI, BPVS III & WMTB-C Results

Table 6: BBSC-R Subtest Results

Table 7: Summary of Criterion Referenced Probes Results

Table 8: Outline of Concepts Activities

Table 9: Coordinating Conjunctions Probes Results

Table 10: Sample Homework Activities

Table 11: Sample Outline of an Intervention Session

Table 12: MLUw Pre-Therapy vs. Post-Therapy

Table 13: Complex Syntactic Structures – Statistical Results

Table 14: Treated vs. Untreated Concepts – Statistical Results

Table 15: Likert Rating Scale Descriptions
List of Figures

Figure 1: Time Allocation Per Session.................................................................19

Figure 2: TROG 2 Raw Data Score – Blocks Passed vs. Blocks Failed..................22

Figure 3: ERRNI MLUw Control...........................................................................23

Figure 4: Complex Syntactic Structures – Untreated vs. Control........................24

Figure 5: Spatial Concepts – Treated vs. Untreated...........................................25

Figure 6: Introduction to Shape Coding – Exposures vs. Total Items Correct......26

Figure 7: Shape Coding Percentage Stimulus Items Correct.............................27

Figure 8: Percentage Usage of Rehearsal Strategy...........................................28

Figure 9: Inter-Session Attention Rating...........................................................30
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Abstract

**Background:** A significant gap exists in the literature on interventions for young school-aged children with language comprehension difficulties. This is due to the heterogeneous nature of language impairments and the variance that exists in the specificity and degree of impairment between children. Research has highlighted the existence of concomitant working memory deficits and processing limitations in many children with language impairment (CwLI) and the effects that these can have on learning. Recent research has demonstrated the success of a metalinguistic coding approach (Shape Coding) in improving grammar comprehension in older children and adolescents (11-16 years). This has not been replicated with younger children. Compensatory strategies such as comprehension monitoring (Bianco et al 2010) and rehearsal (Gill & Klecan-Aker 2003) have demonstrated effectiveness in addressing the working memory deficits and processing limitations of young CwLI (5-8 years).

**Objective:** This pilot single case study investigated the effectiveness of a combined intervention approach to oral language comprehension to establish (i) the suitability of Shape Coding with a younger child and (ii) the usefulness of metacognitive strategies in alleviating the negative impact placed on comprehension by working memory difficulties and processing limitations.

**Results:** The child accessed four out of ten planned intervention sessions. Though no significant improvement was noted in the child’s oral language comprehension following intervention, this study provides novel insight into the complex profile of a child with language impairment and the impact of this on intervention.

**Conclusion:** This in-depth single case approach debates the appropriateness of these interventions for younger children with diverse language needs and raises questions about the roles of (i) dosage of therapy and (ii) memory/attention difficulties in a child’s responsiveness to intervention.
I Introduction

Children with language impairment (CwLI) have been shown to experience lifelong difficulties attributed to their impairment which can include (i) social difficulties, (ii) reduced independence and (iii) limited employment opportunities (Reed 2005; Paul 2012; Conti-Ramsden et al 2008). Research has shown that receptive language impairments in particular are more liable to have long-term impacts on language learning, literacy (Catts et al 2002), behaviour and social development (Beitchmann et al 2001). To date, intervention research has centred on the expressive language difficulties of children, with limited published intervention literature available on young school aged children (less than 9 years old) with receptive language difficulties.

This review will discuss (i) the complex nature of language comprehension, (ii) the ambiguity surrounding the causal factors in language impairment and (iii) a critical analysis of intervention studies targeting receptive language difficulties. From this, conclusions for further research will be drawn which will be linked to the rationale of this study.

Basis of language comprehension

Language comprehension is not a unitary skill. It is dynamic; affected by numerous variables; and is contextually rooted (Norbury 2008). Language learning children are required to integrate a number of processes which include: (i) recognizing the significant information they hear in the speech stream (ii) retaining this meaningful information in their long term memory and (iii) recognising these stored words when they are subsequently re-encountered (Bishop 1997). Heard sentences are required to be parsed into phrases to explain the connection between word meanings. These phrases in turn can contain inflectional endings that communicate meaning and depict relationships between the various phrases themselves (Brackenbury & Pye 2005). Children employ contextual abstraction by using contextual clues to isolate the meaning of unknown words they hear. They also use their world knowledge and prior experiences to comprehend ambiguous words/sentences (Milosky 1992).
Language impairments are heterogeneous in nature and children can vary widely in the specificity and extent of their impairment (Paul 2012). There is an ongoing controversy on the nature of language impairments as the precise cause of the impairment in each child is not fully understood (Schwartz 2009). Are these impairments due to limitations in processing capacity? Representational deficits (i.e. underlying gaps in their linguistic knowledge)? Or both? Processing limitations have been suggested to negatively impact a child’s organisation of their grammatical knowledge. This ultimately impacts the effectiveness of their sentence comprehension (Law et al 2011). More specifically, many CwLI present with working memory difficulties that are postulated to underlie their linguistic deficits (van der Lely & Howard 1993). Research has hypothesised that CwLI are able to simultaneously process and store incoming information during difficult memory activities but have less resources to draw upon in comparison to their typically developing peers (Archibald & Gathercole 2006). Additionally, the limited attentional resources of language impaired children restrict their ability to store a great extent of verbal information while at the same time maintaining accurate comprehension (Mainela-Arnold and Evans 2005).

CwLI vary in their phenotypic characteristics. Though one group of children may present with deficits in vocabulary, for example, concepts or lexical access difficulties (Messer et al 2006); the chief difficulties of another group may be limited to grammar, for example, grammatical specific language impairment (G-SLI) (van der Lely 2005). This can involve difficulties with the comprehension and production of morphology and/or syntax. Finite verb morphology appears to be particularly difficult for CwLI, for e.g. regular past inflections, auxiliary ‘be’ and third person singular (Bedore & Leonard 1998). Syntactic deficits can include difficulties with reversible passives, datives, wh-questions and verb-argument structures. Difficulties with reversible sentences can result from inappropriate assignment of thematic roles (Bishop et al 2000). Interpreting embedded questions and relative clauses involving the movement of ‘wh’ structures also presents difficulty (Marinis & van der Lely 2007); with misinterpretation of dative forms as prepositional forms (Ebbels 2007). Understanding complex grammar requires considerable resource capacity and distribution. This matter is complicated further by our lack of understanding on (i) the extent linguistic and processing deficits impact on comprehension in language impairment and (ii)
the precise location of the breakdown in children with receptive language impairments (Montgomery 2009).

**Critical analysis of the literature on interventions for language comprehension difficulties**

It is difficult to conduct intervention research on heterogeneous subjects as it usually not possible to generalise positive outcomes to other language impaired children. The lack of knowledge on the precise contribution of processing and linguistic deficits to the overall impairment of each child poses difficulty in generating a “one size fits all” intervention method.

Enhanced communication is the ultimate goal of intervention, which can vary depending on the severity and specificity of the individual’s impairment (Olswang and Bain 1991). Goals can include (i) to change or completely eradicate the underpinning difficulty or (ii) to use compensatory strategies to aid management of the impairment for quality of life purposes. While (i) is the most favourable outcome, it is not always realistic due to difficulty isolating the underlying deficit of the child.

The two most recent systematic reviews that have investigated the effectiveness of interventions for CwLI have been conducted by Law et al (2010) and Cirrin et al (2008). The review of randomised control trials (RCTs) conducted by Law et al (2010) contained an evaluation of five interventions specific to receptive language difficulties. It concluded by stressing the need for further studies in this area due to a significant gap in the research. Cirrin et al (2008) reviewed 21 studies which contained RCTs, non-randomised comparison studies and multiple baseline single case studies. The studies targeting receptive language difficulties were predominantly based on the auditory temporal processing deficit theory of language impairment. The relevant interventions contained in both of these studies together with other applicable intervention literature will be discussed below according to the nature of each intervention.

(i) **Grammatical Interventions – Metalinguistic vs. Processing Deficit approach**

A number of grammatical interventions have been developed to target the language comprehension difficulties of children. These can differ in the approach they take. Interventions based on the processing deficit theory of language impairments state that affected children experience difficulty processing fast and transient stimuli (Tallal et al 1985).
Intervention aimed at improving temporal processing is postulated to also improve language comprehension abilities. Tallal (1997) investigated the effects of computer games using acoustically modified speech on the language comprehension difficulties of children aged five to ten years. This single subject multiple baseline study showed these children made significantly greater gains than controls who received games featuring unmodified speech. Following this, a number of controlled observational studies focused on a similar computer based program called Fast ForWord (FFW) (Friel-Patti et al 2001; Gillam et al 2001; Loeb et al 2001). The improvements reported in these studies were less remarkable than those reported by Tallal (1997). In fact, the most severely impaired children appeared to benefit least. Though scores relative to age-equivalency progressed, these were not clinically significant, gains were not maintained and generalisation to conversational speech did not arise. Lack of encouraging outcomes from FFW intervention studies are possibly due to fact that the program lacks specificity in targeting the precise nature of the comprehension deficits that these children have.

There are alternative interventions which employ a metalinguistic approach to target the specific grammatical deficits of CwLI. One such intervention which had success in treating the grammatical difficulties of older children is a visual coding approach called Shape Coding (Ebbels 2007). A variety of colours, shapes and arrows are used to specify elements of speech, phrases and morphology respectively. These elements are taught based on the assumption that CwLI have visual strengths. In a RCT study, shape coding significantly improved the use of verb argument structure in children aged 11-16 years. These improvements were maintained and generalised to control verbs (Ebbels & van der Lely 2001). Additionally, three single case studies have shown shape coding to be effective in treating comprehension of several grammatical structures such as the dative form, passives and “wh” questions in older children aged 11 and 12 years (Ebbels 2007). Furthermore, a recent RCT has demonstrated promising results for the intervention in adolescents (mean age: 13;06 years) with difficulties comprehending coordinating conjunctions compared to waiting controls (Ebbels et al 2012). Other evidence for the potential of metalinguistic approaches came from Levy & Friedmann (2009). They conducted a single subject syntactic intervention study involving the explicit instruction of syntactic movement. The subject improved significantly in all syntactic structures targeted (relative clauses, object questions and sentences with verb movement) compared to baseline results. A contrast between the
effectiveness of metalinguistic interventions such as Shape Coding compared to the
discouraging results of FFW is that unlike FFW, Shape Coding has the ability to target an
individual child’s specific deficit thus producing localised improvements in their particular
area(s) of difficulty.

\[(ii) \quad \textbf{Cognitive and Metacognitive Strategies}\]

There are a number of interventions that are centred on instruction in compensatory
strategies to CwLI. These aim to help children manage their comprehension difficulties and
processing limitations in daily life. Two examples are (i) comprehension monitoring and (ii)
rehearsal/visualisation strategies. Comprehension monitoring is a cognitive strategy used to
help children to actively think and resolve their inconsistencies with comprehension. One
example of this, Visualising & Verbalising (Bell and Lindamood 1991), involves teaching
children to visualise words and sentences to assist them in understanding language. No
evidence was found by Law et al (2010) to support the use of this program over traditional
therapy for difficulties with inference-making and sequence following. As the majority of
studies on comprehension monitoring lack recency and predominantly focus on text
comprehension (Ryan 1982; Wagoner 1983), the ability to evaluate the effectiveness of this
strategy in full for children with oral language comprehension difficulties is limited. One
recent study documented encouraging outcomes of comprehension monitoring in
comparison to two alternative strategies for young school aged children (aged 4-7 years).
Maintenance of gains was also reported (Bianco et al 2010). Though they did not have a
strictly randomised protocol, a large sample size and appropriate control measures were
implemented.

While cognitive strategies can be utilised to aid children in achieving a particular goal
(e.g. understanding a text), metacognitive strategies can be used to ensure that the specific
goal is being achieved (e.g. checking ones understanding of the text). These include
rehearsal and visualisation strategies which aim to alleviate the concomitant working
compared the progress of children (mean age: 8 years) receiving visualisation and rehearsal
strategy training to children receiving traditional therapy and those receiving rehearsal
strategy training alone. Significant outcomes and maintenance of gains were seen for
children who received both rehearsal and visualisation strategy training together.
(iii) **General Language Intervention**

The Law et al review (2010) documented a small number of interventions which were neither specific to targeting expressive language difficulties nor receptive language difficulties. These investigated globally focused intervention techniques with receptive aims in nonrandomised comparison studies (Glogowska 2000; Law et al 1999). Children receiving therapy were compared to waiting controls where both groups still had significant clinical difficulties one year on. Camarata et al (1996) compared conversational recasting to imitative treatment in a small controlled study using children with both receptive and expressive deficits. Significant gains in syntactic acquisition were only observed following the conversational recasting approach. It was suggested that in a recast conversational context children can “bring into working memory relevant non-verbal context along with specific comparison of how sentences relate to that non-verbal context”.

An important consideration following analysis of the literature is the issue of intervention dosage. The Better Communication Research Programme (BCRP) (Lindsay et al 2010) has concluded that intervention provided over a longer period of time is more effective for children with receptive language impairments. This should be interpreted with caution as there appears to be a cut off point to improvements. Positive effects of intervention have appeared to wane after 13 weeks (Nye et al 1987). This highlights the possibility of an ideal time window for intervention which requires further investigation.

**Conclusion**

The key to intervention success appears to be specificity. Following synthesis of the literature, we now know that a metalinguistic approach is effective for older school aged children with receptive and expressive syntactic deficits and that compensatory strategies appear to have a valid place in intervention for older language impaired children with working memory difficulties. What is unknown is if these same approaches will be effective for younger children (aged 6-9 years) with similar deficits? CwLI experience long term difficulties which have a substantial impact on their quality of life. Further studies with younger subject groups are needed to investigate if early intervention provides more long term benefits.
II  Aims and Objectives

The overall aim of this study was to investigate the effectiveness of a combined intervention approach for children with comprehension difficulties. Within this there were 2 objectives:

1. To examine the efficacy of a metalinguistic coding approach (Shape Coding) in improving grammar comprehension in a young school-aged child aged between six and nine years.

2. To evaluate the ability of cognitive and metacognitive compensatory strategies in alleviating the negative impact placed on comprehension by concomitant working memory deficits and processing limitations.
III Methods

Study Design

This single subject design pilot study was part of a case series involving 6 to 9 year old children. Single case research can be particularly effective at providing knowledge on specific treatment effects; which is of primary significance here (Wertz 1992). It has the flexibility and capacity to individually tailor an intervention to the specific characteristics of the child (Tate et al 2008).

Repeated baseline measures were obtained prior to intervention at three points followed by a period of intervention and follow-up re-assessment The planned study protocol consisted of 2 sessions of baseline assessment followed by twice weekly 45-minute intervention sessions across a period of five weeks (10 in total). To accommodate the attentional abilities of the child and behavioural management, the baseline period was extended to three sessions so as to provide as accurate a representation of the child’s deficits as possible. Due to unforeseen circumstances, the child attended four out of ten planned intervention sessions (Table 1).

This case was managed by two second year speech and language therapy students who shared provision of intervention and data collection duties.

Table 1. Actual Timeline of Intervention Project

<table>
<thead>
<tr>
<th>Date</th>
<th>Session</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>13/2</td>
<td>Baseline Assessment</td>
<td>Student 1</td>
</tr>
<tr>
<td>20/2</td>
<td>Baseline Assessment</td>
<td>Student 1</td>
</tr>
<tr>
<td>25/2</td>
<td>Baseline Assessment</td>
<td>Student 1</td>
</tr>
<tr>
<td>26/2</td>
<td>Therapy Session 1</td>
<td>Student 1</td>
</tr>
<tr>
<td>3/3</td>
<td>Therapy Session 2</td>
<td>Student 1</td>
</tr>
<tr>
<td>5/3</td>
<td>Therapy Session 3</td>
<td>Student 2</td>
</tr>
<tr>
<td>2/4</td>
<td>Therapy Session 4</td>
<td>Student 1</td>
</tr>
<tr>
<td>11/4</td>
<td>Reassessment</td>
<td>Student 1 &amp; 2</td>
</tr>
</tbody>
</table>

*Note: One-month gap between therapy sessions 3 and 4.
Ethical Approval

This study was reviewed and given favourable opinion by the HSE Mid-Western Regional Hospital Research Ethics Committee.

Recruitment

A local speech and language therapy manager identified potential subjects based on the following criteria:

Inclusionary Criteria

- Primary diagnosis of language impairment with clinically significant receptive language difficulties
- Receptive language score of $\geq -2$ standard deviations (SD) below the mean in a test of receptive language such as the Clinical Evaluation of Language Fundamentals Preschool (CELF PS), Clinical Evaluation of Language Fundamentals 4 (CELF 4), Test for Reception of Grammar 2 (TROG 2), Preschool Language Scale 4 (PLS 4), or the Reynell Developmental Language Scales (RDLS)
- English as their first language
- Aged between 6 and 9 years of age at the time of recruitment

Exclusionary Criteria

- Children with a primary diagnosis of intellectual and/or sensory impairments and/or emotional/behavioural difficulties
- Children with identified visuo-spatial processing difficulties
- Children whose first language is other than English

A parent information leaflet (Appendix I) and consent form were devised for distribution to suitable candidates. The manager was asked to discuss the contents of this leaflet with parents, particularly where literacy difficulties were suspected.
**Participant**

The child selected, JC, was a male aged 6;06 at the time of recruitment. *Table 2* highlights JC’s profile which matched the recruitment criteria. JC was born prematurely at 29 weeks.

He was initially referred to early intervention services with a moderate motor delay and concerns about his speech and language development. He has a positive family history of speech, language and literacy difficulties (a sister with dyslexia and a brother with Aspergers syndrome). Following both language and psychological assessment, JC was diagnosed with specific language impairment (SLI) at the age of 5;08. He attended speech and language therapy on a fortnightly basis during his first year at school. JC saw the school speech and language therapist for one session during the study timeline where the following was targeted: (i) peer conversations and turn taking, (ii) inferential questions and (iii) coherent narrative formation.
## Table 2. JC’s Profile Pre-Assessment

### JC’s Profile

<table>
<thead>
<tr>
<th>Language</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Diagnosis of SLI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Receptive Language Score &gt; -2 SD below the mean (CELF-PS):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Core Language Score: SS 63 (Severe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Receptive Language Score: SS 65 (Severe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Expressive Language Score: SS 69 (Severe)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CELF-PS Subtests</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts and Following Directions</td>
<td>6</td>
</tr>
<tr>
<td>Word Structure</td>
<td>2</td>
</tr>
<tr>
<td>Recalling Sentences</td>
<td>4</td>
</tr>
<tr>
<td>Word Classes-Receptive</td>
<td>8</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>6</td>
</tr>
<tr>
<td>Sentence Structure</td>
<td>3</td>
</tr>
<tr>
<td>Basic Concepts</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cognitive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Performance Score: SS 90</td>
<td></td>
</tr>
<tr>
<td>• Verbal Score: SS 77</td>
<td></td>
</tr>
<tr>
<td>o Significant Discrepancy between Performance and Verbal Scores: -13</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance</th>
<th>Scaled Score</th>
<th>Verbal</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Design</td>
<td>5</td>
<td>Receptive Vocabulary</td>
<td>7</td>
</tr>
<tr>
<td>Object Assembly</td>
<td>12</td>
<td>Information</td>
<td>4</td>
</tr>
<tr>
<td>Picture Naming</td>
<td></td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

* The derived mean standard score for these assessments is 100, with a standard deviation of 15. A standard score (SS) of one standard deviation below or above the mean (i.e. 85-115) is considered to be within normal limits. The derived mean scaled score is 10, with a standard deviation of 3. A scaled score of one standard deviation below or above the mean (i.e. 7-13) is considered to be within normal limits.
**Project Setting**

All assessment and intervention sessions were conducted in the University of Limerick speech and language therapy clinic. Written parental consent was obtained to audio record sessions for intra- and inter-rater reliability purposes. JC’s mother was present in the room for all sessions with occasional attendance by his sister (aged 9) also.

**Baseline Assessment & Rationale**

Baseline Assessment took place over a period of 3 sessions, in light of JC’s fluctuating attention, requirements for behaviour management, and for implementation of criterion referenced probes based on results of baseline assessment on the TROG 2 (Table 3).

**Table 3. Baseline Assessment**

<table>
<thead>
<tr>
<th>Session</th>
<th>Baseline Assessment</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expression Reception and Recall of Narrative Instrument (ERRNI) (Table 5)</td>
<td>Control Measure</td>
</tr>
<tr>
<td></td>
<td>Test for Reception of Grammar 2 (TROG 2) (Table 4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>British Picture Vocabulary Scale III (BPVS III) (Table 5)</td>
<td>Baseline Profile of Receptive Language</td>
</tr>
<tr>
<td>2</td>
<td>Working Memory Test Battery for Children (WMTB-C) (Table 5)</td>
<td>Selection of Treatment Targets</td>
</tr>
<tr>
<td></td>
<td>Criterion Referenced Probes (Table 7)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bracken Basic Concept Scale – Revised (BBCS-R) (Table 6)</td>
<td>Baseline Profiling and Identification of Potential Treatment Targets</td>
</tr>
</tbody>
</table>

*The ERRNI Mean Length of Utterance in Words (MLUw) was chosen as a control measure due to low correlation between the TROG 2 and the ERRNI (Pearson correlation $p=0.258$ 2-tailed).*
### Table 4. TROG 2 Grammar Comprehension Results

<table>
<thead>
<tr>
<th>Block</th>
<th>Construct</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Two Elements</td>
<td>F</td>
</tr>
<tr>
<td>B</td>
<td>Negative</td>
<td>F</td>
</tr>
<tr>
<td>C</td>
<td>Reversible In &amp; On</td>
<td>F</td>
</tr>
<tr>
<td>D</td>
<td>Three Elements</td>
<td>P</td>
</tr>
<tr>
<td>E</td>
<td>Reversible SVO</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>Four Elements</td>
<td>P</td>
</tr>
<tr>
<td>G</td>
<td>Relative Clause in Subject</td>
<td>F</td>
</tr>
<tr>
<td>H</td>
<td>Not Only But Also</td>
<td>F</td>
</tr>
<tr>
<td>I</td>
<td>Reversible Above and Below</td>
<td>F</td>
</tr>
<tr>
<td>J</td>
<td>Comparative/Absolute</td>
<td>F</td>
</tr>
<tr>
<td>K</td>
<td>Reversible Passive</td>
<td>F</td>
</tr>
</tbody>
</table>

**Total Blocks Passed**: 2

**Standard Score**: 55

**Percentile**: < 1

### Table 5. ERRNI, BPVS III & WMTB-C Results

<table>
<thead>
<tr>
<th>Results</th>
<th>ERRNI (MLUw)</th>
<th>BPVS III</th>
<th>WMTB-C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Digit Recall</td>
<td>Block Recall</td>
<td>Backward Digit Recall</td>
</tr>
<tr>
<td><strong>Raw Score</strong></td>
<td>5.13</td>
<td>67</td>
<td>20</td>
</tr>
<tr>
<td><strong>Standard Score</strong></td>
<td>75</td>
<td>74</td>
<td>93</td>
</tr>
<tr>
<td><strong>Percentile Rank</strong></td>
<td>5</td>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>

### Table 6. BBSC-R Subtest Results

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Raw Score</th>
<th>Scaled Score</th>
<th>Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial</td>
<td>27</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Relational</td>
<td>7</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Development of Criterion Referenced Probes

Criterion referenced probes were developed based on JC’s individual difficulties with grammar comprehension to facilitate selection of individualised treatment targets for Shape Coding. The criterion specified for the development of construct-specific probes was block failure in the TROG 2. To ensure validity, strong effort was sought to (i) carefully match the test items precisely to the knowledge they were intended to measure and (ii) ensure that the consistency of these items within each construct probe remained constant (sample in Appendix II). Ten stimulus items were featured in each probe set. The child was given an option of four pictures to select from, where one answer was correct and each other possibility was a semantic or grammatical foil/distracter which could reasonably tempt the child. The pictures were presented to the child prior to the stimulus sentence to prevent undue burden on his phonological short term memory which could affect the accuracy of his results.

Table 7. Summary of Criterion Referenced Probes Results

<table>
<thead>
<tr>
<th>Probe</th>
<th>No. Correct</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reversible In &amp; On</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Relative Clause in Subject</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Not Only But Also</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Above/Below</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Two Elements</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Negative</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Comparative/Absolute</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Reversible Passives</td>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>
Interpretation of Baseline Assessment Results

JC’s BPVS III score highlighted a moderate deficit in his linguistic knowledge of word meanings. Here, JC made semantically related errors (e.g. map for globe), indicative of weak semantic representations (McGregor & Appel 2002).

JC’s error types on the TROG 2 and criterion referenced probes provides information on his difficulties with grammar comprehension. It was difficult to ascertain if incorrect responses were due to fleeting attention or genuine lack of the required linguistic knowledge. During times of reasonable attention, JC was inclined to opt for the semantic opposite of the desired response. Using neither/nor as an example: JC selected a picture where both the hat and the ball were blue for the stimulus sentence “Neither the hat nor the ball are blue”. A similar pattern arose in the reversible passives probe where JC utilised canonical word order rather than semantic probability to decipher the meaning of a sentence, for example: selecting a picture of a woman carrying a man for the stimulus sentence “The woman was carried by the man”. This highlights difficulty with the assignment of thematic roles to NP arguments that have moved.
**Intervention Approaches**

(i) **Cognitive - Comprehension Monitoring**

Instruction on comprehension monitoring was provided to (i) encourage “good listening” behaviours and (ii) teach JC strategies that he can use when he experiences communication breakdown (e.g. request for clarification when he has not fully understood his conversation partner). A pictorial chart was created which depicted “good listening” behaviours (e.g. lips closed, feet still) and strategies were role played with the child and student observer within the session. The full protocol for comprehension monitoring (Appendix III) was carried out at the beginning of the initial intervention session (10-15mins). Subsequent sessions featured a brief recap on these strategies using the pictorial chart to orientate JC at the beginning of the session (e.g. Do you remember the things we can do to help us be good listeners?).

(ii) **Metacognitive - Rehearsal Strategy**

JC’s baseline assessment revealed working memory difficulties specifically related to executive functioning. It was hypothesised that equipping JC with a strategy to alleviate these difficulties would produce many functional benefits (e.g. increased ability to follow his teacher’s instructions). Rehearsal operates on the premise that the repetition of instructions aloud prior to task completion aids retention of these instructions in the phonological short term memory long enough to allow the individual to complete the task without forgetting the instructions (Gill & Klecan-Aker 2003).

The rehearsal strategy was embedded in a task teaching concepts as this was identified as an area of weakness from both the TROG 2 and BBCS-R. To evaluate the precise nature of JC’s difficulty with concepts, a variety of activities were chosen to facilitate dynamic assessment in which the difficulty level was increased or decreased according to the child’s abilities and progress (*Table 8*). Recent literature also supports the importance of input variability on language learning (Alt et al 2012). During intervention, JC received specific guidelines in following instructions using the spatial concepts “in/on” (Appendix IV). JC was required to use rehearsal prior to completing tasks. Precise repetition was not required. Paraphrasing and omission of function words were allowed provided the key concepts of the instruction were recognised. Commands were controlled for length and syntactic complexity. Prior to undertaking the activity, the student confirmed that the child
was familiar with the vocabulary of the items involved. Rehearsal was temporarily phased out after session 2 as it appeared that the processing demand on the child was too great when rehearsal was embedded in a concepts activity. It was planned to be reintroduced following enhanced acquisition of the concepts “in/on”. Due to limited contact with the child this was not possible.

**Table 8. Outline of Concepts Activities**

<table>
<thead>
<tr>
<th>Session</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Object to Picture Matching using Rehearsal</td>
</tr>
<tr>
<td>2</td>
<td>Manipulation of Objects using Rehearsal</td>
</tr>
<tr>
<td>3</td>
<td>Identification of concept pictorially</td>
</tr>
<tr>
<td>4</td>
<td>Manipulation of Objects using Rehearsal (activity stepped down due to difficulty with pictorial representation in Session 3)</td>
</tr>
</tbody>
</table>

(iii) **Metalinguistic - Shape Coding**

Shape coding is a syntactic-semantic approach, developed to explicitly teach syntax and morphology to language impaired children (Ebbels et al 2007, Ebbels 2007, Ebbels & van der Lely 2001). It involves the use of colours (parts of speech), arrows (tense and aspect) and shapes (syntactic and argument structure) to make the structure of language more concrete and open for discussion. The introductory process of shape coding typically takes three sessions, prior to moving on to specific targets. Ebbels (2007) developed a specified protocol on the teaching order of both the introductory elements (Appendix V) and coordinating conjunction structures (Appendix VI) which was closely adhered to. From JC’s baseline assessment, the initial planned target of intervention was the coordinating conjunction “not only but also”. Due to the hierarchy present in Ebbel’s teaching order of coordinating conjunctions, two further probes (the blocks of which were not reached in the TROG 2) were administered in session 3 (“X but not Y”, “Neither/Nor”). As JC demonstrated difficulty with these conjunctions (Table 9), they were both added as treatment targets in correlation with the protocol steps. Performance on the reversible passives probe was utilised as an untreated control.
As JC attended four out of ten sessions, the student was able to complete steps 1-4 of the introductory protocol and introduce step 1 of the coordinating conjunction protocol. Sentences for use in therapy were selected based on two criteria (i) they should be of interest to the child for motivational purposes, and (ii) they should be functional. Though the focus of intervention was not expressive language, the child was encouraged to contribute sentences of his own and activities were incorporated to facilitate this.

**Table 9. Coordinating Conjunctions Probes Results**

<table>
<thead>
<tr>
<th>Probe</th>
<th>No. Correct</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>X but not Y</td>
<td>5</td>
<td>50%</td>
</tr>
<tr>
<td>Neither/Nor</td>
<td>3</td>
<td>30%</td>
</tr>
</tbody>
</table>

**Homework Activities**

JC received homework on Rehearsal and Shape Coding that was (i) based on activities that occurred in the session and (ii) functionally appropriate for the child (*Table 10*).

**Table 10. Sample Homework Activities**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Homework Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rehearsal</strong></td>
<td>Encourage JC to use rehearsal when asked to follow directions at home (e.g. Put the knife on the table and the cup in the dishwasher).</td>
</tr>
<tr>
<td><strong>Shape Coding</strong></td>
<td>Picture matching game: Match the “What doing?” shape to a series of action pictures.</td>
</tr>
</tbody>
</table>
Structure of Intervention Sessions

The structure of each session remained constant for the length of the intervention study (Table 11).

Figure 1. Time Allocation Per Session

![Time Allocation Per Session](image)

Table 11. Sample Outline of an Intervention Session

<table>
<thead>
<tr>
<th>Session Activity</th>
<th>Intervention Approach</th>
<th>Duration of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Comprehension Monitoring</td>
<td>5 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Rehearsal Strategy</td>
<td>15 minutes</td>
</tr>
<tr>
<td>3</td>
<td>Shape Coding</td>
<td>25 minutes</td>
</tr>
</tbody>
</table>

Due to behavioural issues and fluctuating attention, a visual schedule was used which depicted the order of intervention activities. This was done to utilise JC’s visual strengths, increase in-session motivation and promote flexibility by smoothing the transition between activities. Effort was made to include JC’s mother in the session activities to (i) increase her education on the intervention techniques, and (ii) promote confidence in her ability to implement the homework provided.
**Treatment Fidelity**

To facilitate treatment fidelity, the project supervisor and student observer observed all intervention sessions. In-session data were analysed by the student pair. A joint agreement was reached on the attention rating of the child between the pair to decrease subjectivity. Similarly, MLUw was analysed separately and comparisons were made to reach an agreement on the final MLUw to ensure inter-rater reliability.

**Data Collection**

Quantitative data were collected during the baseline and re-assessment periods by the treating student SLT. Quantitative in-session data for Shape Coding and Rehearsal were collected in each session by the observing student SLT using customised record forms (Appendices VII & VIII). Correct and incorrect responses were documented including the level of prompting provided where relevant. The raw in-session data was then converted into percentage data.

Due to task variability to facilitate dynamic assessment, qualitative measures were obtained for spatial concepts and comprehension monitoring. Observational notes and Likert ratings (Likert 1932) were used to document the attentional variation of the child within therapy sessions.

**Clinical Observations**

JC’s difficulty with syntax and syntactic structures was not only limited to his receptive language. He frequently displayed difficulty creating sentences that contained appropriate word order, for example, “I have a belly in my pain” instead of “I have a pain in my belly”.

Behaviour and attention varied widely both between and within sessions. Common observations included:

- Inappropriate turn-taking in conversation
- Frequently speaking out of turn
- Excessive talking
- Poor topic maintenance
- Difficulty staying at task (e.g. frequently moving in his chair/around the room)
It was difficult to ascertain whether the behaviours observed were attributed to behavioural issues or difficulty with attention stemming from impaired executive functioning. This was highlighted by his poor score on the backwards digit recall task of the WMTB-C (*Table 5*).

**Statistical Analysis**

IBM SPSS© Software Version 20 (SPSS 2011) was used to conduct statistical analysis on pre- and post-intervention data. McNemars test was utilised on the matched data (pre- and post therapy samples) to investigate the occurrence of any change in performance in the TROG 2 and criterion referenced probes.
III  Results

I  Pre vs. Post Therapy Data

All pre- vs. post-therapy data was analysed using McNemar’s non-parametric statistical test. A further chi-square analysis was not conducted between treated and untreated targets due to lack of statistically significant difference between pre- and post-therapy outcomes.

(i)  Standardised Assessments

**Figure 2. TROG 2 Raw Score Data – Blocks Passed vs. Blocks Failed**

No significant improvement overall in JC’s understanding of grammatical constructs tested (*p*=0.625 2-tailed). *Figure 2* illustrates that an additional four TROG blocks were passed during reassessment. 19 stimulus items were failed in total pre-therapy, in comparison to 16 stimulus items post-therapy (Blocks A-K).
It was not possible to conduct statistical analysis on the MLUw raw scores of the ERRNI as sample sizes varied due to a difference in the number of utterances JC produced pre- and post-therapy. On a test comparing standard scores there was no significant difference between pre-therapy MLU and post therapy MLU ($p=0.7671$ 2-tailed).

**Table 12. MLUw Pre-Therapy vs. Post-Therapy**

<table>
<thead>
<tr>
<th>Score</th>
<th>Pre-Therapy</th>
<th>Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Score</td>
<td>5.13</td>
<td>5.31</td>
</tr>
<tr>
<td>Standard Score</td>
<td>75</td>
<td>78</td>
</tr>
</tbody>
</table>
No significant improvement in either untreated syntactic structures or control structure was noted.

**Table 13. Complex Syntactic Structures Statistical Results**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Significant Improvement</th>
<th>P Value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X but Not Y</td>
<td>×</td>
<td>0.625</td>
</tr>
<tr>
<td>Neither/Nor</td>
<td>×</td>
<td>0.375</td>
</tr>
<tr>
<td>Not only but also</td>
<td>×</td>
<td>1.000</td>
</tr>
<tr>
<td>Reversible Passives</td>
<td>×</td>
<td>1.000</td>
</tr>
</tbody>
</table>
There was no significant improvement in either treated or untreated concepts following intervention. JC’s performance was worse on re-assessment of both concepts. These probes were administered towards the end of the re-assessment session when JC’s attention was fleeting. Thus, results yielded may not be an accurate representation of the child’s ability.

**Table 14. Treated vs. Untreated Concepts – Statistical Analysis**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Significant Improvement</th>
<th>P Value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In/On</td>
<td>×</td>
<td>1.000</td>
</tr>
<tr>
<td>Above/Below</td>
<td>×</td>
<td>1.000</td>
</tr>
</tbody>
</table>
II In-Session Data – Quantitative

(i) Metalinguistic Approach - Shape Coding

*Figure 6. Introduction to Shape Coding – Exposures vs. Total Items Correct*

*Figure 6* presents dosage in terms of stimuli presentations within a session. These were stimuli inputted by structure contrasted with the number of each structure JC got correct. This may be illustrating an effect of input on learning; alternatively, this may represent a hierarchy of difficulty where JC found the NP easier to understand.
**Figure 7. Shape Coding – Percentage Stimulus Items Correct**

*Figure 7* demonstrates JC’s progress with each shape and coordinating conjunction across all four sessions. Improvements were made in each structure for Sessions 1-3. JC demonstrated an understanding of the basic Shape Coding elements via his ability to match pictures to their respective shapes to make syntactically accurate sentences (e.g. agent pictures were matched to “Who/What?” and action pictures were matched to “What doing?”). When asked, JC could explain his actions during the matching task (e.g. for action pictures he said “cos it’s what he’s doing”). There was a noticeable decline in progress, particularly in his knowledge of the VP. This may be attributed to the one month gap between sessions 3 and 4.
(ii) **Metacognitive Approach – Rehearsal**

**Figure 8. Percentage Usage of Rehearsal Strategy**

*Figure 8 at a glance suggests success of the rehearsal strategy. Though JC’s use of the rehearsal strategy appears to have improved between sessions 1 and 2, its effectiveness must be questioned due to the manner in which it was utilised. JC did not fully grasp the purpose of rehearsal and tended to rush through the strategy. At times it functioned as a distraction from the concepts task involved. On many occasions, the concept task was not completed accurately when the instructions were accurately rehearsed and vice versa.*
III In-Session Data - Qualitative

(i) Cognitive Approach – Comprehension Monitoring

JC’s limited attention impacted his ability to actively participate in the comprehension monitoring activities. Therapy session 3 was the only session where JC was able to list the four “good listening” behaviours on the pictorial chart without the visual prompt. This may be due to better attention on that day as opposed to an enhanced grasp of the approach. JC had frequent difficulty “settling” into the session. As this was the first intervention activity, it may have suffered as a result. JC’s mother also reported that he was not using the strategies independently outside the clinic. JC did not use any of the strategies independently in the clinic until the re-assessment session where he made five requests for clarification spontaneously during administration of the TROG 2.

(ii) Spatial Concepts

JC’s performance was highly variable and appeared to be task-dependent. JC’s visual strength, illustrated by his score on the block recall of the WMTB-C (Table 5), was exhibited here as he performed better at object to picture matching tasks and at tasks involving the use of contextual referencing. He experienced difficulty when asked to manipulate objects based on spoken instructions. This suggests that the visual aid was a possible support mechanism for his fleeting attention, which when removed, effectively decreased JCs ability to comprehend the instructions.
(iii) Behavioural Data – Attention

**Figure 9. Inter-Session Attention Rating**

*Figure 9* highlights the variability in JC’s attention between sessions using a Likert rating scale. Not only was his attention variable between therapy sessions but there was also a substantial difference in his attention at baseline and at re-assessment. This may account for JC’s improved performance in the re-assessment session.

<table>
<thead>
<tr>
<th>Likert Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Poor</td>
</tr>
<tr>
<td>2</td>
<td>Poor</td>
</tr>
<tr>
<td>3</td>
<td>Fair</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

*Sessions 1-3: Baseline Assessment*
*Sessions 4-7: Intervention*
*Session 8: Reassessment*
Both *Figure 9* and *Figure 10* illustrate the variable nature of JC’s attention. Not only does variation occur from session to session (*Figure 9*) but there also appears to be a time dependent nature to JC’s attention fluctuations (*Figure 10*). He presented with prominent difficulties in sustaining attention for considerable lengths of time. A typical six year old can sustain attention on a given task for approximately 10-15 mins (Cooper et al 1978). JC averaged at less than half of this figure.
IV Discussion

Despite limited contact with the participant, the detailed assessment and intervention data may provide useful insight into the complex profile of a child with oral language comprehension difficulties. It may also provide information on the effect associated working memory limitations and behavioural issues can have on (i) a child’s responsiveness to intervention and (ii) implementation of future studies of this nature. Due to the limited number of intervention sessions availed of, the research questions regarding the efficacy of the intervention cannot be answered but the detailed subject specific information may inform further pilot studies to extend this work.

Implications of Central Executive Functioning for Language Impairment

Attention, like language, is not unitary. It involves various cognitive processes, which includes the ability to focus, sustain attention and inhibit inappropriate stimuli (McCabe et al 2010). JC demonstrated clear difficulties with these processes suggesting that impaired executive functioning may play a dominant role in his oral language comprehension difficulties. These difficulties may have had a negative impact on his test performance which questions the extent to which measured comprehension difficulties are a reliable representation of a child’s underlying ability. This reinforces the importance of dynamic assessment.

The central executive of working memory is responsible for the allocation of attentional resources (Baddeley 1996). Resource allocation is thought to be vital in the auditory comprehension of complex sentences, a difficulty experienced by JC. This process:

(i) Requires sufficient resource allocation to phonological memory so as to retain the word sequence long enough for processing.

(ii) Demands retrieval of the appropriate linguistic features of the heard words to assist the activation of suitable language processing schemes. These schemes create appropriate linguistic representations of the word sequences (e.g. NP, VP).

(iii) Involves retrieval and assimilation procedures responsible for the reactivation of representations from prior processing that are being momentarily stored in working memory for blending with new representations (Just & Carpenter 1992).
Reductions in attention capacity or the ability to allocate resources efficiently will ultimately impact a child’s language comprehension as they have limited executive resources to assign to the wide range of storage and processing demands of complex sentences (Van der Molen 2007).

**What does this study tell us about poor comprehenders?**

The theoretical debate on the precise deficits underpinning SLI is ongoing (Schwartz 2009). This single case study unearths the receptive language deficits of one child, permitting their interpretation and discussion. Baseline assessment and intervention data depict a child with true linguistic deficits; however difficulties in maintaining attention exerted a negative impact on his performance both in testing and in therapy. This raises the question: which is more detrimental to oral language comprehension? Linguistic deficits? Or working memory deficits? It is likely that they are both inextricably linked to the overall difficulties of a child; however the extent of their involvement may vary widely between children.

**Do younger children with oral language comprehension difficulties benefit from a metalinguistic approach?**

It is difficult to generalise the results of a single case study, particularly when contact with the child was limited. Suggestions can be made based on JC’s exposure to this metalinguistic approach and his response to it. The provision of metalinguistic intervention (Shape Coding) via explicit instruction on grammatical structures allows one of two possibilities: (i) it can provide the child with linguistic knowledge he did not have before, or (ii) it can facilitate the “freeing up” of processing space as comprehension has been made much easier.

Despite attention difficulties and dosage of intervention, JC appeared to grasp the basics of Shape Coding to make minor progress in the introductory elements. This however was limited compared to the progress observed in older children who received Shape Coding in a previous study (Ebbels et al 2012). Additionally, this progress does not provide a true predictor of whether JC would continue to benefit from the approach when complex structures were introduced. It is also important to note that the majority of the studies conducted on Shape Coding have treated children with language impairments that are predominantly grammatical. Thus, it may be the case that these interventions may be more
beneficial to children with true G-SLI. The computational grammatical complexity hypothesis (CGC) of language impairment, which states that these children have a “pervasive deficit in grammatical components determined by structural complexity” is one explanation for the profiles of children with G-SLI (van der Lely 2005). These children do not appear to have concomitant processing deficits (e.g. poor executive functioning) further impacting their understanding of syntactic structures. Thus, Shape Coding by aiding the learning of structures that were previously unknown will enhance comprehension. As previously stated, the key to intervention success appears to be specificity. While JC’s profile depicts a child with syntactic difficulties, there appears to be a much larger issue impacting on his comprehension which may render him an unsuitable candidate. However, without further measured intervention this is speculative.

It is also possible that poor metalinguistic awareness may explain JC’s failure to respond to Shape Coding. Metalinguistic approaches may be able to facilitate the shift from implicit to explicit language knowledge however children may need to reach a particular threshold in their metalinguistic development to benefit from these approaches. Metalinguistic development is an ongoing process that develops with age and education. The acquisition of written language has also been described as crucial to this process (Ravid and Hora 2009). As JC is at the early stages of literacy, he may be too young to experience the benefits of a metalinguistic approach.

Are cognitive and metacognitive strategies effective compensatory mechanisms for the working memory deficits and processing limitations of young children?

(i) Cognitive Strategy – Comprehension Monitoring

Attention difficulties impinged on JC’s receptiveness to the comprehension monitoring approach though he did demonstrate some evidence of responsiveness, particularly in the re-assessment session where he utilised the strategy independently for the first time. It is possible there was a consolidation effect whereby JC’s knowledge has become more stable over time and thus more available for him to utilise (Alt et al 2012). Additionally, cognitive strategies do not require the same higher level thinking as metacognitive strategies and thus may be more effective for children at a younger developmental level (Kuhn 2000).
(ii) **Metacognitive Strategy – Rehearsal**

Other than insufficient intervention, the failure of rehearsal to generalise to spontaneous use asks two questions: (i) if too much is entailed in an intervention approach (e.g. rehearsal strategy embedded in a concepts task) does the processing demand on the child become too much? (ii) is the child too young to benefit from strategies requiring higher level processes? It is possible that the answer to both of these questions is “Yes”. JC’s inability to effectively use rehearsal in a functional manner appeared to be underpinned by his fleeting attention. The child showed a degree of success in using this strategy when it was not embedded in a task containing concepts he found difficult. Children with SLI have been shown to have reduced capacity for sustaining attention (Finneran et al 2009). It may be the case that the concepts task placed too great a demand on JC’s attention capacity thus limiting his ability to simultaneously perform rehearsal.

Rehearsal may be more beneficial for language impaired children who have specific deficits in verbal working memory as it encourages the child to repeat instructions aloud. This facilitates their retention in phonological short term memory long enough for them to be able to carry out the task; providing more specificity to that child’s processing limitations.

As with metalinguistic approaches, there may be a critical age for the instruction on metacognitive strategies. Metacognition becomes more powerful with development, implying that the older the child the more effective these strategies may be (Kuhn 2000).

**Limitations**

There are a number of limitations of this study that must be acknowledged when interpreting the data:

(i) **Study Design:**

Single case studies are beneficial in providing a microscopic view of one child’s difficulties with language and the detailed benefit/lack of benefit of an intervention for a child. Despite this, findings cannot be generalised to other language impaired children due to the heterogeneity of this population.
(ii) **Limitations in Assessment:**

While language assessments are useful, they may not truly represent the abilities of the child. As in the case of JC, external factors such as poor attention or unfamiliarity with the tester can have a knock-on effect on performance. Though careful effort was made to ensure the accurateness of the criterion referenced probes, it is possible that the nature of their construction impacted the child’s performance. There is a limit to the nature of items that can be depicted in a static, two-dimensional state (e.g. the concept above and below). There is a possibility that some pictures were too abstract to correlate with the construct being examined. JC’s impulsive nature impacted his approach to the task. Shorr and Dale (1984) compared the diverse nature in which children approach these types of tasks, concluding that impulsive children do not do themselves justice, though they may possess the equivalent grammatical knowledge to peers who are less impulsive.

(iii) **Dosage:**

The child did not receive the required dosage specified in Ebbel’s teaching protocol (Ebbels 2007) due to non-attendance. Hence, it is therefore difficult to state whether this approach would be beneficial for a younger child.

(iv) **Possible Undiagnosed Comorbid Attention Deficit Disorder?**

The issue of JC’s attention comes to the forefront in this study raising the question of whether his attention difficulties can be attributed to his language impairment or whether they signify an underlying attention deficit hyperactivity disorder (ADHD) or ADHD comorbid with SLI. Oral language comprehension difficulties and ADHD have common symptomology which can include: poor attention, hyperactivity and behaviour connected to impaired executive function (Klorman et al 1999). ADHD is commonly over diagnosed (Bruchmüller et al 2011) however an unidentified attention deficit disorder can negatively impact a child’s performance on standardised assessments and their responsiveness to intervention. One subtest of the WMTB-C is not sufficient to quantify JC’s central executive impairment and
onward referral to a psychologist would be crucial to further elucidate the extent of his attention deficits.

**Conclusion**

The area of language research is an exciting and challenging field which continually questions our knowledge and way of thinking to facilitate the development of more effective intervention programmes for language impaired children. Our current knowledge in this area has grown but it is still not sufficient. Effective interventions that benefit children with diverse language profiles are needed. Little research is published on children who fail to respond to “successful” interventions however these children broaden our knowledge on what works and what doesn’t work for individual deficits in this heterogeneous population. Special considerations may need to be made for children to whom their disorder is not language specific. Although this is a single case study with indisputable limitations, it provides some in-depth knowledge on the nature of language impairment in this particular child and what principles can be extrapolated for further research. Reviews of the results of interventions such as FFW have highlighted the need for tailored interventions specific to a child’s deficits. Further well controlled single case studies are needed to test the effectiveness of interventions in various language impaired children. Given the negative academic and social ramifications for language impaired children, it is crucial that we learn from previous mistakes in order to create effective interventions that can improve their quality of life in the long term.
Reference List


SPSS, I. (2011) 'IBM SPSS Statistics Base 20', *SPSS Inc., Chicago, IL*.


Appendices

Appendix I – Parent Information Sheet

Study Title: “A pilot study on the use of Shape Coding and memory strategies to improve understanding of language in school-age children (aged 6-9 years) with language impairment”.

We would like to invite your child to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for your child, please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?
Children with language impairment can have comprehension (understanding) difficulties. This can occur where a child doesn’t understand certain concepts/grammar and/or where memory and or/attention skills are poor. Some recent therapies using coding as clues, have been shown to work with older school aged children and adolescents (11-16 years). The aim of this study is find out whether these approaches work with younger school-age children.

Why has my child been invited to take part?
Six children will take part in this study. Your child has been chosen because:

- He/she has difficulty understanding sentences
- He/she is in the age range of the study: 6 to 9 years.

Do I have to let my child take part?
It is up to you to decide. We will describe the study in this information sheet. We will then ask you to sign a consent form to show you have agreed to take part. You are free to withdraw at any time, without giving a reason. This would not affect any services you or your child receives.

What will happen to my child if we take part?
Your child will be given some tests by the researchers, who are final year student SLTs under the supervision of a qualified Speech & Language Therapist. These tests will include activities
such as asking your child to listen to words and sentences, point to pictures from a choice of pictures that match the words and sentences, and repeat a short story. Your child will also participate in a short memory test, where he/she will be asked to repeat lists of words and numbers. This will take about one and a half hours. We will split the testing over two sessions.

Treatment sessions will then take place twice a week for five weeks. The therapy will involve teaching your child codes or clues (using Shape Coding) to help them understand types of words and sentences, for example colour codes for verbs (doing words) and nouns (names of things) and shapes. We will also introduce your child to strategies to help their memory. Two weeks after the therapy ends we will repeat the tests to see if your child’s understanding of language is better.

**Are there any disadvantages or risks in taking part?**

There are no risks to your child. A disadvantage is that your child may miss other activities while participating in the language activities. The activities used in the programme are meant to be fun for the child.

**Are there any benefits in taking part?**

Your child will receive a very thorough language assessment and participate in a program that should help improve his/her language. This is a small-scale pilot study and from the results we can develop a larger group study. The information we get from this study should help improve the treatment of children with language difficulties in the future.

**What happens when the research study finishes?**

After all the results have been collected, the researchers will write the study up. The results will be analysed and shared with other Speech & Language Therapists to help them decide the best way to treat children with language difficulties. We will give you a summary report of the findings regarding your own child. You may request a copy of the report of all the findings at the end of the study. Your child will not be identified in any research report or publication.

**Will my child’s taking part in the study be kept confidential?**

Yes. All information which is collected about your child during the course of the research will be kept strictly confidential, and any information about him/her which leaves the clinic will
have the name and address removed so that he/she cannot be recognised. You have the right to check any data held about your child for accuracy and correct any errors.

**What will happen if I don’t want my child to carry on with the study?**
You can take your child out of the study at any time, without giving a reason. This will not affect any services you or your child would normally receive.

**What if there is a problem?**
If you have a concern about any aspect of this study, you should ask to speak to the principal investigator who will do her best to answer your questions (Carol-Anne Murphy, 061 213076). If you remain unhappy and wish to complain formally, you can do this through:

**Who is organising and funding the research?**
The research is being carried out as part of final year Speech & Language Therapy students’ Master’s thesis under the supervision of a lecturer and qualified SLT at the University of Limerick, Castletroy, Limerick.

**Who has reviewed the study?**
All research in the University is looked at by independent group of people, called a Research Ethics Committee to protect the safety, rights, wellbeing and dignity of those taking part. This study has been reviewed and given favourable opinion by the HSE Mid-Western Regional Hospital Research Ethics Committee. If you have concerns regarding this study, please contact: Chairman, Mid-Western Regional Hospital Research Ethics Committee Risk Management Dept, 3rd Floor Nurses Home, Mid Western Regional Hospital, Dooradoyle, Limerick Tel (061) 234101 Email: joanne.oconnor@hse.ie

**Further information and contact details:**
For further information please contact the researcher, Carol-Anne Murphy (061 213076, or carol-anne.murphy@ul.ie).

*Thank you very much for taking the time to read this information sheet. We will be grateful if you decide to let your child take part in the study. Your local speech and language therapist will go through the study information with you and your child. We have attached an information sheet for your child also, that he/she/may read or that you can be used to explain the study to him/her.*
If you decide to let your child take part in the study, please sign the attached consent form and return it to Catherine O’Farrell, Speech & Language Therapy Manager, Roxtown Health Centre, Old Clare Street, Limerick. You will then be contacted by phone to arrange an appointment.
Appendix II - Sample Probe

“Neither/Nor”

Stimulus Sentence: “Neither the hat nor the ball is blue”
Appendix III – Comprehension Monitoring Protocol

1. **Establish Rapport**

2. **Introduce the activity**

   Ask the child why they think you both are here, and if they have had speech and language therapy before. Explain using this ‘script’:

   ‘You are going to be coming to therapy two times a week. We are going to think about listening and helping our memories and play lots of games to help us become even better at doing these things.’

3. **Discussion on becoming a good listener**

   With the help of the child, discuss what we can do to become good listeners. For example:
   
   - We need to do good sitting
   - We need to do good looking
   - We need to stop talking
   - We need to do good listening

   These ideas will be further reinforced through relevant Boardmaker™ pictures with the SLT modelling both “good” and “bad” listening, using the above examples. Following this, a guessing game will be introduced where the SLT and child take turns to model “good” or “bad” listening behaviour for the other person, who has to guess what it is.

   Once all the points on the list above have been discussed, a visual reminder of good listening behaviours will be placed on the wall as a reminder throughout the session.

4. **Introduce the idea of communication breakdown**

   Introduce the idea of communication breakdown, saying: ‘You might be doing all the things we have talked about to help you to listen but sometimes the person who is talking to you – it might be your friend or the teacher or another grown up – might do something that makes it hard to understand what they have said. So it might not be your fault when you don’t understand. Let’s think about some of the things that can go wrong that make it hard to understand.’
Explain about rate, volume and noise. List some speaker factors that might affect comprehension:

- Rate - say: ‘I might talk really really fast so you don’t know what I’m saying.’ (Model speaking too quickly).

- Volume - say: ‘I might talk so quietly that you can’t hear me, or there might be lots of noise in the room so you can’t hear me.’ (Model speaking too quietly).

5 Summarise
At the end of the session explain to the child that they have done a lot of work on things that help us to be good at listening. They should try to remember to do some of these things when they are listening in the session/classroom or to their mum or dad or their friends.
Appendix IV – Rehearsal Strategy Protocol

The child was introduced to rehearsal in the form of a “copycat” game. The SLT explained that “sometimes we can find it hard to remember what people say to us or ask us to do”. “If we repeat what someone asks us to do first, it can help us to remember”.

Sample instructional scripts for the rehearsal strategy training
(adapted from Gill & Kleckan-Aker 2003 to incorporate the concepts “in & on”)

SLT: “I will give you a direction. Before you do it, tell me what I said to do. Listen. Then say what I said. Then do it. Remember – say it first, and then do it. Let’s try one. Pick up the teddy.”

Child: “Pick up the teddy.” (Then picks up the teddy)

SLT: “Great! I said it, then you said it before you did it. Let’s do that again. Remember to it before you do it. You can keep saying it to help you remember. Ready? Put the teddy on the hat.”

Child: “Put that teddy on the hat”. (Then does it)

SLT: “Great! Tell me – what you are going to do every time I give you a direction?”

Child: “I’m going to say it first like you did and then I will do it.”

SLT: “OK. We’ll try a harder one. Ready? Put the teddy in the shoe and the hat on the box.”

Child: (starts to get the teddy)

SLT: “Whoa – tell me first.”

Child: “Oh yea, get that teddy and put it in the shoe and put the hat on the box. You don’t have to remind me. I know. . . Say it first, then do it. OK, make the next one really hard.”

SLT: “OK. Now I won’t remind you very often. When I give you a direction, you tell yourself to say it. Keep on saying it to help you remember. See if you can do that every time.”
Directions continued to increase in complexity and in temporal and spatial distance. Children were cued to rehearse as needed until they did it spontaneously.
Appendix V – Shape Coding Introduction Protocol

1. **Who** ◇ **what doing**

2. Teach that can have >1 word per shape and it the correspondence to the question word that is key to coding (**ALWAYS** stress that the shape goes around the words that answer the question):

   - John is running
   - He is running
   - The boy is running
   - The little boy is running
   - John is cleaning the car
   - John is putting the car in the garage

3. To reinforce the meaning of the shapes, give exercises where the shape changes according to the meaning:

   - John is sleeping vs. John is tired

4. **answers questions of Who or What**

   - John is small
   - The house is small

### Sample Session Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape Drawing</strong></td>
<td>• Using Colourcards®, JC was asked to select a card and make a sentence using the picture on that card.</td>
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<tr>
<td></td>
<td>• The student clinician then wrote the sentence on the whiteboard and JC was asked to draw the shapes around the words in the sentence.</td>
</tr>
<tr>
<td><strong>Charades</strong></td>
<td>• The student observer and JC’s mother were provided with action pictures to act out on their turn.</td>
</tr>
<tr>
<td><em>(involving JC’s mother and student observer)</em></td>
<td>• JC was required to guess what they were doing and to make a sentence about it.</td>
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<tr>
<td></td>
<td>• The student would then write this sentence on the flipchart and ask for JC’s help in drawing the shapes.</td>
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</tbody>
</table>
Appendix VI – Coordinating Conjunctions Protocol

Protocol – Treated Target

Step 1: “And” (Subject NP + Verb)

(a) Introduce the templates showing coordination of NPs in subject position

(b) Relate the coordinated subject to the question word “Who” – discuss how ‘and’ means both NPs are carrying out the action.

(c) Take turns to produce sentences using ‘and’ while the other one acts out the sentence

Sample Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Object to Shape Matching</td>
<td>The student clinician modeled this conjunction using objects. For example, using the template in step (a) above, the student used a toy cow and dog to model the sentence for JC. These objects were then placed above the written words to make the meaning of the sentence more concrete. To check JC’s understanding of “and”, the student asked JC to act out sentences using toys when given a sentence such as “The boy and the girl are running”. JC was also asked to make sentences of his own using “and” for the student SLT to act out.</td>
</tr>
</tbody>
</table>
**Protocol – Untreated Targets**

**Step 2: “And” vs. “but not” (Subject NP + Verb)**

(a) Introduce the previous template with “but not”

![Diagram: The cow but not the dog is jumping]

(b) Relate the coordinated subject to the question word “Who” – discuss how ‘but not’ means only the first, not the second NP (shown by the cross) is carrying out the action.

(c) Take turns to produce sentences using ‘but not’ while the other one acts out the sentence

(d) Take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other acts out, using template as a guide

(e) When accurate, remove templates, bring back to check responses

**Step 3: “And” vs. “but not” (Verb Phrases)**

(a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of VPs, e.g.,

![Diagram: The cow is jumping (over the fence) and running (round the field)]

(b) Relate the coordinated VP to the question word “What doing” – discuss how ‘and’ means the subject is doing both verbs (or Verb Phrases)

(c) Take turns to produce sentences using ‘and’ while the other one acts out the sentence

(d) Introduce template with ‘but not’
e) Relate coordinated VP to the question word “What doing” – discuss how ‘but not’ means subject does only the first, not the second verb phrases (shown by the cross)

f) Take turns to produce sentences using ‘but not’ while the other one acts out the sentence

g) take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other one acts out the sentence

h) When accurate, remove templates, bring back to check responses

i) Take turns to create sentences matching one of four templates from sections 2 and 3, other acts out sentence

j) When accurate, remove templates, bring back to check responses

k) Make combinations of the templates using coordinated subjects and/or verbs e.g.,
   - the cow and the cat are jumping but not running
   - the cow but not the cat is lying down and sliding
   - the cow and the cat are standing and jumping
   - the cow but not the cat is lying down but not sliding

l) Take turns to create sentences matching these combined templates, other one acts out sentence

m) When accurate, remove templates, bring back to check responses

Step 4: ‘And’ vs. ‘but not’ (Subject NP + Adjective)

a) Revise the templates showing coordination of NPs in subject position with verb. Show similarity with template showing coordination of NPs in subject position with adjectives, e.g.,
b) Relate the coordinated subject to the question word “Who” – discuss how ‘and’ means both NPs have the feature of the adjective


c) Take turns to produce sentences using ‘and’ while the other one draws / colours in the sentence

d) Introduce template with ‘but not’

![Diagram of coordinated subject with 'and' and 'but not']


e) Relate the coordinated subject to the question word “Who” – discuss how ‘but not’ means only the first, not the second NP (shown by the cross) has the feature of the adjective

f) Take turns to produce sentences using ‘but not’ while the other one draws / colours in the sentence

g) Take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other draws / colours in, using template as a guide

h) When accurate, remove templates, bring back to check responses

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**Step 5 ‘And’ vs. ‘but not’ (Adjective Phrase)**

a) Revise the templates showing coordination of NPs in subject position with adjective. Show similarity with template showing coordination of APs, e.g.,

![Diagram of coordinated AP with 'and' and 'but not']

b) Relate the coordinated AP to the question word “What like” – discuss how ‘and’ means the subject has the feature of both adjectives.

c) Take turns to produce sentences using ‘and’ while the other one draws / colours in the sentence

d) Introduce template with ‘but not’
e) Relate coordinated AP to the question word “What like” – discuss how ‘but not’ means subject only has features of the first, not the second adjective (shown by the cross)

f) Take turns to produce sentences using ‘but not’ while the other one one acts out the sentence

g) Take turns to create a sentence matching one of the two templates (‘and’ or ‘but not’) and the other one draws / colours in

h) When accurate, remove templates, bring back to check responses

i) Take turns to create sentences matching one of four templates from sections 4 and 5, other draws / colours in

j) When accurate, remove templates, bring back to check responses

k) Make combinations of the templates using coordinated subjects and/or adjectives e.g.,

   a. the hat and the ball are big but not blue
   b. the hat but not the ball is yellow and stripy
   c. the hat and the ball are small and black
   d. the hat but not the ball is red but not spotty

l) Take turns to create sentences matching these combine templates, other one draws / colours in

m) When accurate, remove templates, bring back to check responses

Step 6: Neither nor (Subject NP)

a) Revise the templates showing coordination of NPs in subject position with VP. Use ‘neither nor’ as coordinator and discuss how ‘neither nor’ means that not the first and not the second NP are doing the action (shown by crosses)

b) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence
c) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other acts out, using template as a guide
d) When accurate, remove templates, bring back to check responses

**Step 7: Neither nor (VP)**

a) Introduce template with ‘neither nor’

![Diagram](image)

b) Relate coordinated VP to the question word “What doing” – discuss how ‘neither nor’ means subject does not do the first, and not the second verb (shown by the crosses).
c) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence
d) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one acts out the sentence
e) When accurate, remove templates, bring back to check responses
f) Take turns to create sentences matching one of six templates from sections 2,3,6 and 7 other acts out sentence
g) When accurate, remove templates, bring back to check responses
h) Make combinations of the templates using coordinated subjects and/or verbs e.g.,
   - Neither the cow nor the cat is jumping and running
   - the cow and the cat are neither standing nor jumping
   - the cow but not the cat is neither lying down nor sliding
i) Take turns to create sentences matching these combined templates, other one acts out sentence
j) When accurate, remove templates, bring back to check responses
Step 8: Neither nor (Subject NP + Adjective)

a) Introduce template with ‘neither nor’

b) Take turns to produce sentences using ‘neither nor’ while the other one colours in / draws
c) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one colours in / draws
d) When accurate, remove templates, bring back to check responses

Step 9: Neither nor (Adjective Phrase)

a) Introduce template with ‘neither nor’

b) Take turns to produce sentences using ‘neither nor’ while the other one acts out the sentence
c) Take turns to create a sentence matching one of the three templates (‘neither nor’, ‘and’ or ‘but not’) and the other one draws / colours in
d) When accurate, remove templates, bring back to check responses
e) Take turns to create sentences matching one of six templates from sections 4, 5, and 8, other draws / colours in
f) When accurate, remove templates, bring back to check responses
g) Make combinations of the templates using coordinated subjects and/or adjectives
e.g.,
   a. Neither the hat nor the ball is big and blue
   b. the hat but not the ball is neither yellow nor stripy
   c. the hat and the ball are neither small nor black
h) Take turns to create sentences matching these combine templates, other one draws / colours in
i) When accurate, remove templates, bring back to check responses

**Step 10: Not only, but also (Subject NP)**

a) Revise the templates showing coordination of NPs in subject position with VP. Use ‘not only, but also’ as coordinator and discuss how ‘not only, but also’ means that both the first and the second NP are doing the action (no crosses, like and)

b) Take turns to produce sentences using ‘not only, but also’ while the other one acts out the sentence

c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, or ‘neither nor’) and the other acts out, using template as a guide

d) When accurate, remove templates, bring back to check responses

**Step 11: Not only, but also (VP)**

a) Introduce template with ‘not only, but also’

b) Relate coordinated VP to the question word “What doing” – discuss how ‘not only, but also’ means subject does both the first and the second verb (shown by no crosses).

c) Take turns to produce sentences using ‘not only, but also’ while the other one acts out the sentence

d) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, ‘neither nor’) and the other one acts out the sentence

e) When accurate, remove templates, bring back to check responses
f) Take turns to create sentences matching one of eight templates from sections 2, 3, 6, 7, 10 & 11, other acts out sentence

g) When accurate, remove templates, bring back to check responses

h) Make combinations of the templates using coordinated subjects and/or verbs e.g.,
   - Not only the cow but also the cat is jumping and running
   - the cow and the cat are not only standing but also jumping
   - the cow but not the cat is not only lying down but also sliding

i) Take turns to create sentences matching these combine templates, other one acts out sentence

j) When accurate, remove templates, bring back to check responses

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**Step 12: Not only, but also (Subject NP + Adjective)**

a) Introduce template with ‘not only, but also’

![Diagram showing "Not only the cow but also the cat is black"]

b) Take turns to produce sentences using ‘not only, but also’ while the other one colours in / draws

c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, ‘neither nor’) and the other one colours in / draws

d) When accurate, remove templates, bring back to check responses

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**Step 13: Not only, but also (Adjective Phrase)**

a) Introduce template with ‘not only, but also’

![Diagram showing "The cow is not only big but also black"]

b) Take turns to produce sentences using ‘not only, but also’ while the other one draws / colours in

c) Take turns to create a sentence matching one of the four templates (‘not only, but also’, ‘and’, ‘but not’, ‘neither nor’) and the other one acts out the sentence

d) When accurate, remove templates, bring back to check responses
e) Take turns to create sentences matching one of six templates from sections 4, 5, and 8, 9, 12 & 13 other draws / colours in

f) When accurate, remove templates, bring back to check responses

g) Make combinations of the templates using coordinated subjects and/or adjectives
   e.g.,
   - Not only the hat but also the ball is neither big nor blue
   - the hat but not the ball is not only yellow but also stripy
   - the hat and the ball are not only small but also black

h) Take turns to create sentences matching these combine templates, other one draws / colours in

i) When accurate, remove templates, bring back to check responses
Appendix VII - Data Collection Form - Shape Coding

<table>
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<th>Date</th>
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<th>Shape Coding Structure</th>
<th>Exposures</th>
<th>Items Correct</th>
<th>% Items Correct</th>
<th>Comments</th>
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### Appendix VIII - Data Collection Form – Rehearsal Strategy

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<th>Strategy Used</th>
<th>Level of Instruction</th>
<th>Repetitions/Cues Needed</th>
<th>Self Corrections</th>
<th>Comments</th>
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